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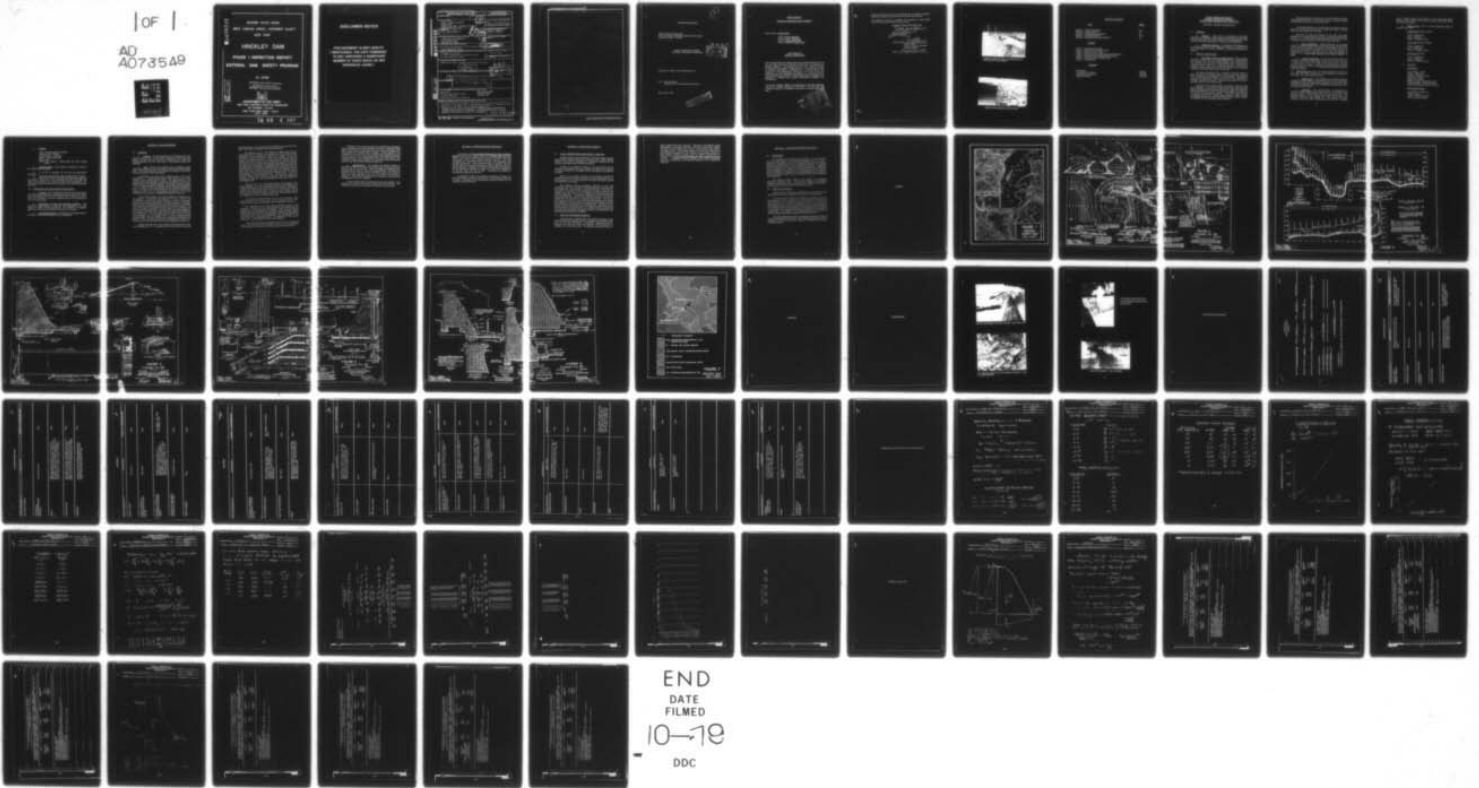
NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/2
NATIONAL DAM SAFETY PROGRAM. HINCKLEY DAM (NY 00181), MOHAWK RI--ETC(U)
SEP 78 J J WILLIAMS DACW51-78-C-0035

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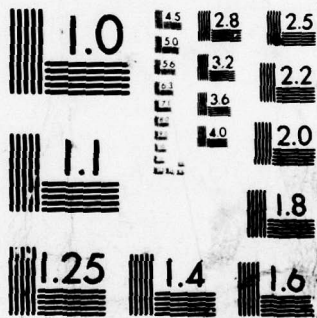
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MOHAWK RIVER BASIN
WEST CANADA CREEK, HERKIMER COUNTY
NEW YORK

HINCKLEY DAM

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

NY 00181

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
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NEW YORK, NEW YORK 10007
JULY 1978

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report Hinckley Dam Mohawk River Basin, Herkimer County, NY Inventory No. N.Y. 181		5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
7. AUTHOR(s) John J. Williams P.E.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS O'Brien and Gere Engineers Inc 1301 Buckley Road Syracuse, NY 13221		8. CONTRACT OR GRANT NUMBER(s) DACW-51-78-C-0035
11. CONTROLLING OFFICE NAME AND ADDRESS New York State Department of Environmental Conservation/ 50 Wolf Road Albany, New York 12233		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Department of the Army 26 Federal Plaza/ New York District, CofE New York, New York 10007		12. REPORT DATE 19 Sep 1978
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; Distribution unlimited.		13. NUMBER OF PAGES 77p
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
18. SUPPLEMENTARY NOTES National Dam Safety Program. Hinckley Dam (NY 181), Mohawk River Basin, West Canada Creek, Herkimer County, New York. Phase I Inspection Report.		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety National Dam Safety Program Visual Inspection Hydrology, Structural Stability West Canada Creek Herkimer County Hinckley Dam		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. Hinckley Dam was found to have areas of seepage with discoloration of standing water at several locations. It was recommended that a boring program be instituted to evaluate the embankment.		

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MOHAWK RIVER BASIN

Name of Dam: Hinckley Dam
County and State: Herkimer County, New York State
Inventory Number: NY 00181

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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Prepared by: O'Brien and Gere Engineers, Inc.

For: New York State
Department of Environmental Conservation

Date: July 6, 1978

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Hinckley Dam

State Located: New York
County Located: Herkimer
Stream: West Canada Creek
Date of Inspection: June 6, 1978

ASSESSMENT OF
GENERAL CONDITIONS

Areas of saturation and standing water on the embankments and at the toe, and fabric filter and stone fill remedial work are indicative of seepage problems. The discoloration of standing water at several locations could be evidence of fines migration. A boring program should be initiated immediately to determine the composition and in situ properties of the embankment materials to determine if they are satisfactory for the embankment as designed and constructed and to detect possible fines migration. Piezometers should be installed in the boreholes to evaluate pore pressure development throughout the embankment.

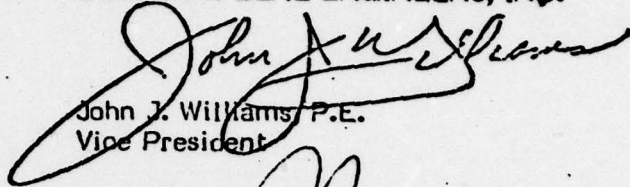
The masonry sections appear to be stable for all analyzed conditions, except the Probable Maximum Flood (PMF). For the PMF, the foundation reaction of the spillway is outside of the middle third of the base.

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23			Justification	General

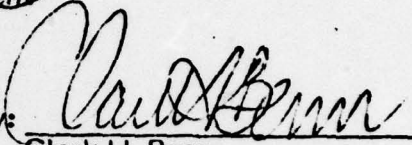
Concrete surfaces that have deteriorated due to spalling should be resurfaced to protect the concrete from further deterioration.

The spillway capacity is adequate for discharge of flood flows associated with the Probable Maximum Flood.

O'BRIEN & GERE ENGINEERS, INC.

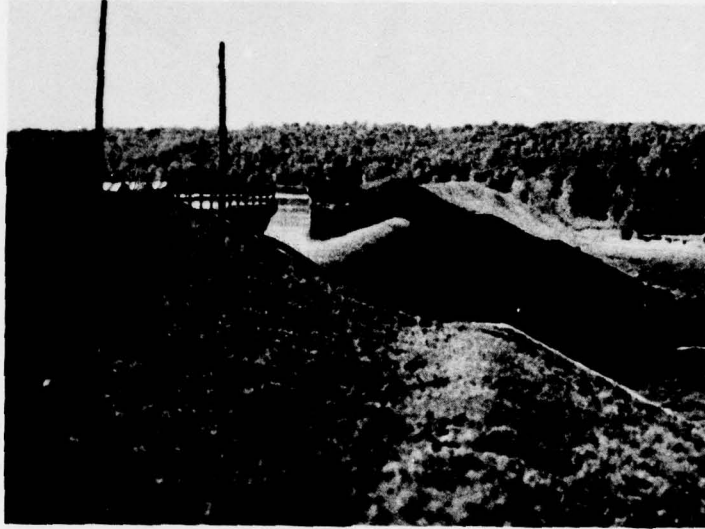

John J. Williams, P.E.
Vice President

Approved by:


Clark H. Benn
Colonel, Corps of Engineers
District Engineer

Date:

19 September 1978



OVERALL VIEW OF DAM LOOKING SOUTH
FROM NORTH ABUTMENT



VIEW OF UPSTREAM FACE OF DAM

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**PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM HINCKLEY DAM ID# NY 00181**

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority This report is authorized by the Dam Inspection Act, Public Law 92367, and has been prepared in accordance with contract #1467-021 between O'Brien & Gere Engineers, Inc., and the New York State Department of Environmental Conservation.

b. Purpose of Inspection - The purpose of this inspection is to evaluate the structural and hydraulic conditions at Hinckley Dam and to determine if the dam constitutes a hazard to human life or property.

1.2 PROJECT DESCRIPTION

a. Description of Dam and Appurtenances (From drawings obtained from the New York State Department of Transportation). The Hinckley Dam is located on West Canada Creek, about one-half mile upstream from the town of Hinckley, New York. The structure consists of about 3,100 feet of earth embankment, a 400-foot long cyclopean masonry spillway with concrete wingwalls, and a cyclopean masonry non-overflow section about 65 feet long.

The earth embankment has a maximum structural height of about 48 feet, and is provided with a concrete core wall extending from 4 feet below the embankment crest into bedrock. The upstream slope of the embankment varies from 2.5:1 to 3.5:1 (horizontal to vertical), as shown on Figure 4. The downstream slope is 2:1, and is provided with two 8-foot wide benches.

The masonry non-overflow section is located to the north side of the spillway. The structure houses four 60 inch reservoir outlet pipes controlled by sluice gates at the upstream side of the structure. Operating assemblies for the sluice gates are located in a chamber at the top of the non-overflow section. The outlet pipes are also controlled by 48-inch spur-geared valves located in a gate chamber immediately downstream of the non-overflow section. Refer to Figure 5 for details of the outlet pipes, gates, and valves.

The south wingwall of the spillway is provided with sluice gates controlling discharge into a 42-inch cast iron pipe. The pipe is used to provide water for the City of Utica, New York.

The masonry spillway is an ungated ogee type section anchored with 2.5 inch diameter anchor bolts through the keyway at 8-foot centers for the length of the structure.

The dam is owned and operated by the New York State Department of Transportation (N.Y.S.D.O.T.), Waterways Maintenance Division. The reservoir provides flow augmentation for the Erie Canal, recreation, and water supply for the City of Utica, New York.

b. Size Classification - Hinckley Reservoir has a storage volume of 92,000 acre-feet at the normal pool elevation of 1225.0 feet above mean sea level (MSL). The height of the structure from the top of dam to the streambed elevation at the toe of the spillway is approximately 90 feet. The dam is in the large size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

c. Hazard Classification - The town of Hinckley, New York is located along West Canada Creek within one-half mile of the dam. A failure of the dam could result in the loss of many lives and extensive economic losses. Therefore, the structure is in the high hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.3 PERTINENT DATA (from information supplied by N.Y.S.D.O.T. and New York State Department of Environmental Conservation (N.Y.S.D.E.C.) or other sources as noted)

a. Drainage Area - The drainage area to Hinckley Reservoir is about 370 square miles, as determined by the use of United States Geological Survey quadrangle sheet (2 degree), for Utica, New York. The basin is completely within the Adirondack State Forest, and is well vegetated and undeveloped.

b. Discharges - The Hinckley Dam was designed for a maximum reservoir elevation of 1232.2 feet MSL. The corresponding spillway outflow is about 27,000 cubic feet per second (cfs). The spillway capacity with the reservoir water surface at the top of dam (elevation 1240.0) is about 80,000 cfs. The combined discharge capacity of the outlet pipes was calculated to be 650 cfs. According

to Mr. Russel Logalbo, Chief Engineer of the Utica Water Supply Board, the City of Utica is limited to a maximum withdrawal rate of 75 cfs for water supply.

c. Reservoir Data (from 15 minute quadrangle sheet for Hinckley, New York)

Normal Pool (Elevation 1225.0)

Length - 34,000 feet

Area - 3,070 acres

Volume - 92,000 acre-feet

Top of Dam (Elevation 1240.0)

Length - 40,000 feet

Area - 9,400 acres

Volume - 154,000 acre-feet

Maximum Pool (PMF)

Length - 38,000 feet

Area - 7,900 acres

Volume - 139,000 acre-feet

d. Dam Data

Embankment

Top elevation - 1242.0

Length - 3,100 feet

Height - 48 feet (maximum)

Top width - 11 feet

Slopes - See Figure 4

Impervious core - concrete core wall

Core wall height - 65 feet maximum

Zoning, cutoff, grout curtain - unknown

Non-Overflow Section

Top elevation - 1240.0 feet

Length - 65 feet

Height - 80 feet (maximum)

Type - cyclopean masonry

e. Spillway

Type - cyclopean masonry overflow

Length of weir - 400 feet

Crest elevation - 1,225 feet

Height - 83 feet (maximum)

Gates - none

Downstream channel - stilling basin and West Canada Creek

f. Engineering Data - The information available for review of the Hinckley Dam included:

- 1) A set of 36 drawings for the dam and appurtenant structures
- 2) Documents and inspection reports supplied by N.Y.S.D.E.C.
- 3) Discussion with Mr. Frank Jennings, Maintenance Engineer, N.Y.S.D.O.T., Utica, New York, concerning an area of stonefill and fabric filter remedial work observed on the north embankment. No drawings or reports pertaining to the remedial work were made available for review.

1.04 OPERATING AND MAINTENANCE PROCEDURES

a. Operation - Mr. Pritchard, gate operator at the dam, stated that operation was limited to regulating the gate openings of the outlet works for augmentation of flow in the Erie Canal. The City of Utica, New York, is allowed a maximum withdrawal rate from the reservoir of 75 cfs for water supply.

b. Maintenance of Dam and Operating Facilities - The mechanical appurtenances are old, but well maintained. The dam appears to receive limited maintenance, as evidenced by the general appearance of the earth embankments and gravity structures.

c. Flood Warning System - According to Mr. Pritchard and Mr. Jennings, no flood warning system has been established.

SECTION 2 - VISUAL INSPECTION

2.1 FINDINGS

a. General - The field inspection of the Hinckley Dam took place on June 6, 1978. At the time of inspection the reservoir water surface was about one-half foot below the spillway crest. Water was observed flowing from the outlet pipes. No underwater areas were inspected.

b. Dam - Riprap on the upstream face is composed of large angular stone varying in size from about 12 cubic feet to about 60 cubic feet. The riprap placement is very uniform and appears to have been placed on the slope, rather than dumped.

A depression was noted on the upstream slope of the north embankment. A localized area about 6 feet from the top of dam appears to have settled about 6 inches. The visible portion of the upstream slope was measured at about one horizontal to one vertical. Measurement of the upstream extension of the north wingwall revealed a 2.5 to 1 slope (horizontal to vertical). The available drawings indicate a 2.5 to 1 slope for both the wingwall and the upstream embankment slope. The slope of the upstream face of the south embankment was measured to be 2.5 to 1. The observed inconsistency on the north embankment could indicate a widespread settlement in this area.

The downstream slope of the north embankment is provided with two benches. The benches are sloped towards the center of the embankment to provide for surface drainage. A swale is constructed near the center of the embankment. The swale extends from the upper bench to a ditch downstream of the toe of the embankment. Standpipes were noted on each bench about 30 feet from the north wingwall. The water levels below the upper and lower benches were measured at 24 feet and 11.8 feet respectively. Just above the toe of the embankment is an area of stone fill over a fabric filter extending about 20 feet up the embankment. The area extends laterally about 75 feet from the north wingwall, and is provided with a 6 inch corrugated metal underdrain pipe. The pipe terminates at a drainage ditch downstream of the toe. Flow from the pipe was clear and estimated at 1 gpm. See Figure 2 for the approximate location of the standpipes and stone fill.

Seepage was observed in the drainage ditch downstream of the north embankment toe. The seepage, which was brown or rust colored

and appeared oily, was entering at several locations on each side of the ditch. The sources of seepage could not be determined.

The upstream side of the wingwall is deeply spalled at the construction joints, and aggregate is exposed over much of the surface. Widespread surface spalling was noted on the vertical face of the downstream wingwall extension. Some minor seepage was observed along the wingwall adjacent to the stone fill area. Seepage was also evident about 10 feet south of the downstream end of the wingwall. The ground surface was saturated and some discoloration of the water was observed at this location. A retaining wall for deflecting flow from the outlet pipes is constructed downstream of the non-overflow section. Surface spalling of the concrete was observed at all construction joints. Weep holes were located several feet above the tailwater pool at approximately 30-foot intervals along the retaining wall. Flow from the weep holes was estimated at .5 cfs. This high flow may be the result of seepage that is flowing unimpeded from the embankment foundation or saturated areas and through the horizontal joints of the thinly bedded rock.

The concrete of the non-overflow section has undergone local surface spalling. Some age cracks were noted, but these appear to be surficial and should not affect the safety of the structure. Aggregate is exposed over approximately 60 per cent of the non-overflow masonry section of the downstream face. A concrete valve chamber extends from the base of the non-overflow section. The chamber houses 48 inch spur geared valves for the reservoir outlet pipes.

The spillway section appears to be in fair condition. Minor surface spalling and abrasive wear of the concrete surface were apparent, but in general the spillway concrete appeared to be sound.

The upstream face of the south embankment was in good condition. The slope of the visible portion of the embankment was measured as 2.5:1 (horizontal to vertical). Small trees and bushes growing on the south embankment have been recently cut down. Animal burrow holes were noted at many locations on the south embankment. The lower third of the south embankment near the spillway is very moist, with local saturated areas. The vegetation in this area is indicative of a prevailing moist or saturated condition.

The downstream slope is overgrown with tall grass, weeds, and brush. Trees and large brush have been cut down recently, and portions of the embankment appear to have been burned clear of vegetation.

Drainage of the downstream slope is accomplished by backsloping the two benches to form swales parallel to the crest. Cobblestone lined ditches, constructed at right angles to the benches, are provided at 300 foot intervals for drainage down the slope. A ditch parallel to the embankment is provided at the toe. Standing water was observed in the toe ditch, and in many areas standing water was widespread, creating swampy conditions. The standing water was brown or rust colored. The vegetation in these areas is indicative of a prevailing moist or saturated condition (See the bottom photograph on page A1).

c. Appurtenances - The masonry non-overflow section is provided with four 60 inch outlet pipes controlled by sluice gates at the upstream side of the structure. The 60 inch pipes are connected to 48 inch spur-gear valves by means of a reducer section. The valves are located in a gate chamber at the downstream side of the structure. Water was being discharged from two of the pipes at the time of inspection. The operating assemblies for the pipes are well lubricated and appeared to be in fair condition.

A gate chamber adjoins the south abutment of the spillway. This chamber is the intake for the water supply to the City of Utica. The chamber was locked and no inspection was made of these features.

SECTION 3 - HYDROLOGY AND HYDRAULICS

According to the Recommended Guidelines for Safety Inspection of Dams, the Spillway Design Flood is the Probable Maximum Flood (PMF). The PMF was calculated from the 24 hour Probable Maximum Precipitation (PMP) using standard reduction factors. The flood hydrograph was constructed from the Snyder unit hydrograph using average coefficients. Flood routing through the reservoir was performed assuming the gated outlets to be closed. The peak inflow and outflow rates were calculated as 73,900 cfs and 56,500 cfs respectively. The peak outflow corresponds to a stage of 11.6 feet above the spillway, or 3.4 feet below the top of dam. Therefore, the spillway is hydraulically adequate for the PMF.

A drawdown analysis was performed assuming discharge from four 60 inch pipes, the starting water surface at the spillway crest, and no inflow. According to the calculations, complete drawdown of the reservoir would take 85 days.

SECTION 4 - STRUCTURAL STABILITY

4.1 VISUAL OBSERVATIONS AND STABILITY ANALYSIS

Stability analyses were performed on both the spillway and the non-overflow masonry sections of the Hinckley Dam. More complete analyses would require information on foundation materials and the effects of side shear against adjoining structures.

Review of the stability analyses for the non-overflow section indicates that adequate factors of safety are present and that the foundation reaction is in the middle third of the base for all conditions analyzed.

Review of the stability analyses for the spillway indicates that satisfactory factors of safety are present for the normal pool and ice load conditions. For the PMF loading, the resultant of forces is outside the middle third of the base.

The remedial measures previously employed on the north embankment and noted during the field inspection visit, indicates that the embankment is susceptible to excessive seepage at this location. Saturation of portions of the embankment at other locations, and standing water near the toe of the embankments indicate that seepage could be widespread. The sources of seepage could not be determined during the inspection. Animal burrow holes and tree trunks in the south embankment are indicative of infrequent maintenance. The burrow holes and root systems of trees create potential seepage paths through the embankment. No information was made available on earth materials and construction techniques for the embankments. Assessment of the stability of the earth embankments is not within the scope of this report due to unknown conditions such as: the condition of the concrete core wall, the extent and sources of seepage, and the in situ properties of the embankment and foundation materials.

4.2 GEOLOGY AND SEISMIC STABILITY

The Reservoir is located within the western extremity of the Hudson-Mohawk physiographic province, between the Adirondack Highlands and the Tug Hill Upland. A northeast trending lineament is located to the north side of the north abutment. The lineament is an extension of a known fault zone. The bedrock underlying the dam is a

thinly bedded Ordovician limestone. Outcrops of this bedrock, noted downstream of the north abutment, were almost horizontally bedded. The dam is within Seismic Risk Zone 2 of the Seismic Zone Map of Contiguous States. The masonry sections of the dam were analyzed for an earthquake acceleration of .05g. Review of the stability analyses for both masonry sections indicates that the stability requirements of Chapter 4 of the Recommended Guidelines for Safety Inspection of Dams are met. Assessment of seismic stability of the earth embankments could not be made due to the unknown character of the embankment materials.

SECTION 5 - ASSESSMENT/REMEDIAL MEASURES

5.1 ASSESSMENT

The remedial work completed in November, 1977, the high flow from the weep holes in the downstream wingwall, and the areas of saturation and standing water on the embankments and at the downstream toe, indicate that excessive seepage is occurring. The seepage may be occurring from the embankment or the foundation. Discoloration of standing water, evident at several locations, could be indicative of fines migration or precipitation of ferrous impurities in the embankment or foundation. In addition, the observed depression on the upstream slope of the north abutment may be the result of fines migration through the embankment.

The masonry sections appear to be stable for all analyzed conditions, except the PMF. For the PMF loading, the foundation reaction of the spillway section is outside of the middle third of the base. Surface spalling has occurred on most concrete surfaces.

5.2 REMEDIAL MEASURES

Concrete surfaces that have deteriorated due to spalling should be resurfaced to protect the underlying concrete from further spalling.

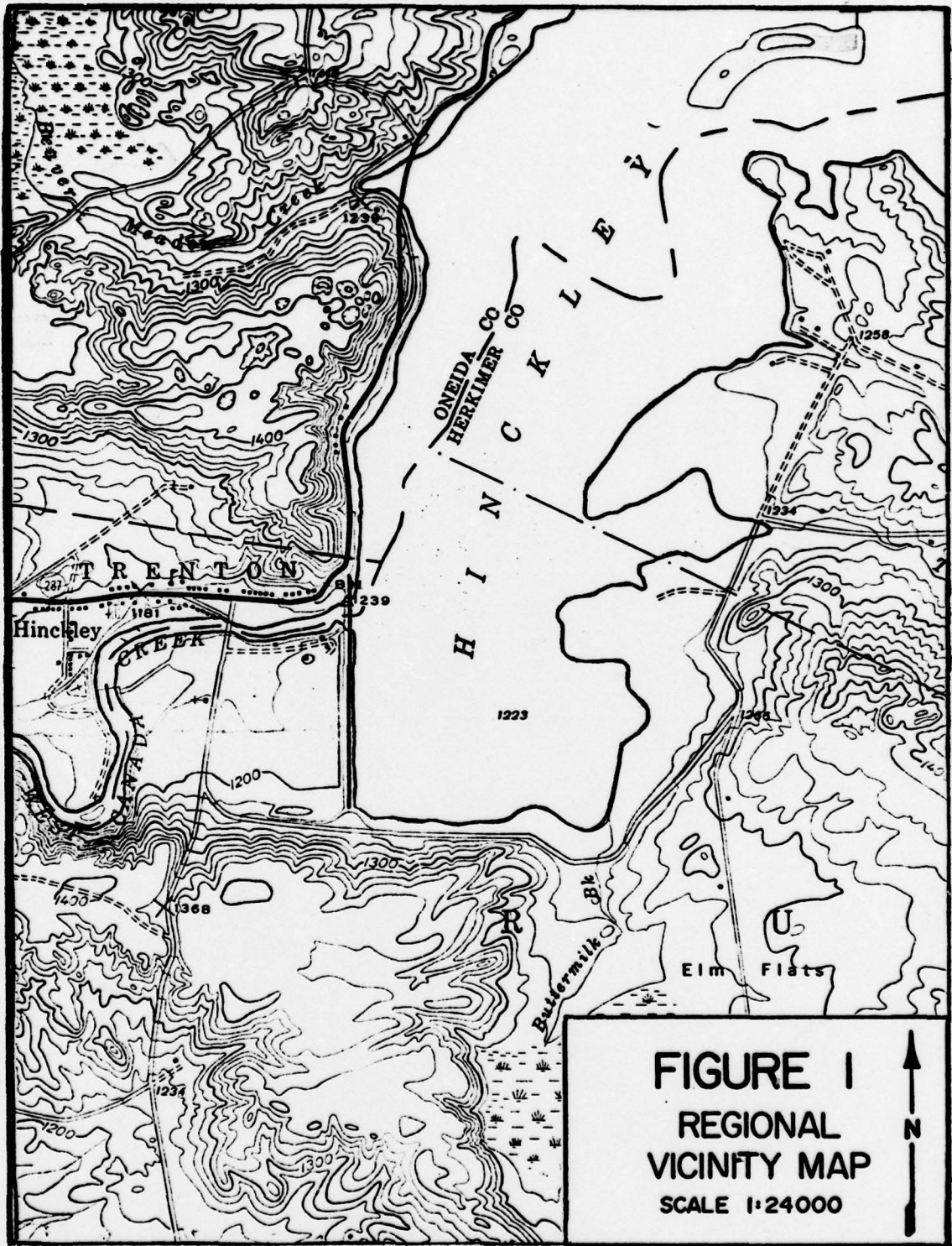
A boring program should be initiated immediately at several selected sections of the embankment to include, but not be limited to, determination of the composition and in situ properties of the embankment and foundation materials, to establish if they are satisfactory for the embankment core wall and foundation as designed and constructed, and to detect possible fines migration. Piezometers should be installed in the boreholes to evaluate pore pressure development throughout the embankment. The results of these investigations should be used to perform seepage and stability analyses for the embankments.

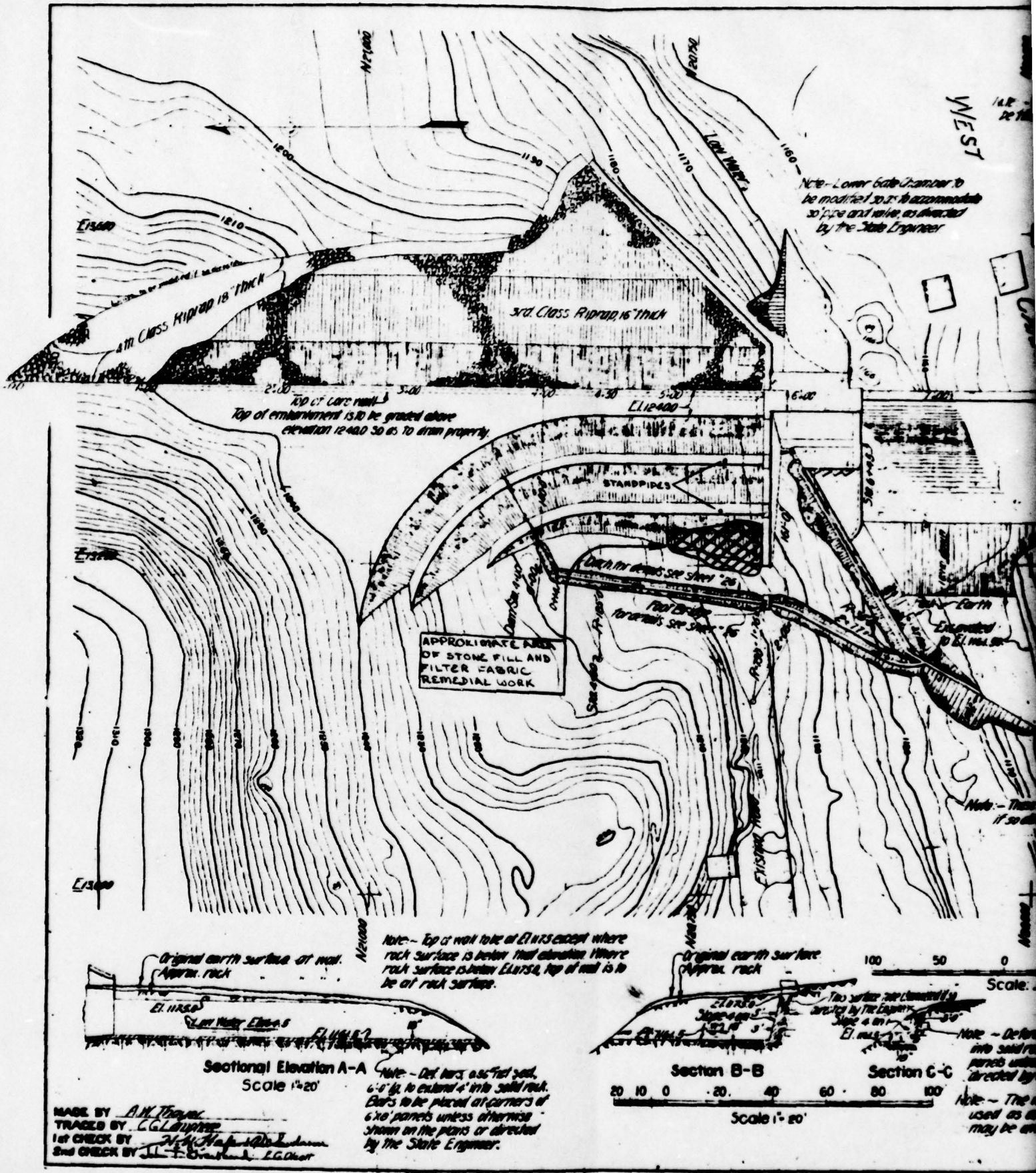
The earth embankments should be monitored regularly for signs of increased seepage and turbid water. The embankments should be mowed regularly to prevent the growth of deep rooted vegetation and to deter burrowing animals.

6

FIGURES

6





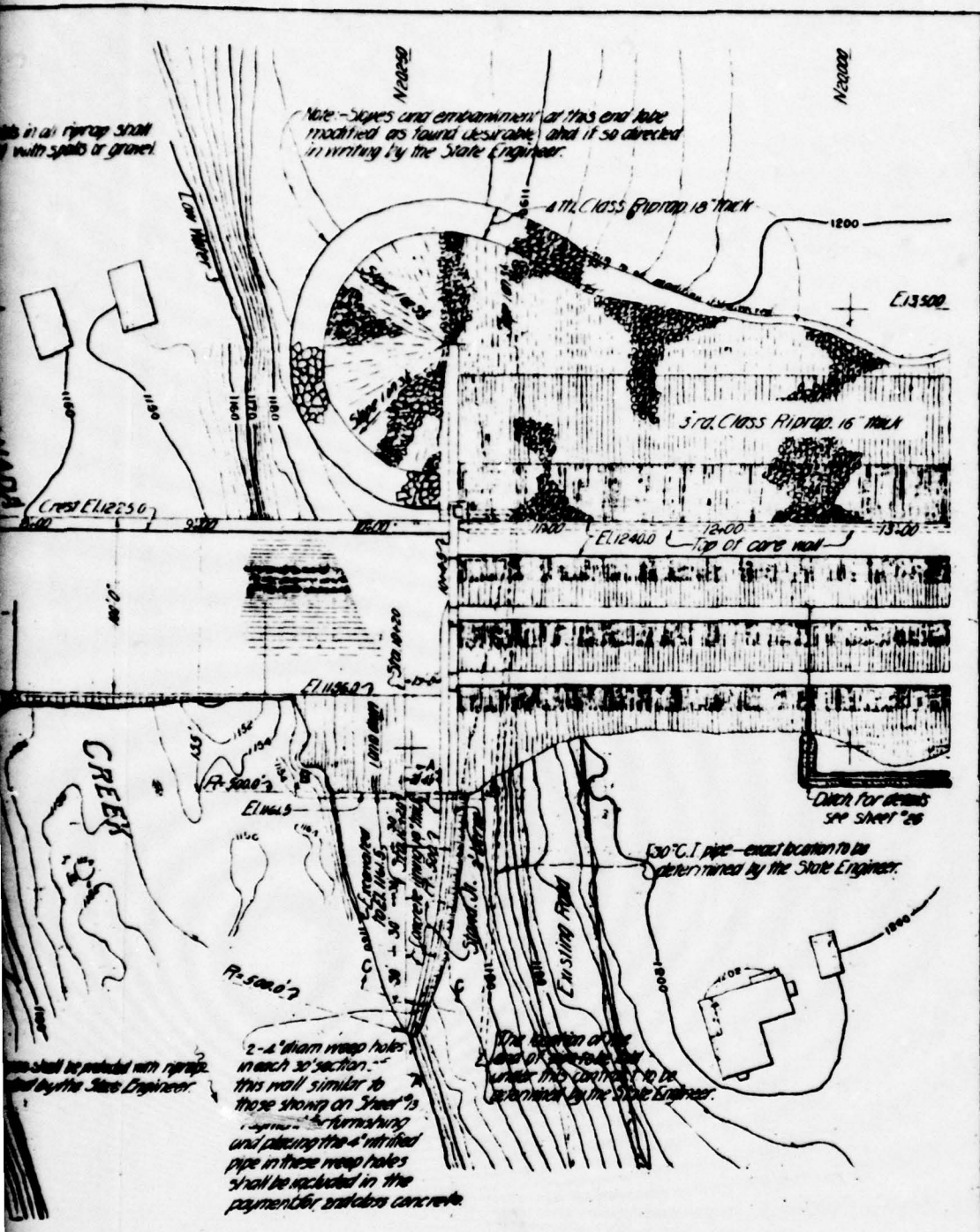


FIGURE 2
Contract No. 50.

Erie Canal Section 5

Reservoir and Dam at Hinckley.

GENERAL PLAN OF MASONRY DAM
SHOWING FINISHED STRUCTURES

Scales as indicated

Examined and approved
[Signature]
 Special Deputy State Engineer
 1906

8

shall be included with riprap
 by the State Engineer.

Note - Slopes and embankment at this end have
 modified as found desirable and if so directed
 in writing by the State Engineer.

Check for details
 see sheet 28

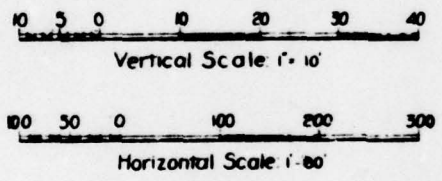
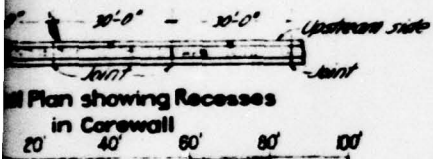
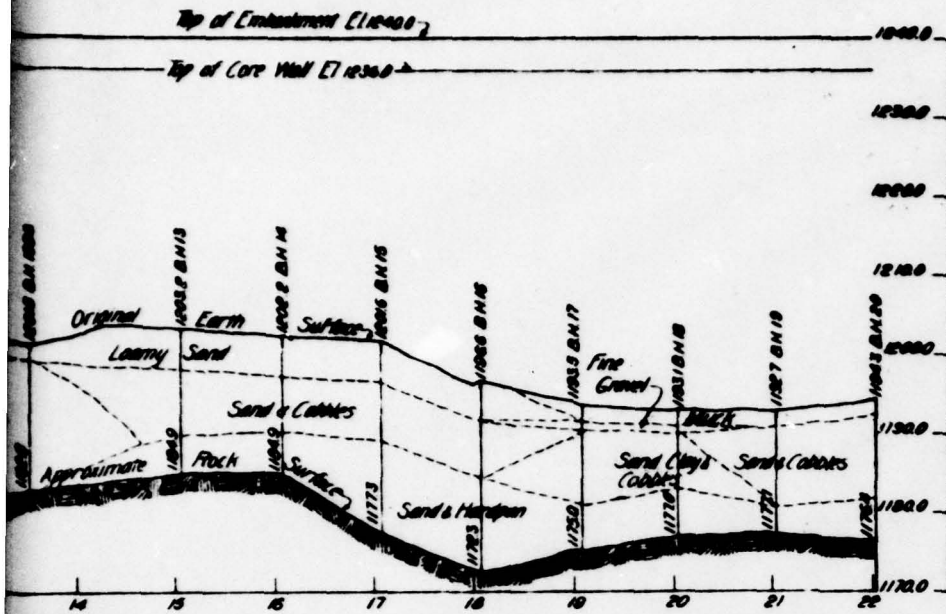
150' C.I. pipe - exact location to be
 determined by the State Engineer.

2-4" diam wrap holes
 in each 30' section -
 this wall similar to
 those shown on Sheet 23
 and placing the 4" vitrified
 pipe in these wrap holes
 shall be included in the
 payment for ordinary concrete.

The location of the
 150' C.I. pipe shall
 be determined by the
 State Engineer.

Bars, 0.36" dia sect, 6'-0" lg, to extend 4'
 Bars to be placed at corners of 5'x10'
 service shown on the plans or
 by State Engineer.

and spacing of all deformed bars
 or bolts may be modified or the bars
 if so directed by the State Engineer.



Note - A thin layer of clay and sand from about 10 to 15 below the surface between stations 19 and 20 was shown by some dry samples in the vicinity of this line.

Note - The bases of structures shown on any of the plans of this contract shall be considered as approximate only, and may be ordered by the State Engineer in writing to be at any elevation and of any dimensions necessary to give a proper foundation.

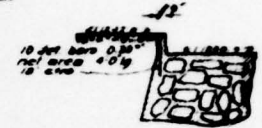
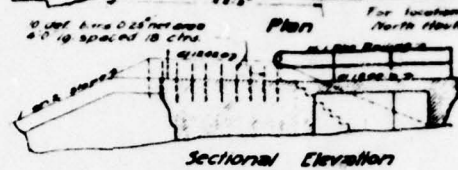
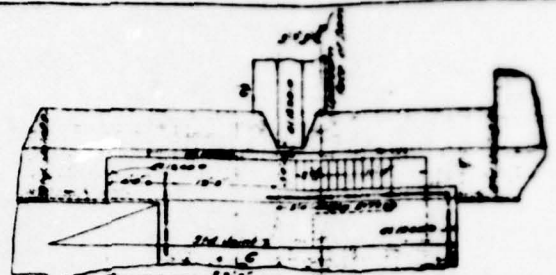
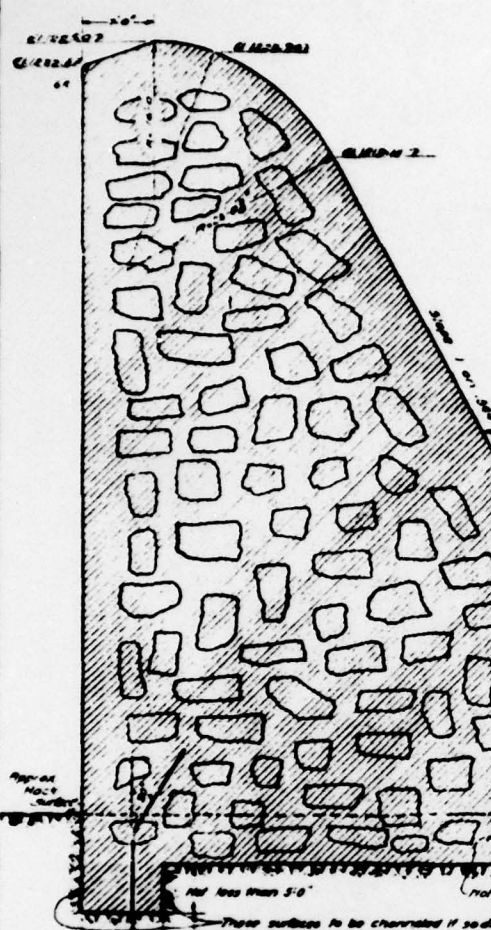
The ends of the corewall shall be extended into the hill to the distance deemed necessary by the Engineer to give proper security. All work constructed with such extension shall be paid for at corresponding contract prices.

Contract No. 50.
Erie Canal Section 5
 Reservoir and Dam at Hinckley.
PROFILE ON AXIS OF DAM.
 Scales as indicated

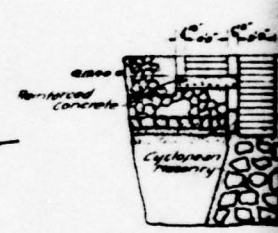
FIGURE 3

Examined and approved
[Signature]
 State Engineer
 1904

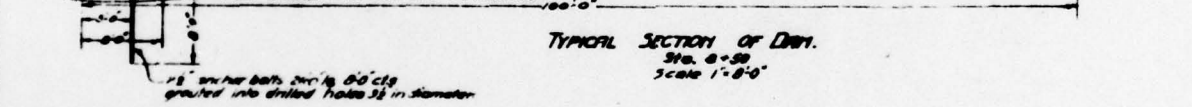
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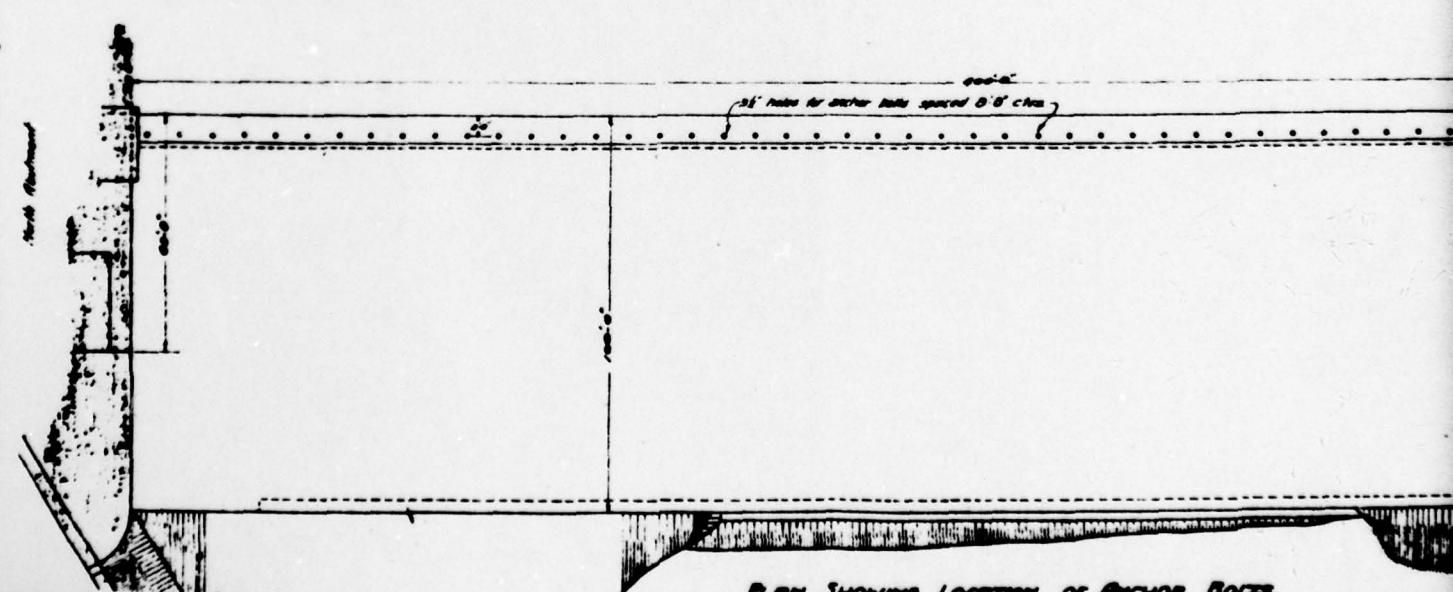
Section C-C
Scale 1"=8'-0"



Section A-A
Scale 1"=8'-0"



TYPICAL SECTION OF DAM.
Sta. 6+50
Scale 1"=8'-0"



PLAN SHOWING LOCATION OF ANCHOR BOLTS.
Scale 1"=20'-0"

Made By: [unclear]
 1st Check By: [unclear]
 Traced By: [unclear]
 2nd Check By: [unclear]

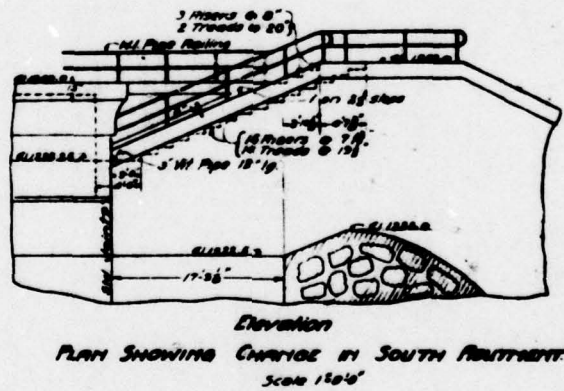
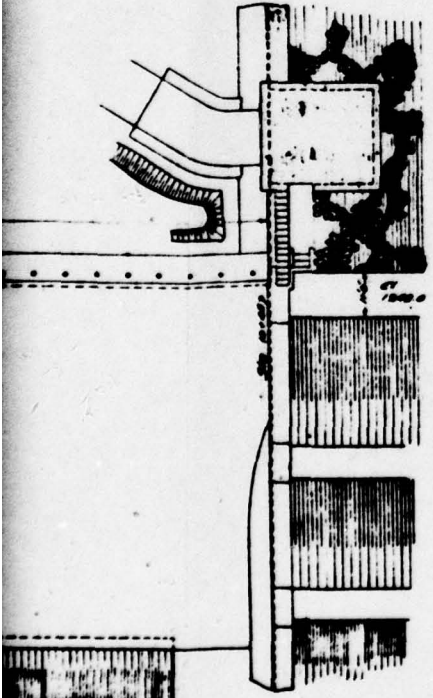
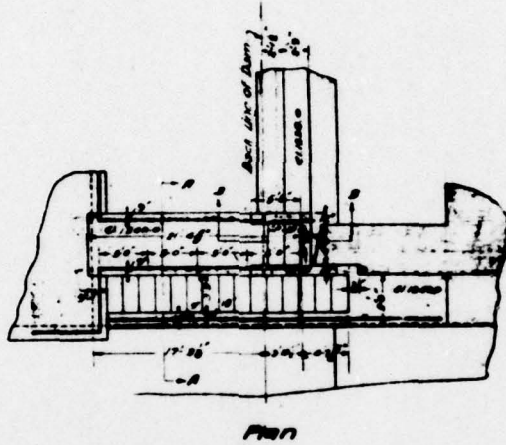
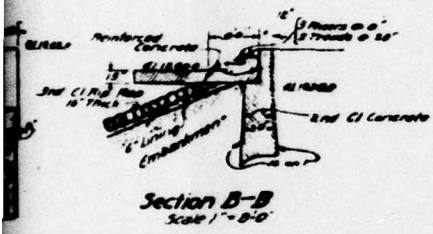
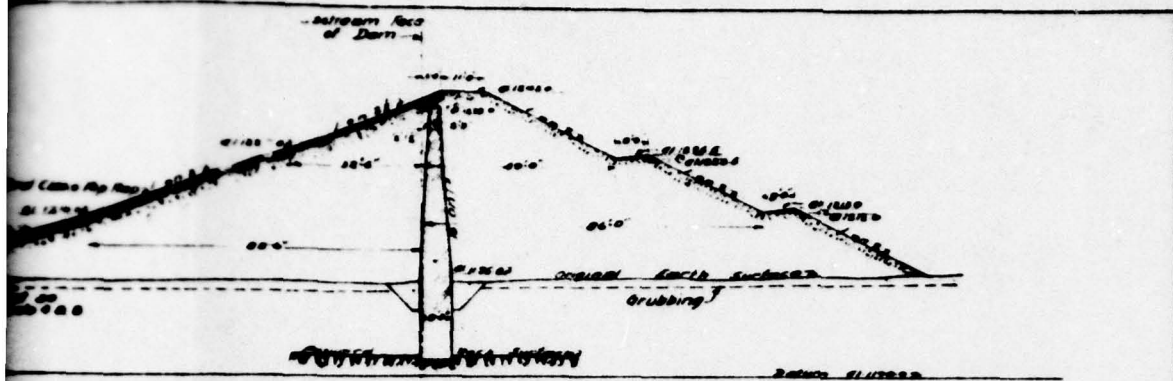


FIGURE 4
Contract No. 50.
 ALTERATION NO. 2
Erie Canal Section 5
REVISED DETAILS OF MASONRY & EARTH SECTIONS OF HINCKLEY DAM
 Scales as indicated

Designed and approved
 May 2, 1912
A. F. ...
 Consulting Engineer

Designed and approved
 May 6, 1912
Ally. G. ...
 Special Deputy State Engineer

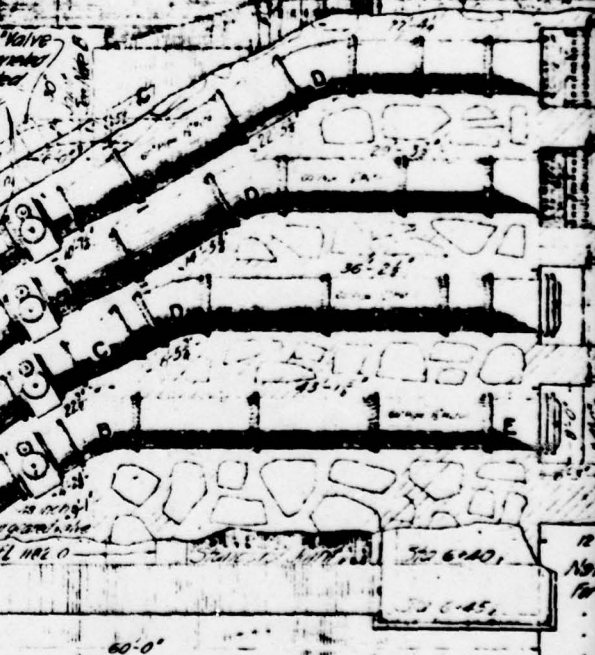
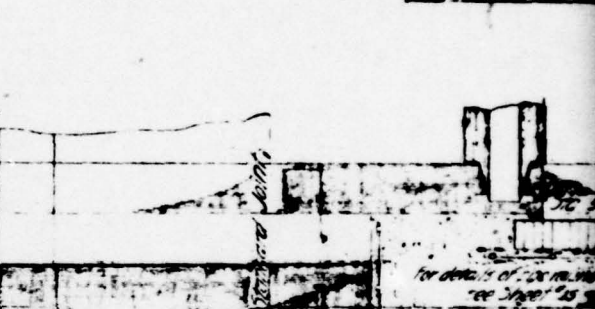
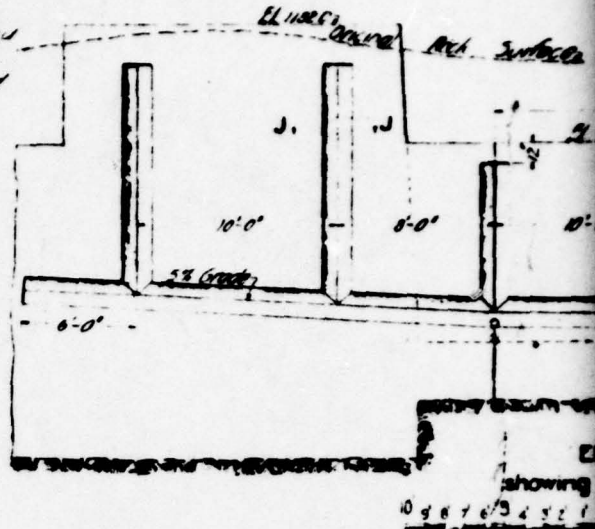


Top View Cover
Scale 1/2"=1'-0"

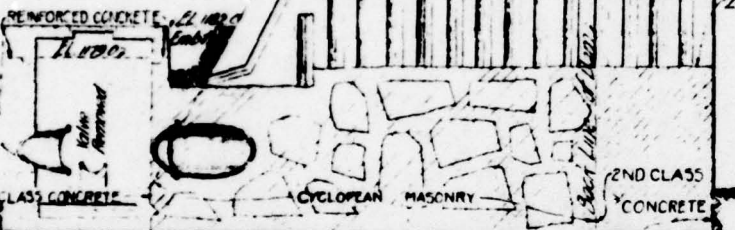


Section I-I
Scale 1/2"=1'-0"

Detail of Drain in Standard Joints

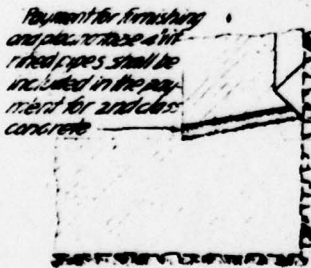


Sectional Plan
showing Pipes and Gate Chambers
Scale 1/2"=1'-0"



Section at Sta 6+07

Scale 1/2"=1'-0"



Weep Hole
(2 to each 3d section of wall)

Scale 1/2"=1'-0"

Section J-J
through Drainage Keyway
Scale 1/2"=1'-0"

MADE BY A.H. Thayer
TRACED BY A.H. Thayer
1st CHECK BY E.C. O'Leary
2nd CHECK BY G.Z. Sanderson

Notes - Plans of Lower Gate Chamber to be modified so as to accommodate 30" C.I. pipe and to be as determined by the Structural Engineer

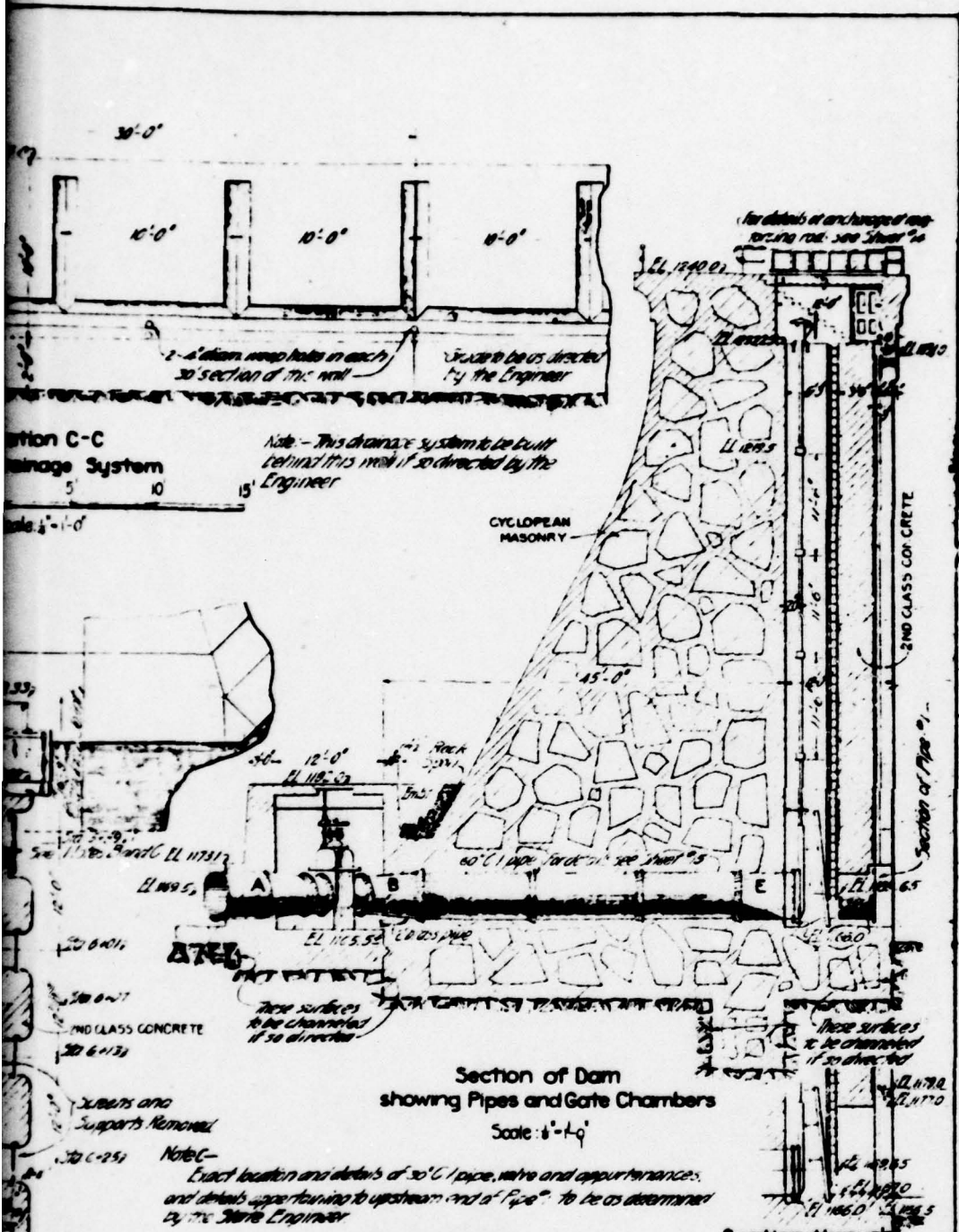


FIGURE 5
Contract No. 50.

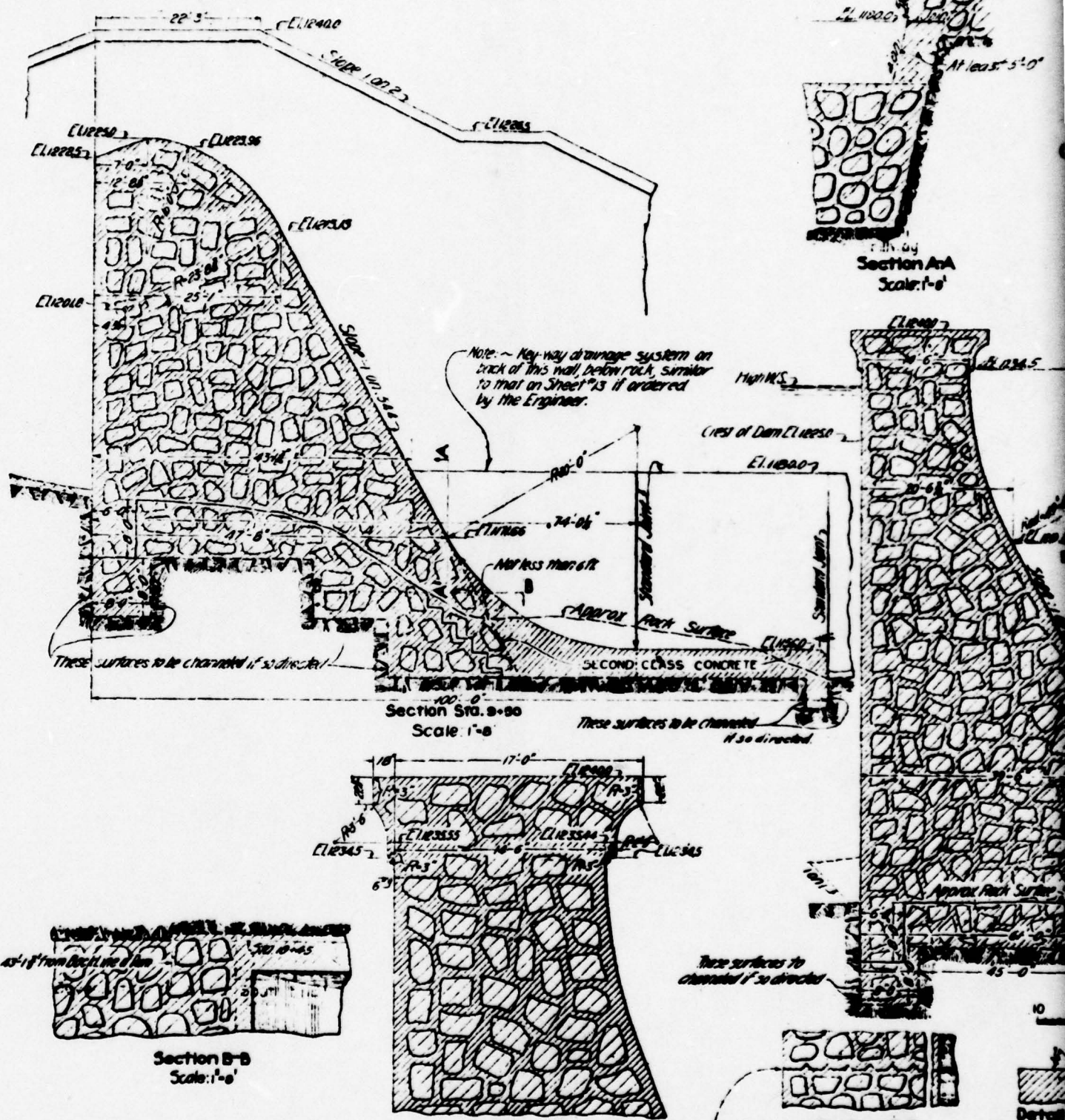
Erie Canal Section 5

Reservoir and Dam at Hinckley
SECTIONS OF DAM SHOWING DISCHARGE PIPES

Scales as indicated

Examined and approved
Henry B. ...
Special Highway Eng. Division
July 12, 1912

2



Note: ~ Key-way drainage system on back of this wall, below rock, similar to that on Sheet #13 if ordered by the Engineer.

These surfaces to be channelled if so directed

These surfaces to be channelled if so directed

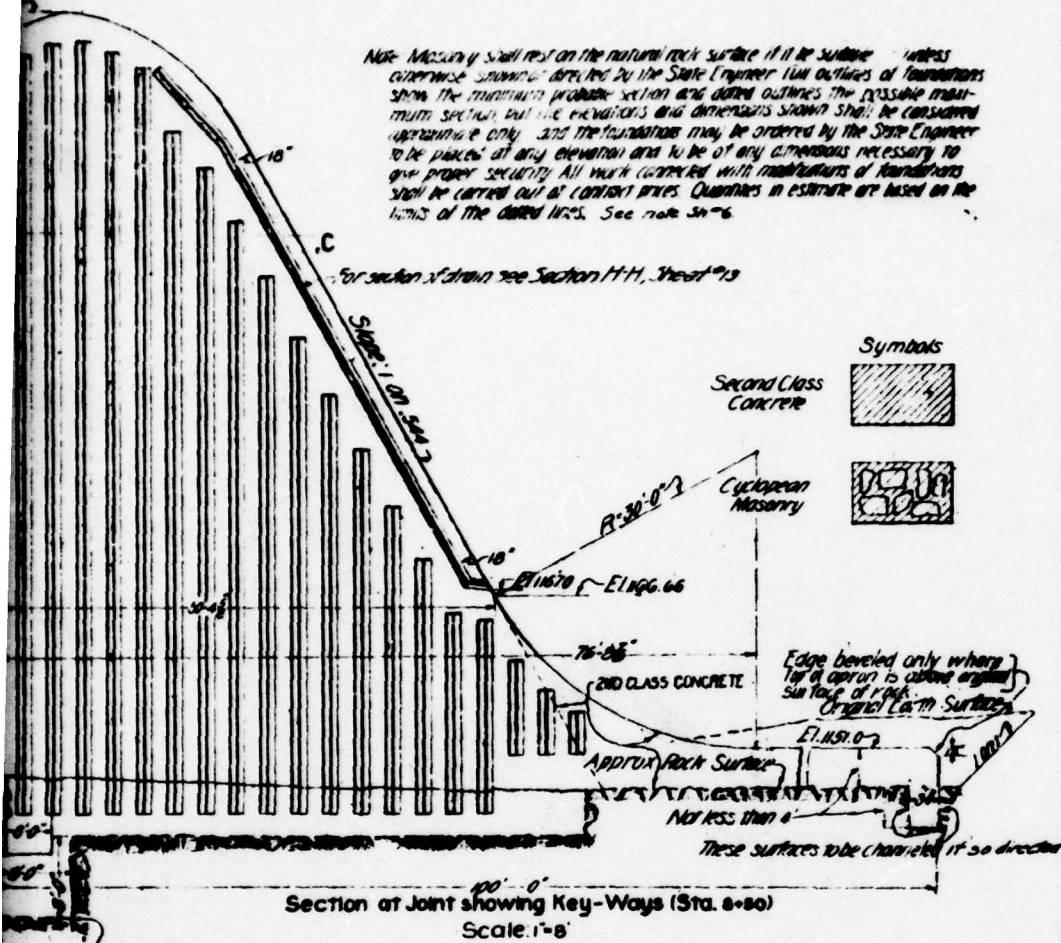
These surfaces to be channelled if so directed

MADE BY W. H. H. H.
 TRACED BY C. L. H. H.
 1st CHECK BY J. T. B. H.
 2nd CHECK BY E. C. H. H.

Notes -
 Angle of joints to be built as shown by detail
 Area of key-ways to be between 25'
 Key-ways to be built at all situations

Note: Masonry shall rest on the natural rock surface if it be suitable, unless otherwise shown. The minimum probable section and dotted outlines show the possible maximum section, but the elevations and dimensions shown shall be considered approximate only, and the foundation may be ordered by the State Engineer to be placed at any elevation and to be of any dimensions necessary to give proper security. All work connected with foundations of foundations shall be carried out at contract prices. Quantities in estimate are based on the limits of the dotted lines. See note 30-6.

For section of drain see Section H-H, Sheet 93



Symbols

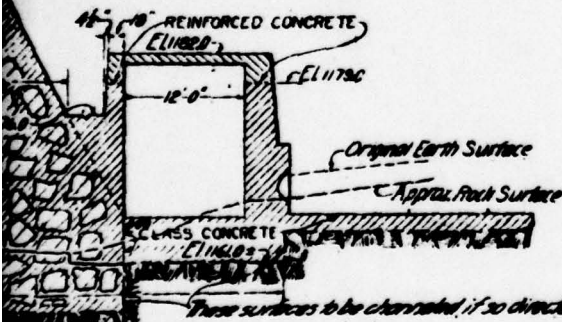
Second Class Concrete



Cyclopean Masonry



These surfaces to be channeled if so directed



Section Sta 6-58
Scale 1"=8'

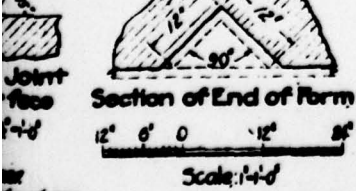
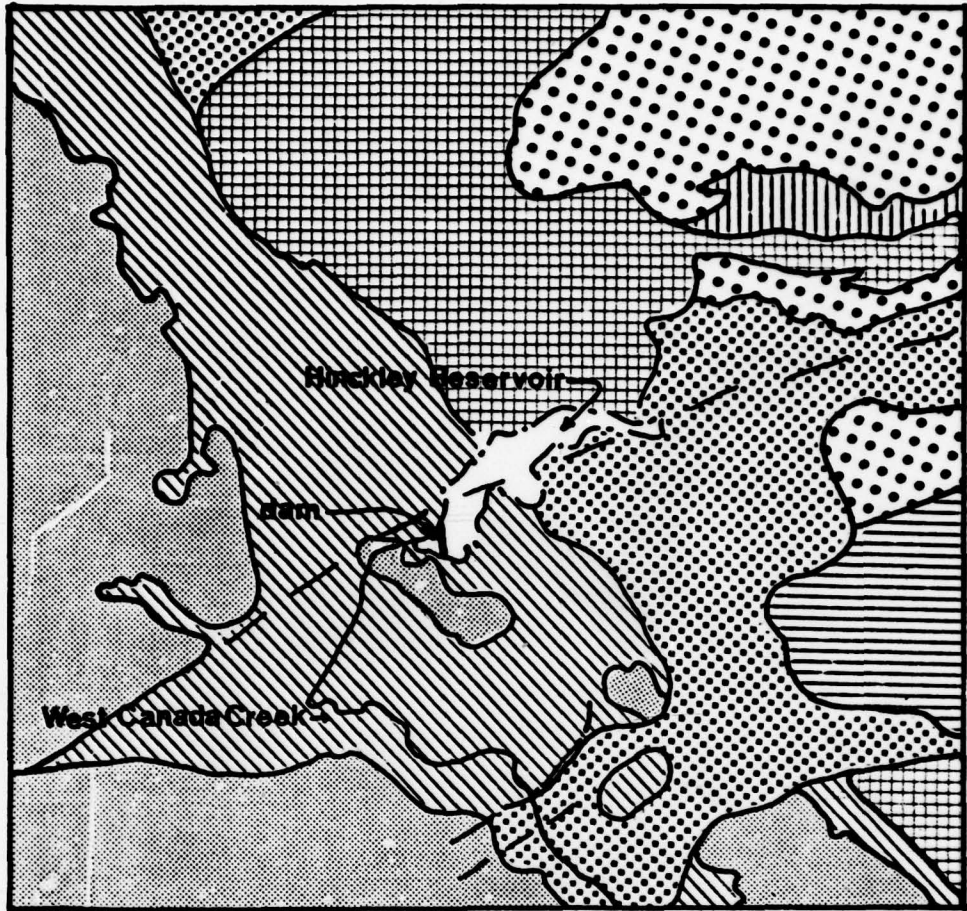


FIGURE 6 Contract No. 50.

Erie Canal Section 5
Reservoir and Dam at Hinckley.
DETAIL SECTIONS OF MASONRY DAM

Scales as indicated

Examined and approved
Wm. J. ...
Chief Deputy State Engineer



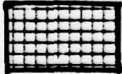






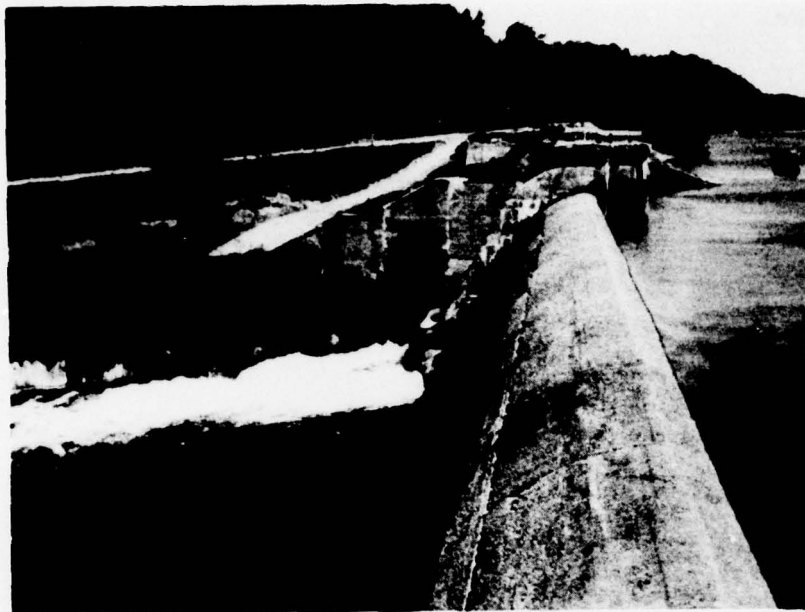
- Topographic Lineament
-  mug - Interlayered metasedimentary rock, granite and gneiss
-  Q - Glacial and alluvial deposits
-  hbg - Biotite and/or hornblende granitic gneiss
-  Ot - Limestones
-  bqpq - Biotite-quartz-plagioclase gneiss
-  Ou - Utica shale
-  mu - Undivided metasedimentary rock

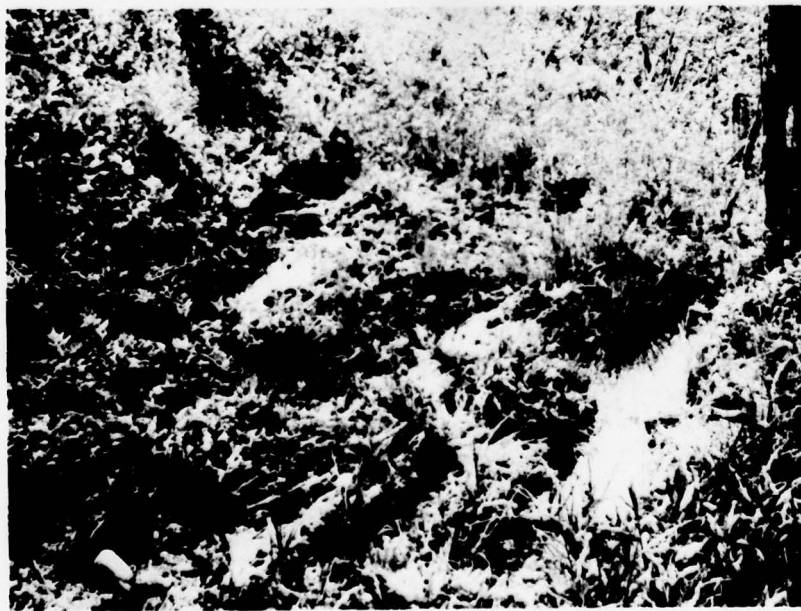
FIGURE 7
GEOLOGIC MAP
 Scale 1:250000

APPENDIX

PHOTOGRAPHS



NORTH ABUTMENT, OUTLET WORKS, AND SPILLWAY



SATURATED AREA WITH STANDING WATER AT TOE OF EMBANKMENT



CRACKING AND SPALLING
OF CONCRETE ON SPILLWAY
WING WALL



VIEW OF DOWNSTREAM CHANNEL

6

FIELD INSPECTION REPORT

6

Check List
Visual Inspection
Phase 1

Name Dam Hinckley Reservoir Dam County Herkimer State New York Coordinators _____

Date(s) Inspection 6/6/78 Weather Clear Temperature 70°

Pool Elevation at Time of Inspection 1,224 M.S.L. Tailwater at Time of Inspection 1,170 M.S.L.

Inspection Personnel:

- _____ Mr. George Elias _____
- _____ Mr. Steven Snider _____
- _____ Mr. David Cambell _____

_____ Mr. David Cambell Recorder

Accompanied by:

Mr. Pritchard, gate operator, New York State Department of Transportation.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Widespread spalling and surficial cracking of concrete structure was noted.	Cracks and spalled areas should be resurfaced to protect the underlying concrete.
STRUCTURAL CRACKING	None Noted.	None.
VERTICAL AND HORIZONTAL ALIGNMENT	No problems noted.	None.
MONOLITH JOINTS	No problems noted.	None.
CONSTRUCTION JOINTS	Some separation was observed at construction joints on portions of the wingwalls and the retaining wall in contact with water surfaces.	The separation should be monitored to detect any further movement.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

SEE PAGE ON LEAKAGE

STRUCTURE TO
ABUTMENT/EMBANKMENT
JUNCTIONS

No problems noted.

None.

DRAINS

A5

Weepholes were observed in the retaining wall downstream of the gravity section outlet works. The weep holes are spaced at about 30 feet and were noted to be discharging clear water at a rate of about 1 cfs each.

None.

WATER PASSAGES

The gravity section is provided with four 60 inch cast iron pipes controlled by sluice gates at the upstream side and 48 inch spur geared valves in the downstream gate chamber.

None.

FOUNDATION

Outcrops of flatly bedded limestone were noted along the north embankment of West Canada Creek downstream of the dam.

None.

EMBANKMENT

REMARKS OR RECOMMENDATIONS

VISUAL EXAMINATION OF

OBSERVATIONS

SURFACE CRACKS

None noted.

None.

**UNUSUAL MOVEMENT OR
CRACKING AT OR BEYOND
THE TOE**

None noted.

None.

**2. SLOUGHING OR EROSION OF
EMBANKMENT AND ABUTMENT
SLOPES**

Remedial slope protection of filter fabric and stone on north embankment. Could not determine if the remedial work was due to a slope failure, excessive seepage, or for some other reason.

See Figure 2 for area of remedial work.

**VERTICAL AND HORIZONTAL
ALIGNMENT OF THE CREST**

No problems noted.

None.

RIPRAP FAILURES

None.

None.

EMBANKMENT

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

No problems noted.

None.

ANY NOTICEABLE SEEPAGE

Minor seepage was noted at the toe of both earth embankments. At most locations, the seepage water was observed to have a rust or brown discoloration.

See comments on previous page.

STAFF GAGE AND RECORDER

None noted.

None.

DRAINS

Weep holes were observed in the retaining wall downstream of the outlet pipes at 30 foot intervals. Flow from each weep hole was estimated @.5cfs.

None.

8

UNGATED SPILLWAY

REMARKS OR RECOMMENDATIONS

VISUAL EXAMINATION OF

OBSERVATIONS

CONCRETE WEIR

The 400-foot concrete gravity spillway appears to be in fair condition. Some minor spalling and abrasive wear has occurred on the surface concrete.

None.

APPROACH CHANNEL

None.

None.

A8

DISCHARGE CHANNEL

A concrete apron extends downstream from the spillway.

None.

BRIDGE AND PIERS

None.

None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Some surface spalling has occurred on the concrete surfaces of the gate chamber.	None.
INTAKE STRUCTURE	The intake structure is the non-overflow gravity Section. Sluice gates control inflow to the outlet pipes.	None.
OUTLET STRUCTURE	A concrete gate chamber is located just downstream of the non-overflow section. Discharge is controlled by 48 inch spur-gear valves at the outlet.	None.
OUTLET CHANNEL	A concrete apron is constructed downstream of the outlet. and a retaining wall deflects flow towards the main channel.	None.
EMERGENCY GATE	None observed.	None.

INSTRUMENTATION

VISUAL EXAMINATION MONUMENTATION/SURVEYS	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	<p>A survey monument was noted at the top of the non-overflow gravity section. The elevation was marked as 1239.9 feet MSL.</p>	<p>None.</p>
OBSERVATION WELLS	<p>None noted.</p>	<p>None.</p>
WEIRS	<p>None noted.</p>	<p>None.</p>
PIEZOMETERS	<p>Stand pipes were noted at each bench above the area of filter fabric and stone fill.</p>	<p>Water surface elevations were determined by splash to be 1202.0 feet MSL and 1201.7 feet MSL for the upper and lower benches respectively.</p>
OTHER		

RESERVOIR

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

Reservoir slopes are mild
and well covered with
vegetation.

None.

SEDIMENTATION

No estimate of reservoir
sedimentation could be
made.

None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

**CONDITION
(OBSTRUCTIONS,
DEBRIS, ETC.)**

A truss bridge is constructed across West Canada Creek about 1,500 feet downstream of the spillway. The bridge creates only a mild obstruction.

None.

SLOPES

Downstream slopes are mild and well vegetated.

None.

AL

**APPROXIMATE NO.
OF HOMES AND
POPULATION**

The town of Hinckley, New York, is located about one-half mile downstream of the dam. About 60 homes (250 people) are located within one mile of the dam.

None.

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

NAME OF CLIENT CORP OF PENNSYLVANIA

COMP. BY DBC

PROJECT HINCKLEY RESERVOIR

CHECKED BY RELL

DRAINAGE AREA (BY PERIMETER) ≈ 370 SQ. MI.

L = 50 MILES LCA = 18 MILES

AVERAGE SUTCLIFF COEFFICIENTS

$C_p = .625$ $C_f = 2.0$

$$t_p = C_f (L \times L_{CA})^{.3} = 2.0 (50 \times 18)^{.3} = 15.4 \text{ HOURS}$$

$$t_r = z_p / 5.5 = 2.8 \text{ HOURS USE } t_r = 3.0 \text{ HOURS}$$

$$z_{PR} = z_p + .25 (t_r - t_p) = 15.4 + 25(3.0 - 2.8) = 15.45$$

6 HOUR PMP = 21"

REDUCTION DUE TO PROFILE MISFIT OF MAIN
WITH STORM ISONYETALS IS 10%

6 HR. PMP = 18.9"

DEPTH AREA - DURATION FOR PMP
(ZONE 1)

$$6 \text{ HR. PMP} = 18.9" \times .6 = \underline{11.3"} \quad 14.0 - 11.3 = \textcircled{2.7"} \quad \textcircled{1.7"}$$

$$12 \text{ HR. PMP} = 18.9" \times .74 = \underline{14.0"} \quad 15.7 - 14.0 = \textcircled{1.7"}$$

$$24 \text{ HR. PMP} = 18.9" \times .82 = \underline{15.7"} \quad 15.7 - 14.0 = \textcircled{1.7"}$$

NAME OF CLIENT CORPS OF ENGINEERS

PROJECT H. W. KELLY RESERVOIR

CN=55 MOUNTAIN FOREST - (LARGELY UNDEVELOPED)

THIRD RAINFALL

<u>TIME (HRS)</u>	<u>RAINFALL</u>
0-3	⑤ 8.5" (75% GHI. RMP)
3-6	④ 2.8" (25% GHI. RMP)
6-9	⑥ 1.4" } 12 H. RMP - GHI. RMP
9-12	③ 1.3" }
12-15	⑦ .5" }
15-18	⑧ .4" } 24 H. RMP - 12 H. RMP
18-21	② .4" }
21-24	① .4" }

THIRD QUANTILE DISTRIBUTION

<u>TIME (HRS)</u>	<u>RAINFALL</u>
0-3	.4"
3-6	.4"
6-9	1.3"
9-12	2.8"
12-15	8.5"
15-18	1.4"
18-21	.5"
21-24	.4"

6

NAME OF CLIENT CORPUS ENGINEERS
 PROJECT BRIDGE REPAIR

RAINFALL-RUNOFF RELATION

ADJUSTED PMP INCREMENTS	Σ PMP	RUNOFF INCR.	Σ	LOSSES INCR.	Σ
4"	4"	.0"	.0"	.4"	4"
.4"	.8"	.0"	.0"	.4"	.8"
1.3"	2.1"	.0"	0"	1.3"	2.1"
2.8"	4.9"	.9"	.9"	1.9"	4.0
8.5"	13.4"	6.0"	6.9"	2.5"	6.5
1.4"	14.8"	.5"	7.7"	.6"*	7.1
.5"	15.3"	.0"	7.7"	.5"*	7.6
.4"	15.7"	.0"	7.7"	.4"*	8.0

* MINIMUM LOSS RATE OF .2 IN/HR. = .6 IN/3 HR.

NAME OF CLIENT CORPS OF ENGINEERS

DATE 6/10/78

PROJECT HINDELBY RESERVOIR

COMP. BY DEC

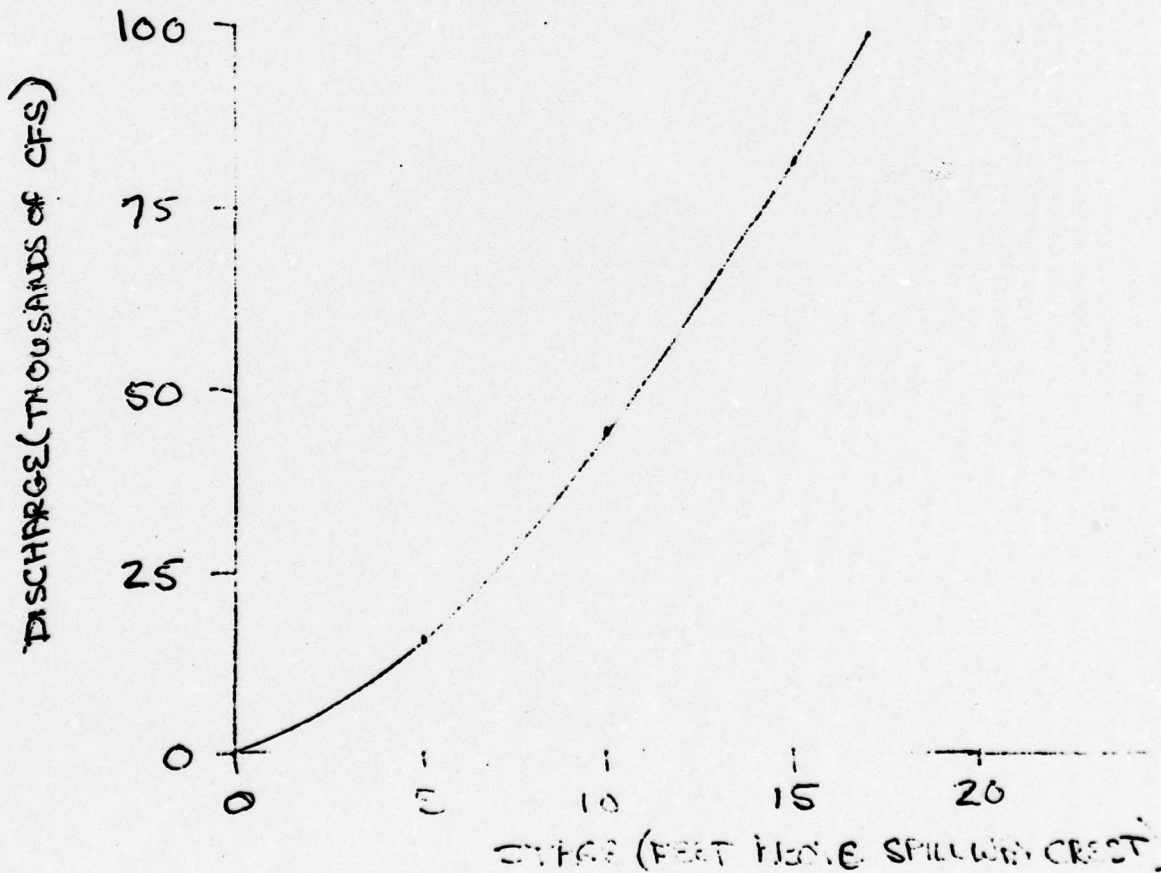
CHECKED BY REH

STAGE-DISCHARGE RELATION

$C = 3.5$

$Q = CLH^{3/2} = 3.5 \times 400 \times H^{3/2}$

$Q = 1400H^{3/2}$



NAME OF CLIENT CORP OF ENGINEERS
 PROJECT HINKLEY RESERVOIR

STAGE - STORAGE RELATION

BY PLANIMETER FROM (USGS QUAD)

ELEVATION - 1223' AREA - 2863 ACRES

ELEVATION - 1240' AREA - 4618 ACRES

ASSUME A LINEAR VARIATION IN SURFACE AREA
 FROM ELEV. 1223 TO 1240

(S) STAGE = 0 AT EL. 1225

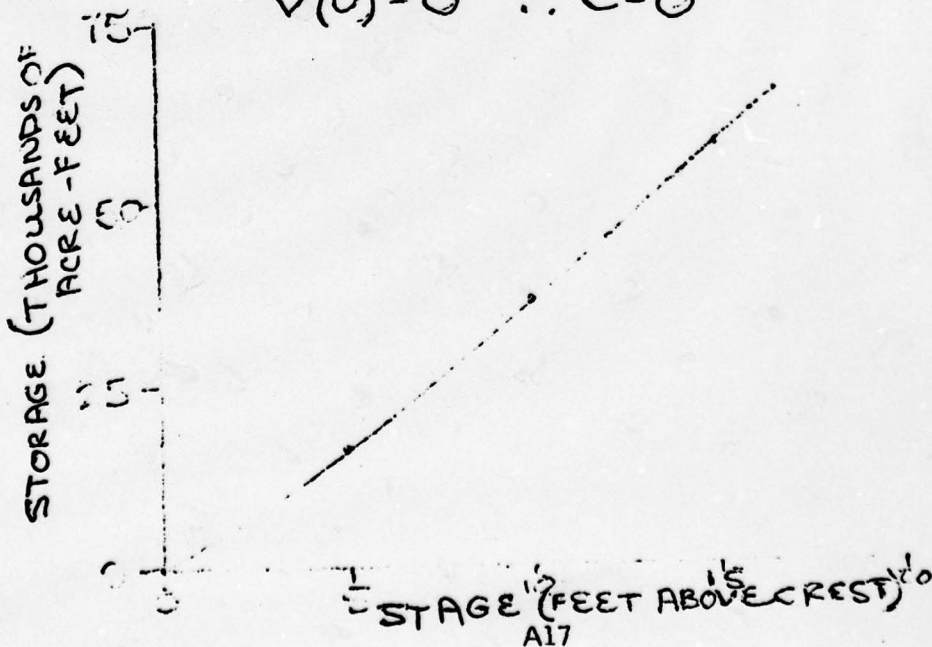
$A(-2) = 2863$

$A(15) = 4618$

$\therefore A = 103.25 + 3070$

$V = \int (103.25 + 3070) dS = 51.65^2 + 3070S + \frac{0}{1}$

$V(0) = 0 \therefore C = 0$



JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 6 OF _____
DATE 6/10/78
COMP. BY DEC
CHECKED BY REI

NAME OF CLIENT CORPS OF ENGINEERS
PROJECT HUXLEY RESERVOIR

<u>STORAGE</u> (ACR-FEET)	<u>DISCHARGE</u> (CFS)
0	0
6350	3960
13110	11200
20280	20580
27860	31600
35860	44270
44270	58200
53090	73340
62330	89600
67100	98130

NAME OF CLIENT NYDEC

PROJECT HINCKLEY RESERVOIR DAM

Discharge capacity for outlet pipes.

$$H = \frac{V^2}{2g} + K_e \frac{V^2}{2g} + K_b \frac{V^2}{2g} + K_v \frac{V^2}{2g} + h_f$$

H = available head

K_e = entrance loss coefficient

K_b = bend loss coefficient

K_v = valve loss coefficient

$$h_f = \frac{29.8 L}{R_h^{1.33}} \left(\frac{V^2}{2g} \right) \quad \& \quad \frac{V^2}{2g} = \frac{Q^2}{29 A^2}$$

$$K_e = .2 \quad K_b = .2 \quad K_v = 1.0 \quad n = .01$$

$$H = \left(1 + .2 + .2 + 1 + \frac{29 \times (.01)^2 \times 90}{(1.25)^{1.33}} \right) \frac{Q^2}{29 \times \pi^2 \times (2.5)^2}$$

$$H = .00205 Q^2 \quad Q = 22. H^{1/2} \text{ (each pipe)}$$

Outlet capacity at normal pool

$$Q_{total} = 4 \times 22 (55)^{1/2} = 650 \text{ cfs}$$

H	50	40	30	20	10
Q	622	557	482	394	278

A19

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 PHILADELPHIA, PA

SHEET NO. 9 OF

NAME OF CLIENT NYDEC.

DATE 6/20/73

PROJECT HINCKLEY RESERVOIR DAM

COMP. BY JEC

CHECKED BY REH

SURFACE AREA (NORMAL POOL) = 3070 ACRES
 ASSUME A LINEAR VARIATION IN SURFACE AREA
 FROM 3070 ACRES AT THE CREST TO ZERO AT
 ELEVATION 1170.

ΔH (feet)	HAVE (feet)	Q_{AVG} (cfs)	A_{AVG} (acres)	Δt (days)	t (days)
	50	622	2791	23	33
10	40	557	2233	20	43
10	30	482	1675	18	61
10	20	394	1117	14	75
10	10	278	558	10	85

 4FC-1 REVISION DATED JAN 1973
 UPDATED AUG 74
 CHANGE NO. 01

NATIONAL DAM INFILTRATION PROGRAM
 MINCKLEY RESERVOIR
 PMF HYDROGRAPH

JOB SPECIFICATION
 NO MHR NYEH IDAY IHP ITHN METPC IDLT IPRT NSTAM
 32 3 0 1 0 0 0 0 0 2 0
 JNDFR MWT
 3 0

SUR-AREA RUNOFF COMPUTATION
 ISTAT ICOMP IECOM ITAPE JPLY JPRY INAME
 1 0 0 0 0 0 0

HYDROGRAPH DATA
 IHWG IJWG IJWG SWAP ITCDA ITCPC PATTN ICSNOW ICSAME LOCAL
 0 1 370.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

PRECIP DATA
 MP STORM NAJ DAK
 3 0.30 0.00 0.00
 PRECIP PATTERN

.30 6.00 .00

LOSS DATA
 STOKR OLTCR RTIOL EPAIM STOKS P11OK S1R1L CNSTL ALSM4 RTIMP
 0.00 0.00 1.00 0.00 0.00 1.00 0.00 0.00 0.00 0.00

UNIT HYDROGRAPH DATA
 TP= 15.45 CP= .63 NTA= 0

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SWYDER CP AND TP ARE TC= 6.05 AND P= 4.56 INTERVALS
 STI2C= 0.00 RECSN= 0.00 RTIOP= 1.00
 REFESSION DATA

UNIT HYDROGRAPH 20 FWD-OF-PERIOD ORDINATES. LAG= 15.34 HOURS. CP= .63 VOL= 1.00
 747. 2713. 5311. 7817. 9417. 10763. 12616. 14339. 15937. 17497. 19017. 20497. 21937. 23337. 24697. 26017. 27297. 28537. 29737. 30897. 32017. 33097. 34137. 35137. 36097. 37017. 37897. 38737. 39537. 40297. 41017. 41697. 42297. 42897. 43417. 43897. 44337. 44737. 45097. 45417. 45697. 45937. 46137. 46297. 46417. 46497. 46537. 46597. 46637. 46697. 46737. 46797. 46837. 46897. 46937. 46997. 47017. 47097. 47137. 47197. 47237. 47297. 47337. 47397. 47437. 47497. 47537. 47597. 47637. 47697. 47737. 47797. 47837. 47897. 47937. 47997. 48017. 48097. 48137. 48197. 48237. 48297. 48337. 48397. 48437. 48497. 48537. 48597. 48637. 48697. 48737. 48797. 48837. 48897. 48937. 48997. 49017. 49097. 49137. 49197. 49237. 49297. 49337. 49397. 49437. 49497. 49537. 49597. 49637. 49697. 49737. 49797. 49837. 49897. 49937. 49997. 50017. 50097. 50137. 50197. 50237. 50297. 50337. 50397. 50437. 50497. 50537. 50597. 50637. 50697. 50737. 50797. 50837. 50897. 50937. 50997. 51017. 51097. 51137. 51197. 51237. 51297. 51337. 51397. 51437. 51497. 51537. 51597. 51637. 51697. 51737. 51797. 51837. 51897. 51937. 51997. 52017. 52097. 52137. 52197. 52237. 52297. 52337. 52397. 52437. 52497. 52537. 52597. 52637. 52697. 52737. 52797. 52837. 52897. 52937. 52997. 53017. 53097. 53137. 53197. 53237. 53297. 53337. 53397. 53437. 53497. 53537. 53597. 53637. 53697. 53737. 53797. 53837. 53897. 53937. 53997. 54017. 54097. 54137. 54197. 54237. 54297. 54337. 54397. 54437. 54497. 54537. 54597. 54637. 54697. 54737. 54797. 54837. 54897. 54937. 54997. 55017. 55097. 55137. 55197. 55237. 55297. 55337. 55397. 55437. 55497. 55537. 55597. 55637. 55697. 55737. 55797. 55837. 55897. 55937. 55997. 56017. 56097. 56137. 56197. 56237. 56297. 56337. 56397. 56437. 56497. 56537. 56597. 56637. 56697. 56737. 56797. 56837. 56897. 56937. 56997. 57017. 57097. 57137. 57197. 57237. 57297. 57337. 57397. 57437. 57497. 57537. 57597. 57637. 57697. 57737. 57797. 57837. 57897. 57937. 57997. 58017. 58097. 58137. 58197. 58237. 58297. 58337. 58397. 58437. 58497. 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7 0 0.00
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 2 15 0 0.00
 2 19 0 0.00
 2 21 0 0.00
 3 0 0 0.00
 3 3 0 0.00
 3 6 0 0.00
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 3 15 0 0.00
 3 18 0 0.00
 3 21 0 0.00
 4 0 0 0.00
 4 3 0 0.00
 4 6 0 0.00
 4 9 0 0.00
 4 12 0 0.00
 4 15 0 0.00
 4 18 0 0.00
 4 21 0 0.00
 5 0 0 0.00

SUM 7.70 7.70 60987A.

PEAK 73905.
 2FS 72815.
 TMCIFS 1.81
 AC-FT 36125.

6-HOUR 1.81
 24-HOUR 5.57
 72-HOUR 7.61
 TOTAL VOLUME 60987A.
 7.67
 151287.

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HYDROGRAPH ROUTING

TSTAO 2 ICOMP 1
 TECDN 0
 JPT 2
 INAME 0
 NSTPS 0
 HSTML 0
 LAG 0
 AMSKX 0
 X 0
 YPK 0
 STORA -1.

ROUTING DATA
 QLOSS 0.00
 AVG 0.00
 IREFS 1
 ISAME 0

STORAGE= 0.
 OUTFLOW= 0.

TIME	EOP	STOR	AVG IN	FOP	OUT
1	1	0	672.	672.	672.
1	6	0	3799.	1121.	1121.
1	9	0	14289.	3011.	3011.
1	12	0	11509.	9056.	9056.
1	15	0	14971.	20176.	20176.
1	18	0	29507.	34372.	34372.
1	21	0	37889.	46969.	46969.
2	0	0	42294.	59779.	59779.
2	3	0	41219.	56459.	56459.
2	6	0	41513.	53666.	53666.
2	9	0	39668.	49577.	49577.
2	12	0	36852.	45586.	45586.
2	15	0	31170.	39300.	39300.
2	18	0	27666.	31376.	31376.
2	21	0	26887.	26883.	26883.
3	0	0	21557.	22563.	22563.
3	3	0	18911.	18934.	18934.
3	6	0	16713.	16713.	16713.

3 7 0	14751.	6657.	14866.
3 12 0	13041.	5742.	11126.
3 15 0	11544.	6206.	9723.
3 18 0	10211.	4637.	9077.
3 21 0	9044.	2760.	6466.
4 0 0	8031.	2215.	5760.
4 3 0	7159.	1777.	4926.
4 6 0	6415.	1426.	4029.
4 9 0	5754.	1164.	3588.
4 12 0	5140.	919.	3205.
4 15 0	4564.	706.	2846.
4 18 0	3986.	331.	2485.
4 21 0	3421.	36.	2134.
5 0 0	2910.	0.	1427.

SUM

603121.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
56459.	55619.	46707.	24417.	603121.
	1.40	6.71	7.37	7.59
	27594.	92348.	145369.	149661.

3FS
TMC-FS
AC-FT

DATE

STATION 7

INFLOW, OUTFLOW, AND ON-SERVO FLOW

	20000.	30000.	40000.	50000.	60000.	70000.	80000.	90000.	0.
1	3	0	0	0	0	0	0	0	0
2	6	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	12	0	0	0	0	0	0	0	0
5	15	0	0	0	0	0	0	0	0
6	19	0	0	0	0	0	0	0	0
7	21	0	0	0	0	0	0	0	0
8	20	0	0	0	0	0	0	0	0
9	23	0	0	0	0	0	0	0	0
10	26	0	0	0	0	0	0	0	0
11	23	0	0	0	0	0	0	0	0
12	21	0	0	0	0	0	0	0	0
13	21	0	0	0	0	0	0	0	0
14	21	0	0	0	0	0	0	0	0
15	21	0	0	0	0	0	0	0	0
16	21	0	0	0	0	0	0	0	0
17	21	0	0	0	0	0	0	0	0
18	21	0	0	0	0	0	0	0	0
19	21	0	0	0	0	0	0	0	0
20	21	0	0	0	0	0	0	0	0
21	21	0	0	0	0	0	0	0	0
22	21	0	0	0	0	0	0	0	0
23	21	0	0	0	0	0	0	0	0
24	21	0	0	0	0	0	0	0	0
25	21	0	0	0	0	0	0	0	0
26	21	0	0	0	0	0	0	0	0
27	21	0	0	0	0	0	0	0	0
28	21	0	0	0	0	0	0	0	0
29	21	0	0	0	0	0	0	0	0
30	21	0	0	0	0	0	0	0	0
31	21	0	0	0	0	0	0	0	0
32	21	0	0	0	0	0	0	0	0
33	21	0	0	0	0	0	0	0	0
34	21	0	0	0	0	0	0	0	0
35	21	0	0	0	0	0	0	0	0
36	21	0	0	0	0	0	0	0	0
37	21	0	0	0	0	0	0	0	0
38	21	0	0	0	0	0	0	0	0
39	21	0	0	0	0	0	0	0	0
40	21	0	0	0	0	0	0	0	0
41	21	0	0	0	0	0	0	0	0
42	21	0	0	0	0	0	0	0	0
43	21	0	0	0	0	0	0	0	0
44	21	0	0	0	0	0	0	0	0
45	21	0	0	0	0	0	0	0	0
46	21	0	0	0	0	0	0	0	0
47	21	0	0	0	0	0	0	0	0
48	21	0	0	0	0	0	0	0	0
49	21	0	0	0	0	0	0	0	0
50	21	0	0	0	0	0	0	0	0
51	21	0	0	0	0	0	0	0	0
52	21	0	0	0	0	0	0	0	0
53	21	0	0	0	0	0	0	0	0
54	21	0	0	0	0	0	0	0	0
55	21	0	0	0	0	0	0	0	0
56	21	0	0	0	0	0	0	0	0
57	21	0	0	0	0	0	0	0	0
58	21	0	0	0	0	0	0	0	0
59	21	0	0	0	0	0	0	0	0
60	21	0	0	0	0	0	0	0	0
61	21	0	0	0	0	0	0	0	0
62	21	0	0	0	0	0	0	0	0
63	21	0	0	0	0	0	0	0	0
64	21	0	0	0	0	0	0	0	0
65	21	0	0	0	0	0	0	0	0
66	21	0	0	0	0	0	0	0	0
67	21	0	0	0	0	0	0	0	0
68	21	0	0	0	0	0	0	0	0
69	21	0	0	0	0	0	0	0	0
70	21	0	0	0	0	0	0	0	0
71	21	0	0	0	0	0	0	0	0
72	21	0	0	0	0	0	0	0	0
73	21	0	0	0	0	0	0	0	0
74	21	0	0	0	0	0	0	0	0
75	21	0	0	0	0	0	0	0	0
76	21	0	0	0	0	0	0	0	0
77	21	0	0	0	0	0	0	0	0
78	21	0	0	0	0	0	0	0	0
79	21	0	0	0	0	0	0	0	0
80	21	0	0	0	0	0	0	0	0
81	21	0	0	0	0	0	0	0	0
82	21	0	0	0	0	0	0	0	0
83	21	0	0	0	0	0	0	0	0
84	21	0	0	0	0	0	0	0	0
85	21	0	0	0	0	0	0	0	0
86	21	0	0	0	0	0	0	0	0
87	21	0	0	0	0	0	0	0	0
88	21	0	0	0	0	0	0	0	0
89	21	0	0	0	0	0	0	0	0
90	21	0	0	0	0	0	0	0	0
91	21	0	0	0	0	0	0	0	0
92	21	0	0	0	0	0	0	0	0
93	21	0	0	0	0	0	0	0	0
94	21	0	0	0	0	0	0	0	0
95	21	0	0	0	0	0	0	0	0
96	21	0	0	0	0	0	0	0	0
97	21	0	0	0	0	0	0	0	0
98	21	0	0	0	0	0	0	0	0
99	21	0	0	0	0	0	0	0	0
100	21	0	0	0	0	0	0	0	0

THINNET SUMMARY, AVERAGE FLOW

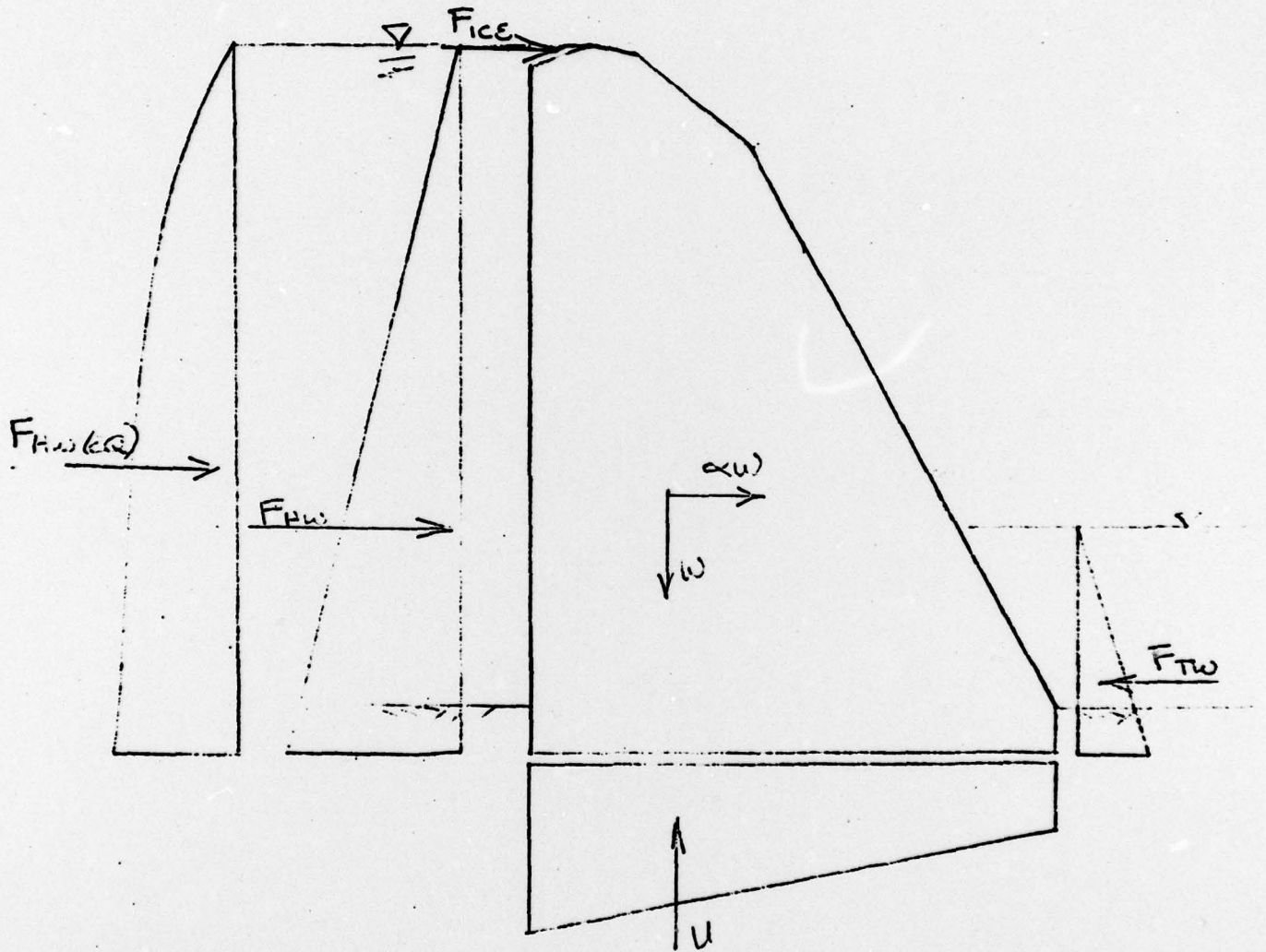
HYDROGRAPH AT	PEAK	6-11:00P	24-10:17	77-10:10P	ADFA
00010113	1 7390R.	72815.	55606.	25227.	170.00
	2 56653.	55619.	46297.	24617.	170.10

STABILITY ANALYSES

NAME OF CLIENT NYSDEC

PROJECT Hickley Reservoir

GENERALIZED LOADING FOR SPILLWAY



- W - Weight of Section
- F_{Hw} - Headwater Force
- F_{Tw} - Tailwater Force
- $F_{Hw(\alpha)}$ - Earthquake inertia of Headwater
- αW - Earthquake inertia of Gravity Section
- U - Uplift
- F_{ice} - Ice Load

NAME OF CLIENT NY DEC.

PROJECT HINKLEY RESERVOIR DAM

Effective strength of anchor bolts through the keyway of the spillway section.

Embedment length = 8' Bar size = 25"

$$\begin{aligned}\text{Pullout shear area} &= \pi \times d \times L \\ &= \pi \times 2.5'' \times 8' \times 12 \frac{\text{in}}{\text{ft}} \\ &= 754 \text{ in}^2\end{aligned}$$

Assume 100 psi shear needed to break the bond.

$$\text{Shear per bar} = 100 \text{ psi} \times 754 \text{ in}^2 = 75,400 \text{ \#}$$

Bars are spaced at 8' c-c, so the available shear/foot section = $9,425 \text{ \#} \approx \underline{\underline{9.4 \text{ k}}}$

$$\begin{aligned}\text{Stabilizing moment/foot section} &= 9.4 \text{ k} \times 57' \\ &= \underline{\underline{536 \text{ k}}}\end{aligned}$$

Per foot force needed at 57' for P.M.F. to be in the central third of the base.

$$\frac{3413 + 57 \times F_{AE}}{282.5 + F_{AE}} = 62/3$$

$$F_{AE} = \underline{\underline{66.75 \text{ k/ft}}}$$

or 534 k per bar.

STABILITY ANALYSIS OF MASONRY SPILLWAY AT HINCKLEY RESERVOIR
 NOPHAL POOL

BASE ELEVATION= 112.00FT. TOP ELEVATION= 125.00FT. BASE WIDTH= 62.00FT. DENSITY= 155.00PCF
 HEADWATER ELEVATION= 125.00FT. TAILWATER ELEVATION= 115.00FT. EARTHQUAKE ACCELERATION= .000G (HORIZ) .000G (VERT)
 SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
 SHEAR STRESS= 100.00PSI SHEAR WIDTH= 62.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	531.24	35.89	20657.44	5940.64
HEADWATER	214.94	27.64		
TAILWATER	5.27	6.33	22.81	
UPLIFT	105.70	39.53		7155.99
				13096.63

NET HORIZONTAL FORCE= 209.66 KIPS
 NET VERTICAL FORCE= 345.54 KIPS
 NET MOMENT= 7503.64 KIP-FEET
 X-BAR OF FOUNDATION REACTION= 21.95 FEET
 ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 9.05 FEET
 FOUNDATION REACTION PRESSURES= 72.61 PSI=HEEL= 4.00 PSI
 OVERTURNING FACTOR OF SAFETY= 1.56
 SLIDING FACTOR OF SAFETY= .99
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .61
 SLIDING WITH SHEAR FACTOR OF SAFETY= 5.25(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF MASONRY SPILLWAY AT HINCKLEY RESERVOIR
 NORMAL POOL AND ICE LOAD

BASE ELEVATION= 1142.00FT. TOP ELEVATION= 1225.00FT. BASE WIDTH= 62.00FT. DENSITY= 155.00PCF
 HEADWATER ELEVATION= 1225.00FT. TAILWATER ELEVATION= 1155.00FT. EARTHQUAKE ACCELERATION= .000G (HORZ) .000G (VERT)
 SILT ELEVATION= 0.00FT. SILT DENSITY(SUMMERCEN)= 0.00PCF. SILT PRESSURE COEFFICIENT(K)= .33
 SHEAR STRESS= 100.00PSI SHEAR WIDTH= 62.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	531.24	34.89	20657.44	5948.64
HEADWATER	214.96	27.64		
TAILWATER	5.27	4.33	22.83	
UPLIFT	185.70	30.53		7195.99
ICE LOAD	5.00	83.00		415.00
			20880.26	13511.63

NET HORIZONTAL FORCE= 214.66 KIPS
 NET VERTICAL FORCE= 345.54 KIPS
 NET MOMENT= 7168.66 KIP-FEET
 X-BAR OF FOUNDATION REACTION= 20.75 FEET
 ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 10.25 FEET
 FOUNDATION REACTION PRESSURES= 77.11 PSI @HEEL= .36 PSI @TOE
 OVERTURNING FACTOR OF SAFETY= 1.53
 SLIDING FACTOR OF SAFETY= .97
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .62
 SLIDING WITH SHEAR FACTOR OF SAFETY= 9.12(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF MASONRY SPILLWAY AT HINCKLEY RESERVOIR
 NORMAL POOL AND EARTHQUAKE

BASE ELEVATION= 1142.00FT. TOP ELEVATION= 1225.00FT. BASE WIDTH= 62.00FT. DENSITY= .155.00PCF
 HEADWATER ELEVATION= 1225.00FT. TAILWATER ELEVATION= 1155.00FT. EARTHQUAKE ACCELERATION= .050G (HORIZ) .000G (VERT)
 SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
 SHEAR STRESS= 100.00PSI SHEAR WIDTH= 62.00FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
HEIGHT OF DAM	531.24	38.89	20657.44	
HEADWATER	214.94	27.64		5948.64
TAILWATER	5.27	4.33	22.83	
UPLIFT	185.78	38.53		7155.99
EARTHQUAKE INDUCED LOADINGS				
INERTIA-WATER	11.71	33.20		388.62
HORIZONTAL INERTIA-DAM	26.56	33.34		885.47
			20680.26	14378.91

NET HORIZONTAL FORCE= 247.94 KIPS
 NET VERTICAL FORCE= 345.54 KIPS
 NET MOMENT= 6309.35KIP-FEET
 X-BAR OF FOUNDATION REACTION= 19.26 FEET
 ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 12.74 FEET
 FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE
 FOUNDATION REACTION PRESSURES= 86.42 PSI AT TOE -9.02 PSI AT HEEL
 OVERTURNING FACTOR OF SAFETY= 1.44
 SLIDING WITH SHEAR FACTOR OF SAFETY= .72
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .86
 SLIDING WITH SHEAR FACTOR OF SAFETY= 4.44 (SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF MASONRY SPILLWAY AT HINCKLEY RESERVOIR
 PROBABLE MAXIMUM FLOOD

BASE ELEVATION= 1142.00FT. TOP ELEVATION= 1225.00FT. BASE WIDTH= 62.00FT. DENSITY= 155.00PCF
 HEADWATER ELEVATION= 1237.60FT. TAILWATER ELEVATION= 1175.00FT. EARTHQUAKE ACCELERATION= .000G (HORIZ), .000G (VERT)
 SILT ELEVATION= 0.00FT. SILT DENSITY (SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(K)= .33
 SHEAR STRESS= 100.00PSI SHEAR WIDTH= 62.00FT. FRICTION FACTOR= .68

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	531.24	30.89	20657.64	
HEADWATER	280.19	30.89		8654.79
TAILWATER	33.98	10.99	373.37	
UPLIFT	246.76	36.03		8962.98
			21030.91	17617.77

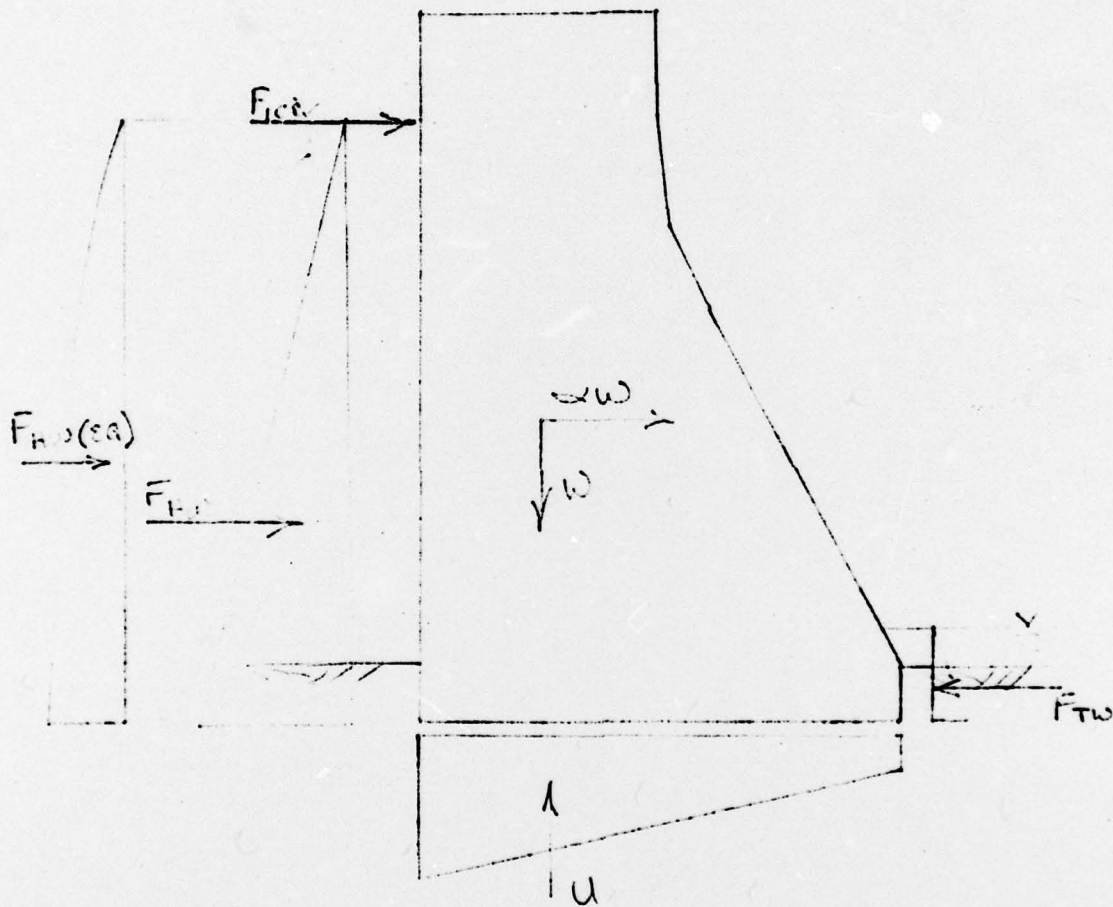
NET HORIZONTAL FORCE= 246.22 KIPS
 NET VERTICAL FORCE= 282.48 KIPS
 NET MOMENT= 3413.04 KIP-Feet

X-BAR OF FOUNDATION REACTION= 12.86 FEET
 ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 18.92 FEET
 FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE
 FOUNDATION REACTION PRESSURES AT HEEL OF DAM= 49.56 PSF
 OVERTURNING FACTOR OF SAFETY= 1.19
 SLIDING FACTOR OF SAFETY= .69
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .87
 SLIDING WITH SHEAR FACTOR OF SAFETY= 4.31 (SHEAR ACROSS FULL BASE WIDTH)

NAME OF CLIENT NYDEC

PROJECT Highway Interchange

GENERALIZED LOADING FOR NONOVERFLOW SECTION



- W - weight of section
- F_H2 - wind water force
- F_TW - tide water force
- F_H1 (EA) - earthquake inertia of head section
- U - uplift
- F_TW - tide water force
- x, y - earthquake inertia of girder section

STABILITY ANALYSIS OF MASONRY GRAVITY SECTION AT HICKLEY WESEHVOIR
NORMAL POOL

BASE ELEVATION= 1162.00FT, TOP ELEVATION= 1240.00FT, MASE WIDTH= 51.50FT, DENSITY= 155.00PCF
 HEADWATER ELEVATION= 1225.00FT, TAILWATER ELEVATION= 0.00FT, EARTHQUAKE ACCELERATION= .000G (HORIZ), .000G (VERT)
 SILT ELEVATION= 0.00FT, SILT DENSITY (SUBMERGED)= 0.00PCF, SILT PRESSURE COEFFICIENT(K)= .33
 SHEAR STRESS= 100.00PSI, SHEAR WIDTH= 51.50FT, FRICTION FACTOR= .60

LOADING	FORCE (KIPS)	ARM (FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	432.00	32.45	14050.31	2597.89
HEADWATER	123.00	20.00		3475.51
UPLIFT	101.23	36.33		
			14050.31	6073.40

NET HORIZONTAL FORCE= 123.03 KIPS
 NET VERTICAL FORCE= 331.70 KIPS
 NET MOMENT= 7976.91 KIP-Feet

X-BAR OF FOUNDATION REACTION= 24.05 FEET
 ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 1.70 FEET
 FOUNDATION REACTION PRESSURES= 53.59 PSI
 OVERTURNING FACTOR OF SAFETY= 2.31
 SLIDING FACTOR OF SAFETY= 1.61
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .37
 SLIDING WITH SHEAR FACTOR OF SAFETY= 7.60 (SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF MASONRY GRAVITY SECTION AT HINCKLEY RESERVOIR
 NORMAL POOL AND ICE LOAD

BASE ELEVATION= 1162.00 FT. TOP ELEVATION= 1240.00 FT. BASE WIDTH= 51.50 FT. DENSITY= 155.00 PCF
 HEADWATER ELEVATION= 1225.00 FT. TAILWATER ELEVATION= 0.00 FT. EARTHQUAKE ACCELERATION= .0006 (VERT)
 SILT ELEVATION= 0.00 FT. SILT DENSITY (SUBMERGED)= 0.00 PCF SILT PRESSURE COEFFICIENT (K)= .33
 SHEAR STRESS= 100.00 PSI SHEAR WIDTH= 51.50 FT. FRICTION FACTOR= .60

LOADING	FORCE (KIPS)	ARM (FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	432.92	32.45	14050.31	2597.89
HEADWATER	123.83	20.98		3475.51
UPLIFT	101.21	34.33		315.00
ICE LOAD	5.26	63.00		6386.40

NET HORIZONTAL FORCE= 148.83 KIPS
 NET VERTICAL FORCE= 331.70 KIPS
 NET MOMENT= 7661.91 KIP-FEET
 E-CENTRICITY OF FOUNDATION REACTION= 23.11 FEET
 FOUNDATION REACTION PRESSURES= 54.54 PSI
 OVERTURNING FACTOR OF SAFETY= 2.20
 SLIDING FACTOR OF SAFETY= 1.54
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .39
 SLIDING WITH SHEAR FACTOR OF SAFETY= 7.30 (SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF MASONRY GRAVITY SECTION AT HINCKLEY RESERVOIR
 NORMAL POOL AND EARTHQUAKE

BASE ELEVATION= 1162.00FT. TOP ELEVATION= 1240.00FT. BASE WIDTH= 51.50FT. DENSITY= 155.00PCF
 HEADWATER ELEVATION= 1225.00FT. TAIL WATER ELEVATION= 0.00FT. EARTHQUAKE ACCELERATION= 0.050G (HORIZ) 0.000G (VERT)
 SILT ELEVATION= 0.00FT. SILT DENSITY(SUBMERGED)= 0.00PCF SILT PRESSURE COEFFICIENT(Ks)= .33
 SHEAR STRESS= 100.00PSI SHEAR WIDTH= 51.50FT. FRICTION FACTOR= .60

LOADING	FORCE (KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	437.92	32.45	14050.31	
HEADWATER	123.43	20.98		2597.89
UPLIFT	101.23	34.33		3475.51
EARTHQUAKE INDUCED LOADINGS				
INERTIA-WATER	7.61	25.20		189.19
HORIZONTAL INERTIA-DAM	21.65	33.51		725.46
			14050.31	6988.05

NET HORIZONTAL FORCE= 152.99 KIPS
 NET VERTICAL FORCE= 331.70 KIPS
 NET MOMENT= 7062.26KIP-FEET
 X-CENTRITY OF FOUNDATION REACTION= 21.20 FEET
 ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 4.66 FEET
 FOUNDATION REACTION PRESSURE= 67.46 PSI
 OVERTURNING FACTOR OF SAFETY= 2.01
 SLIDING FACTOR OF SAFETY= 1.30
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .46
 SLIDING WITH SHEAR FACTOR OF SAFETY= 6.15(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS OF MASONRY GRAVITY SECTION AT MINCKLEY RESERVOIR
 PROBABLE MAXIMUM FLOOD

BASE ELEVATION= 1162.00FT. TOP ELEVATION= 1240.00FT. BASE WIDTH= 51.50FT. DENSITY= 155.00PCF
 HEADWATER ELEVATION= 1237.00FT. TAILWATER ELEVATION= 1175.00FT. EARTHQUAKE ACCELERATION= .000G (HORIZ) .000G (VERT)
 SILT ELEVATION= 0.00FT. SILT DENSITY(SURPOSED)= 0.00PCF. SILT PORE COEFFICIENT(K)= .33
 SHEAR STRESS= 100.00PSI. SHEAR WIDTH= 51.50FT. FRICTION FACTOR= .60

LOADING	FORCE(KIPS)	ARM(Feet)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	432.02	32.45	14050.31	4489.15
HEADWATER	178.12	25.17		
TAILWATER	5.27	4.33	22.83	
UPLIFT	162.36	31.81		4529.19
			14073.13	9018.35

NET HORIZONTAL FORCE= 113.05 KIPS

NET VERTICAL FORCE= 290.56 KIPS

NET MOMENT= 5054.79 KIP-Feet

X-DIR OF FOUNDATION REACTION= 17.60 FEET

ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 8.35 FEET

FOUNDATION REACTION PRESSURES= 77.31 PSI TO 0.00 PSI

OVERTURNING FACTOR OF SAFETY= 1.56

SLIDING FACTOR OF SAFETY= 1.01

DEVELOPED FRICTION FACTOR (NO SHEAR)= .60

SLIDING WITH SHEAR FACTOR OF SAFETY= 5.29 (SHEAR ACROSS FULL BASE WIDTH)