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NATIONAL DAM SAFETY PROGRAM. DIAMOND MILLS PAPER COMPANY DAM (N--ETC(U)
AUG 78 E A NOWATZKI, G S SALZMAN DACW51-78-C-0035

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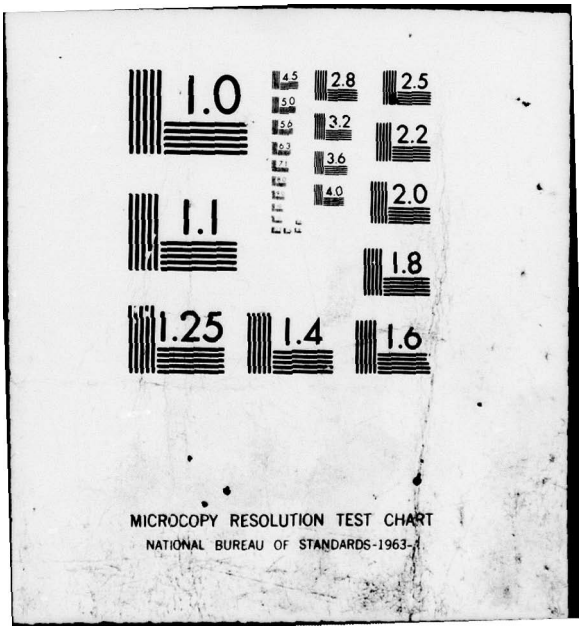
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NO

DISTRICT ENGINEER, CORPS OF ENGINEERS

XX NEW YORK DISTRICT, NEW YORK 10007

TO: HONORABLE HUGH L. CAREY

GOVERNOR OF NEW YORK

ALBANY, NEW YORK 12224

INFO: MR. GEORGE KOCH

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL

CONSERVATION

50 WOLF ROAD

ALBANY, NEW YORK 12233

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ENGINEERS FROM THE CONSULTING FIRM OF WARD-ZETLIN, UNDER CONTRACT TO THE STATE OF NEW YORK, DEPARTMENT OF ENVIRONMENTAL CONSERVATION INSPECTED THE DIAMOND MILL PAPER COMPANY DAM, ULSTER COUNTY, NEW YORK (I.D. NO. 89) ON 29 JUNE 1978 AS PART OF THE NATIONAL DAM INSPECTION PROGRAM.

VISUAL INSPECTION OF THE CONCRETE GRAVITY STRUCTURE REVEALED "WHITE WATER" SEEPAGE AND "ROOSTER TAILS" AT THE DOWNSTREAM INTERFACE OF THE FOUNDATION ROCK AND THE GATED INLET TO THE OLD MILL AT THE LEFT WING-

JEROME CASPE, Civil Engineer, NANEN-P
X-9111

CLARK H. BENN, COL, DE, NAN X-0100

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WALL OF THE OVERFLOW SECTION. IN ADDITION THE CONCRETE WALLS FORMING THIS GATED STRUCTURE ARE SEVERELY SPALLED AND STRUCTURALLY CRACKED. IT IS QUESTIONABLE WHETHER ANY OF THE THREE GATED OUTLETS ARE OPERABLE.

WE CONSIDER THE ABOVE TO REPRESENT AN UNSAFE CONDITION REQUIRING THE FOLLOWING ACTIONS BY THE OWNER AS SOON AS POSSIBLE:

1. DRAWDOWN OF THE IMPOUNDMENT OR OF THE SIDE CHANNEL INLET GATE AREA BY ISOLATING IT AND DEWATERING.

2. EXAMINATION AND TEST BORINGS OF THE CONCRETE WALLS TO ASCERTAIN THE STRUCTURAL STABILITY, INTEGRITY AND EFFECT AND SOURCE OF SEEPAGE.

THE OWNERSHIP OF THE DAM IS NOT CLEAR, HOWEVER, IT IS KNOWN THAT THE DAM IS WHOLLY OR PARTIALLY OWNED BY EITHER THE SAWYER NATIONAL BANK IN SAUGERTIES, OR THE PARTITION STREET CORPORATION OF WHICH THE BANK IS A MEMBER.

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
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18. SUPPLEMENTARY NOTES

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

Dam Safety
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Visual Inspection
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Ulster County
Diamond Mills Paper Company 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.

Diamond Mills Paper Company Dam was found to be unsafe-emergency. Due to serious structural deficiencies. Lowering of the reservoir was recommended so as to allow further evaluation of the dam to be made.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

LOWER HUDSON RIVER WATERSHED
ESOPUS CREEK BASIN
ULSTER COUNTY, NEW YORK

DIAMOND MILLS PAPER COMPANY DAM
SAUGERTIES, NEW YORK
OWNER UNKNOWN
NDS # NY 89
NYSDEC # 210-829

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared by

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Caldwell, New Jersey 07006

For

DEPARTMENT OF THE ARMY
New York District, Corps of Engineers
26 Federal Plaza
New York, New York 10007

29 July 1978

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam: Diamond Mills Paper Company Dam

Owner: Unknown

State Located: New York

County Located: Ulster

Stream: Esopus Creek

Date of Inspection: 29 June 1978

Inspection Team: Joseph S. Ward and Associates
91 Roseland Avenue, P. O. Box 91
Caldwell, New Jersey 07006

Based on our visual inspections, a review of the limited available data, and calculations performed as part of this study, the Diamond Mills Paper Company Dam is judged to be unsafe because of serious structural deficiencies which, if left uncorrected, could result in the failure of the dam with subsequent loss of lives and/or substantial property damage. Although the dam is considered to be unsafe, it is not felt that failure is imminent or that immediate action is required to eliminate or reduce the danger. In our opinion, a non-emergency situation exists.

These assessments are based mainly on the following factors:

1. The deteriorated condition of the side-channel spillway at the left abutment, and the amount of seepage taking place through and under it.

2. The competence of the left abutment itself as evidenced by the amount of seepage occurring in the turbine generator house which is located just below the left abutment, and the deteriorated condition of the upstream and left walls of that structure.

3. The fact that apparently none of the outlets can be operated to alleviate flood conditions. These structures are apparently inoperable either because of mechanical deterioration, as is the case with the penstock gate at the left abutment, or because they are inaccessible (and may be blocked with sediment), as is the case with the two 42-inch diameter sluice gates near the center of the dam.

4. The dam and its appurtenant structures are reported to have not been maintained for at least the past 10 years and, because of an unresolved ownership issue, it is not likely that they would be repaired or maintained in the near future.

If the deterioration of the structures noted above is allowed to continue, it is our opinion that the dam will eventually fail even under other than SDF conditions. It is also our opinion that the noted structures may fail even in their present state of deterioration and disrepair should the SDF occur. To compound matters, there is apparently no emergency warning system in effect, and no responsible party who can be contacted in case of trouble. There is also a question whether the dam and lake continue to serve any significantly useful function.

Our assessment of the general condition of the Diamond Mills Paper Company Dam has led us to make the following recommendations:

1. Lower the reservoir substantially in order to:

   a. Find out if any of the control structures can be operated.

   b. Permit the upstream and downstream faces of the main dam structure to be inspected.

   c. Provide a means for determining the amount of leakage taking place through monolithic joints or under the dam.

   d. Allow for a detailed inspection and evaluation of the competence of the left abutment area including

the side channel spillway, the step-tapered pier, the penstock gate, the penstock itself, and the turbine generator house.

At the conclusion of this investigation, the safety of the dam should be reassessed and the need for, and type of mitigating measures determined. The need for the dam should be considered in the light of its present function before any mitigating measures are implemented.

The lowering of the reservoir should be done before the end of October 1978, with consideration given to the ownership and legal questions raised in Item 3 below.

2. Fence the area along the cliffs on both sides of the Esopus Creek near the damsite to prevent the public from inadvertently walking or driving off the cliffs, and to keep people away from the left abutment area.

   This should be done immediately.

3. Before any of the above recommendations are implemented, an attempt should be made to resolve the ownership question. All legal implications of the proposed actions should be established, including the legal rights of upper riparian users.

Respectfully submitted,

JOSEPH S. WARD AND ASSOCIATES

Edward A. Nowatzki, Ph.D., P.E.

Gary S. Salzman, P.E.

LICENSED PROFESSIONAL GARY S. SALZMAN UNIVERSITY STATE OF NEW YORK No. 40046

Date: 31 July 1978

Approved by:
Colonel Clark H. Benn
New York District Engineer

Date: 23 August 1978

OVERVIEW - DIAMOND MILLS PAPER COMPANY DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority

The authority to conduct this Phase I inspection and evaluation comes from the National Dam Inspection Act (P.L. 92-367) of 1972 in which the Secretary of the Army was authorized to initiate, through the Corps of Engineers, a program of safety inspections of non-federal dams throughout the United States. Management and execution of the program within the State of New York has been undertaken by the New York State Department of Environmental Conservation.

b. Purpose

The primary purpose of the inspection is to evaluate available data and to give an opinion as to whether the subject dam constitutes a hazard to human life or property.

1.2 Description of Project

a. General

The subject dam will be referred to in this report as the "Diamond Mills Paper Company Dam" even though the Diamond Mills Paper Company and the Martin Cantine Company, co-owners of the dam at the time of its construction, are apparently no longer corporate entities.

b. Description of Dam and Appurtenances

The Diamond Mills Paper Company Dam is a concrete gravity structure approximately 346 feet in length with a maximum height of approximately 32 feet. The dam consists of eight monolithic concrete sections of variable length and variable section, keyed to each other and to the foundation material. Starting with the 4-foot section at the right abutment, all sections are anchored on 100-foot centers along a line 2 feet from the heel by 1-inch to 2-inch steel rods grouted up to 15 feet into the foundation rock. A similar line of anchor rods, offset 50 feet cross-stream and 10 feet downstream from the first, runs the length of dam on 100-foot centers (refer to Plate II).

Except for the 4-foot section at the right abutment, the entire length of the dam is the main spillway. A tyyical section shows that the spillway is of the ogee type (Plate III). Because of the variable depth to sound rock, the heights of the sections and the depths of key embedment differ.

Although it is not indicated in the initial design drawings or specifications, from visual inspection, the dam seems to have been gunited (reinforced with wire) at least on the downstream face.

Two 42-inch diameter sluice pipes run through the dam near its center. Their center lines are located approximately 135 feet and 145 feet from the right abutment. The inverts of these sluiceways are at approximately Elevation 15.35, or about 31.15 feet below the crest of the spillway. Flow through each pipe is controlled individually by a circular opening, iron body, bronze mounted, non-rising stem sluice gate manufactured by the Ludlow Valve Company (Plate IV). Operating nuts are located 5 feet below the crest of the spillway (upstream of the spillway) and were not visible on the day of the inspection. There is no walkway access to the control gates.

There is a small side-channel spillway at the left abutment, the left (upstream) face of which is located approximately 17.5' from the left channel (vertical rock) walls of the stream. This spillway is approximately 30 feet long between its intersection with the downstream face of the main spillway section and the concrete pier of the left abutment. It has a base width of about 6.25 feet and a height of 9 feet. The crest is flat and approximately 4.25 feet wide. The crest elevation is about 1.5 feet higher than that of the main channel spillway crest. The design drawings (Plates II and V) incorrectly show the crests of the main and auxiliary spillways to be at the same elevation. The junction of the main spillway section with the auxiliary side-channel spillway is shown on Plate V. The impoundment behind the side-channel section forms the inlet channel to the gate leading to the turbine penstock. There are no design data available for the turbine generator or turbine house, which are located downstream from the left abutment at approximately Elevation 25. This facility was used to generate electricity for the Martin Cantine Company which was located on the cliff above the left abutment of the dam.

There is a by-pass channel cut through the right channel walls about 15 feet upstream from the right abutment. This channel used to lead to the Diamond Mills Paper Company which was located about 1/3-mile downstream from the dam. It has a control section and gate house near its opening on the Esopus Creek. No design information on these control structures is available. Visual observation of the structures indicated that they are inoperative and probably could not be restored. The channel itself is full of silt, debris and stagnant water, and probably would be ineffective as a by-pass during a major flood.

c. Location

The dam is located on Esopus Creek at Saugerties in Ulster County, New York. Its exact location is shown on Plate I which is a reproduction of part of the USGS 7.5 minute Quadrangle Sheet of Saugerties, N.Y., N42°00'00", W73°52'30". As shown on the map, the dam is located about 1 mile from the confluence of the Esopus Creek and the Hudson River.

d. Size Classification

The dam is classified as "small" (storage = 826 acre-feet; height = 32 feet).

e. Hazard Classification

Because of the large number of homes, industrial plants and support facilities (sewage treatment plant, lighthouse, pump houses, etc.) downstream from the subject dam, the hazard classification is "high".

f. Ownership

There is apparently some question concerning ownership of the Diamond Mills Paper Company Dam. As indicated in Section a. above, neither the Diamond Mills Paper Company nor the Martin Cantine Company apparently exist as corporate entities today. Our research indicates that a part owner seems to be the Partition Street Corporation (refer to Appendix E). For further information refer to:

Mr. Robert P. Schirmer
Schirmer and Hrdlicka
Attorneys for Partition Street Corporation
33 W. Bridge Street
Saugerties, N.Y. 12477

or

Mr. William D. Brinnier, Attorney
Village of Saugerties
34 W. Bridge Street
Saugerties, N.Y. 12477

g. Purpose of Dam

The dam was built to create a pool for the generation of electricity at the Martin Cantine Company site and to supply water via a by-pass channel to the Diamond Mills Paper Company for industrial use. These functions have been discontinued.

h. Design and Construction History

There are no formal records on the design and construction history except what can be found in the files of the New York State Department of Environmental Conservation (NYSDEC). An Application for Reconstruction (refer to Appendix E) dated 23 February 1929 indicates that the present dam replaced an already existing wooden dam which was located about 4 feet downstream from the present dam. Associated correspondence indicates that a Mr. Fred S. Van Voorhis, apparently an engineer with the Diamond Mills Paper Company, was the designer of the present structure. Although no construction records are available, there is reason to believe that some modifications to the original design were made during or after construction. For example, the observed elevation of the side-channel spillway is different from that indicated on the design drawing.

In all, there are on file 12 design drawings, a set of general specifications, and a stability computation (erroneously performed) for the dam overtopped with 14 feet of water. Some of these drawings are shown as Plates II through V. The general specifications, and application-related materials, are contained in Appendix E.

1.3 Pertinent Data

a. Drainage Area

Since the dam is virtually at the mouth of the Esopus Creek, its drainage area is approximately 423 square miles, and includes all of the subbasin areas as described for the Esopus Creek Basin in Hydrologic Flood Routing Model for Lower Hudson River Basin. This study was prepared for the U.S. Army Corps of Engineers (USACE), New York District, by Water Resources Engineers, Inc., Springfield, Virginia. The 1929 application for permit

to build the dam indicates a much smaller drainage area, 175 sq. mi., which is approximately that given by the USACE study if all drainage areas above the Ashokan Reservoir are excluded.

b. Discharge at Damsite

Maximum known flood at damsite: 32,500 cfs. (Indicated in permit application to have been measured in 1926, but noted in stability computations to have occurred on nearby Rondout Creek.)

Total spillway capacity at maximum pool elevation: Unknown, assume 32,500 cfs.

c. Elevation (ft. above MSL)

Top of dam: 46.5.

Maximum pool: 55.0 (estimated).

Normal pool: 46.5± (spillway crest).

Upstream sluiceway invert (see group h, sub-paragraph 1 below): 15.25.

Downstream sluiceway invert: 15.25.

Streambed at sluiceway outlet: 14.25 (approximate).

d. Reservoir Length

Normal pool: unknown.

Maximum pool: unknown.

e. Storage (acre-feet)

Normal pool: 826.

Maximum pool: unknown.

f. Reservoir Surface (acres)

Normal pool: 140.

Maximum pool: unknown.

g. Dam

Type: Concrete gravity; eight monolithic sections keyed vertically to each other and keyed horizontally and anchored to rock foundation.

Length: 346 feet (excluding auxiliary side-channel spillway).

Height: Variable; ranges from 14.5± feet near left abutment to 32.0± feet close to center.

Top width: Round crested; nominally 8 feet.

Side slopes: Vertical upstream face; 1.45 vertical to 1 horizontal on downstream face.

Cutoff: Concrete base of variable thickness is keyed and anchored into sound rock. No cutoffs are indicated in design drawings.

h. Diversion and Regulating Structures

1) Tunnels:

Type: Two low-level, circular conduits 3.5 feet in diameter. The centerline of one is located 135 feet from the right abutment; the centerline of the other is 145 feet from the right abutment.

Length: Approximately 28 feet along the centerline.

Closure: Manually operated, vertical gate, manufactured by the Ludlow Valve Company of Troy, N.Y.

Access: Neither the sluice gates nor their controls are accessible, except perhaps by boat if water is not going over the spillway.

Regulating facilities: 2-inch x 2-inch cast iron operating nuts are located 5 feet below crest on upstream side of dam. They are supposed to be operated manually with a wrench from the top of the dam. No equipment for turning the nuts was readily available at the site.

2) By-pass channel:

Type: Open channel cut through vertical rock banks about 15 feet upstream of right abutment. The channel

leads from Esopus Creek, east to the site of the old Diamond Mills Paper Company.

Length: Unknown. Approximately 1200 feet.

Closure: None.

Access: Via private road east of Esopus Creek.

Regulating facilities: There used to be two vertical rising sluice gates across this channel about 50 feet downstream from its opening on Esopus Creek. The controls for these gates have been destroyed and the gates are inoperative.

3) Turbine generator penstock:

Type: 5-foot diameter steel pipe with intake approximately 9 feet below spillway crest. This pipe leads from the downstream end of side-channel spillway to the turbine house located below the left abutment.

Length: Unknown. Approximately 50 feet.

Closure: Vertical lifting gate.

Access: Wooden stairs (in disrepair) lead from top of cliff to left abutment. Controls for gate are on top of left abutment.

Regulating facilities: The gate is closed. The controls used to regulate the gate are electrically driven. There is no source of electricity and the controls themselves are in disrepair.

i. Main Spillway

Refer to Item g above.

j. Auxiliary Spillway

Type: Concrete gravity, side-channel. Keyed into main section of dam. Flat crest, nominally 4.25 feet wide. It forms the left abutment of the main section of the dam.

Length of weir: Approximately 30 feet.

Crest elevation: Approximately 48.0.

Gates: None.

Piers: None.

k. Regulating Outlets

Refer to Item h above.

SECTION 2

ENGINEERING DATA

2.1 Design

A moderate amount of engineering design data is available for the dam structure itself, but very little could be found for the appurtenant structures such as the turbine generator facility and the by-pass channel. The main sources of data are:

a. "Application for Construction of a Dam" filed by Diamond Mills Paper Company and Martin Cantine Company, both of Saugerties, N.Y., with the New York State Department of Public Works, Division of Engineering. (Refer to Appendix E.) The approval date on the document is 15 March 1929. In addition to containing information on the dimensions of the dam, watershed, impoundment, etc., an attachment to this document contains a stability analysis for overturning. It is of interest to note that in the analysis the hydrostatic forces due to impoundment are shown acting on the downstream face of the dam; the results of the analysis are obviously incorrect. In the analysis a flow of 32,500 cfs is assumed to be passing over the dam with a depth of 14 ft. This was the design flow that was used originally.

b. A set of twelve (12) drawings showing details for each of the following:

i. Average sections (6 drawings)

ii. Rock lines (1 drawing)

iii. Plan showing locations of anchor holes (1 drawing)

iv. Sketch of dam profile (1 drawing)

v. Details of expansion joints and some approximate estimates of drilling, excavation, grout and concrete quantities (1 drawing)

vi. Details of the sluice gate (2 drawings)

Except for the latter two drawings which were prepared by the gate manufacturer, all other drawings were prepared by Mr. F. Van Voorhis of the Diamond Mills Paper Company.

Some of the drawings and parts thereof are presented as Plates II through V in this report.

c. A set of general specifications (refer to Appendix E) regarding concrete mixes, steel anchor rods, stream diversion (hydrology), etc., also prepared by Mr. Van Voorhis.

Except for the incorrect stability analysis referred to above, there are no structural design or hydraulic/hydrological computations available.

d. Some information concerning the foundation materials may be obtained from Mr. Van Voorhis' cover letter to the State Department of Public Works that accompanied the application referred to in Item a. above (refer to Appendix E).

2.2 Construction

There are no formal construction records available for either the dam or any of its appurtenant structures.

2.3 Operation

There are no formal records of operation or flow discharges at the dam site available. Information regarding flow of the Esopus Creek at Saugerties, N.Y. is contained in Hydrologic Flood Routing Model for Lower Hudson River Basin, a 1977 report prepared for the U.S. Army Corps of Engineers (USACE), New York District, by Water Resources Engineers, Inc., Springfield, Virginia.

Because of the unresolved question of ownership, there is no formal program now in effect for opening and testing either the two sluice gates, the turbine penstock gate, or the by-pass control gates. In fact, visual inspection of the site suggests that none of these controls could be operated in their present condition.

Although no formal records of operation or flow discharge are available, information regarding these items was obtained from interviewing some long-time residents of the area. Mr. William Morgan, 70+ years old, residing in a house less than 200 feet from the cliff overlooking the right abutment, informed us that when the Martin Cantine Company was in full operation (more than 10 or 15 years ago), the water level of Esopus Creek regularly fell below the crest of the dam. He said that during the week, water was led through the turbine house in sufficient quantity to lower the impoundment so that there was no overflow. On weekends, the gate was closed

and the water again rose to overflowing. He also noted that since the Martin Cantine Company ceased operations, the water level has never dropped below crest elevation. This would suggest that the gates have not been operated in that period of time.

Mr. Morgan also indicated that he had seen the water level at times of heavy flood extend well above the "VI" (6-foot?) mark painted on the right abutment.

Additionally, in a letter dated 20 June 1977 from Mr. Robert P. Schirmer, attorney for the Partition Street Corporation, to Mr. George Koch, New York State Department of Environmental Conservation (NYSDEC) (refer to Appendix E) it is acknowledged that the Martin Cantine Company lowered the water level about 10 years ago, presumably by operating the turbine gate, the sluice gates,or both.

2.4 Evaluation

a. Availability

Engineering data were available from NYSDEC and the New York District of USACE. Other potential sources of information, specifically the owner, are not readily accessible because of legal implications.

b. Adequacy

Although the nature and amount of the formal engineering data available are limited, when taken in conjunction with the results of the visual inspection and interviews, they provide a basis from which assessments of stability and overtopping potential may be made.

c. Validity

On a whole, there is no reason to question the validity of the data that are available. However, some items are inaccurate or incorrect. For example, the stability analysis performed by Mr. Van Voorhis is obviously incorrect. In the application for permit to build, data regarding the size of the watershed area do not agree with the information given in the USACE report; this inaccuracy, however, can be explained. The elevation of the side-channel spillway at the left abutment is incorrectly given as being the same as that of the main channel spillway. Finally, none of the elevations shown on the drawings refer to MSL. This is not an error since the MSL reference elevation is given in a note, but that note occurs only on Plate II; consequently, the elevations given on the other drawings could be misleading if Plate II were not at hand.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General

The dam is located in a small canyon, naturally carved by the Esopus Creek through black and gray shales. The channel bottom is approximately 60 feet below the top of the cliffs on the right, and about 45 feet below the top of the cliffs on the left. There is a highway bridge spanning the Esopus Creek about 250 feet upstream of the dam. Figure 1, Appendix D, shows a panoramic view looking downstream towards the dam from the highway bridge.

Access to the right abutment is not possible on foot. Access to the left abutment can be gained via a badly maintained and deteriorated set of wooden stairs and walkway. The left abutment consists of a side-channel spillway, a stepped concrete pier, and a control platform for a gate that leads to a turbine generator located in a turbine house downstream of the pier. At the time of the inspection the structures of the old Martin Cantine Co. were being demolished and the site was being cleared for future development of unknown nature. The turbine house remained untouched.

The cliffs evident in Figure 1 decrease in height rapidly both upstream and downstream so that within a short distance (less than about 1000 feet), there is a flat shoreline. Upstream from the dam and the highway bridge is a small recreational area and beach (Fig. 2, Appendix D). Immediately downstream there are a number of residences and docks (Fig. 1, Appendix D).

On the day of the inspection, water was flowing at a depth of from 3 to 6 inches over the main spillway. There was no flow over the side-channel spillway. Attempts had been made to have the impoundment level dropped below the crest elevation, but because of legal implications, the alleged owner was reluctant to do so. (Refer to Appendix E.)

b. Dam

Because of the flow of water over the main spillway, direct observation of the dam structure was not possible. However, even with the flow of water, it was

apparent that the concrete face of the dam is badly cracked, scaled and spalled (Fig. 3, Appendix D; also Overview picture). Construction joints between the monoliths appear to be open to a significant depth (Fig. 4, Appendix D) and spalling on the joints at some sections along the crest has left what appear to be V-notches (Figs. 5 and 6, Appendix D). The monoliths at some sections appear to be offset horizontally 6± inches; however, it is difficult to tell whether there is actually an offset or whether there appears to be an offset because of the large amount of spalling that has taken place (Figs. 6 and 7, Appendix D). At some sections along the spillway crest it is apparent that a large amount of spalling has taken place (Fig. 24, Appendix D).

The right abutment of the dam is not accessible directly. It was viewed from a distance with a pair of high powered binoculars. It was apparently in good condition. There is a set of water marks (Roman numerals) that have been painted in yellow on the right abutment. Water stains indicate that the water level has reached the "VI" mark (6 feet?), but there is no record of who painted the marks there or what they mean.

The left abutment, as indicated previously, consists of a side-channel spillway, concrete pier, and control platform and gate leading to the turbine generator (Fig. 8, Appendix D). Observations on each of these structures follow.

i. The side-channel spillway appeared to be in very poor condition. The concrete is severely scaled and spalled on the downstream face and seepage is clearly visible coming both through the concrete and under the spillway structure (Figs. 7 and 8, Appendix D). The junction with the main spillway section is badly eroded and there is a large longitudinal crack at about the main spillway crest elevation running the length of the side-channel spillway (Fig. 8, Appendix D).

ii. The concrete pier which supports the downstream end of the side-channel spillway, and the control platform and gate that leads to the turbine generator, shows signs of moderate spalling (Fig. 9, Appendix D) and severe erosion at its base (Fig. 10, Appendix D).

iii. The gate control platform is in good condition. The access to it is via a wooden stairway and bridge. The basic support for this access structure is a steel frame which seems to be in satisfactory condition, but the wooden boards are rotten and both the stairway and the bridge are

overgrown with vegetation. (Fig. 11, Appendix D.) The iron handrail and stairs leading from the control gate platform to the side-channel spillway crest are rusted out and could not be used safely. On the day of the inspection water was not flowing over the side-channel spillway. There was still water behind the spillway which submerged the vertical lift gate so that only the trash rack was visible. The gate controls are rusted and inoperative (Fig. 12, Appendix D). They are apparently driven by an electric motor and belt system but there is no electrical supply at or near the gate platform, so the gate cannot be operated. Even if there were an electrical supply at hand it is questionable whether the gate controls would work.

c. Appurtenant Structures

There are two structures appurtenant to the Diamond Mills Paper Company Dam:

i. Turbine generator house.

The gate at the left abutment leads via a steel penstock into a turbine house that is located approximately 25 feet below the main spillway crest elevation (Fig. 8, Appendix D). The stairway leading from the cliff on the left side of the channel to the turbine house is in very bad condition. The building itself appears to be unsafe and in imminent danger of collapse. The upstream and left channel walls bulge and there is substantial leakage through them into the building. The floors are wet and covered with silt. The equipment itself is rusted and generally in disrepair (Figs. 14 and 15, Appendix D). The two penstock outlets leading to the tailrace are deteriorated (Fig. 16, Appendix D). There is some discharge coming from these pipes even though the gate to the turbine is closed; this indicates that the gate is probably leaking. Furthermore, the penstock in the turbine building is leaking through pinhole(s) just above its connection to the turbine nozzle chamber. There is substantial seepage coming through the rock foundation under the turbine building. This is evident in Figure 16 both by the wet spot on the pipe in the foreground and by direct observation of the seepage coming from the wall between the pipes. A close-up of this seepage is shown in Figure 17, Appendix D.

ii. Sluice tunnels.

There are two 42-inch diameter sluice pipes that run through the fourth monolithic section from the

right wall of the channel (Fig. 18, Appendix D). They are located approximately 135 and 145 feet from the right channel wall. Because of the flow over the top of the spillway, it was not possible to see them clearly; however, from a vantage point as close as one could get to the downstream face, it appeared that little if any water was discharging from them (Figs. 18 and 19, Appendix D). According to the design drawings the turning nuts for the gates controlling flow through these pipes are located 5 feet below the crest on the upstream side of the dam. (Refer to Plate IV.) There was no way to access these turning nuts; they were not visible and the extension wrenches required to turn them could not be found.

d. Foundation

Because of the flow of water over the spillway, the foundation of this structure was not visible. For the most part, the rock in the area (channel walls, downstream outcrops) is shale, and in certain locations it is highly fractured (Fig. 20, Appendix D). Several deep, near-vertical cracks were observed in the rock above the right abutment. Some clay was noted on the banks downstream of the right abutment. It would not be surprising if there was substantial seepage beneath the dam; one local resident (name unknown, reliability questionable) maintained that there is a "space" under the dam.

e. Reservoir Area

The reservoir area just upstream of the dam up to the highway bridge contains near-vertical walls to an average height of about 20 to 30 feet above main spillway crest elevation on the right bank and 5 to 10 feet above spillway crest elevation on the left bank. These heights recede rapidly from the banks upstream of the highway bridge so that there is a large area of relatively low-lying ground just upstream of the highway bridge. At crest elevation, this area is approximately 45 acres. If the pond were to reach the cliffs, this area would be approximately 98 acres.

There are some recreational facilities in the low-lying upstream areas (Fig. 2, Appendix D). The banks are heavily wooded and vegetated, and there is no evidence of slope failure. About ½ mile upstream from the highway bridge, the cliffs approach to within 350 feet of each other again, and the Esopus Creek is confined by both banks.

A feature of the reservoir area behind the Diamond Mills Paper Company Dam is the by-pass channel that

has been cut into the right channel wall about 15 to 20 feet upstream from the right abutment. This cut is barely visible in the Overview Photo by the way the vegetation on the cliff is displaced inland, away from the stream. The inlet to the by-pass channel is also just visible on the right side edge of Figure 1. As mentioned previously, this channel led from the Esopus Creek, through the Diamond Mills Paper Company property, and exited farther downstream on Esopus Creek. Visual inspection of the channel revealed that it contains a control structure with 2 vertical lift gates approximately 50 feet from the inlet. The gates are closed and the controls have been wedged. It does not appear that they could be opened even if the opening mechanism were available; it is doubtful that they can be repaired. The channel itself is littered with debris and contains a good deal of silt. What water is in the channel is stagnant. Downstream from the control gates the channel is overgrown with vegetation and it has apparently not been in use for quite a long time.

f. Downstream Channel

Immediately downstream of the dam, there is an energy dissipation apron composed of massive blocks of rock and natural bench outcrops (Figs. 21, 23 and 24, Appendix D). Farther downstream, the channel widens. There are numerous boulders in the stream and a lush growth of trees along the banks (Fig. 22, Appendix D). There is no significant amount of debris in the downstream channel. As is evident in Figure 1, the channel widens and the cliffs receded sufficiently about ½ mile downstream for docks and houses to be built on the banks of Esopus Creek. These structures would probably be destroyed or severely damaged in the event of a dam failure. In general, the cliffs along the channel appear to be stable, although in certain areas the shale is badly fractured, and there are talus deposits and evidence of mass wasting.

3.2 Evaluation

The Diamond Mills Paper Company Dam appears to be in poor condition structurally. It appears to be leaking badly. The left abutment is in danger of collapse in the near future, especially if it is subjected to the Spillway Design Flood (SDF). Because the dam and its appurtenant structures have reportedly not been maintained for a long period of time (at least 10 to 15 years) the control structures have fallen into disrepair such that it is doubtful whether they can economically be made to function properly again. Visual inspection of this dam

disclosed the existence of many serious conditions that could threaten the safety of the people living downstream, such as the potential for one or more components of the left abutment area to fail.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

There are no established operational procedures on file with NYSDEC. Therefore, in view of the fact that ownership of the dam cannot be established, it must be assumed that no operational procedures exist. Even if such procedures could be found in the records of past owners, it is doubtful whether they could be implemented because of the condition of the control structures themselves.

4.2 Maintenance of Dam

Based on the information obtained, we infer that the dam has not been maintained for at least 10 to 15 years.

4.3 Maintenance of Operating Facilities

We understand the operating facilities have not been maintained for at least 10 to 15 years. Mr. William Morgan, a lifelong (70+ years) resident of Saugerties, reported that it has been that long since the controls were last operated and the stream diverted. It was done at that time by personnel of the Martin Cantine Company.

4.4 Warning System in Effect

None.

4.5 Evaluation

There are no procedures now in effect for maintaining, operating or otherwise attending to the dam. This probably stems from the ownership question. There is also no known warning system in effect. The last time there was a suspected danger to the dam (a fire at the adjacent Martin Cantine Company Mill in January 1978), the Mayor of Saugerties sent a telegram to the USACE, New York District, requesting help! (Refer to Appendix E.) Such a procedure is obviously unacceptable in a potential emergency situation.

SECTION 5

HYDRAULICS/HYDROLOGY

5.1 Evaluation of Hydraulic Features

a. General

The turbine generator system is not considered to be a hydraulic feature of the dam itself and, as such, it will not be considered in this report. Further, there is no information, design or otherwise, available about it. Therefore, the subject here will be restricted to the dam itself.

b. Design Data

The available data indicate that the dam was designed to operate as an ogee type spillway. Severe deterioration of the concrete on the downstream face and on certain sections of the crest, plus the fact that water is continuously flowing over the spillway, have resulted in a very undesirable situation. Deterioration can be expected to continue due to erosion and cavitation. The hydraulic performance of the dam will thereby be degraded.

The data available for the sluice gates and tunnels may be of no value as we believe there is a good chance that the gates may be blocked by silt, or may be inoperative for mechanical reasons.

There are no data available for the gate controlling the turbine penstock or for the gates meant to control the by-pass channel leading to the Diamond Mills Paper Company.

There are no data on the hydraulics of the side-channel spillway.

c. Experience Data

No formal data or measurements are available for any of the hydraulic structures.

d. Visual Observations

On the day of the inspection, the main spillway was passing from 3 to 6 inches of water. Water splash was noted at various points on the downstream face and in the monolith joints indicating the existence of cracks or

spalls (see, for example, Figs. 3, 4, 5, 9 and 18). A longitudinal crack was noticed on the upstream face near the right abutment about 6 inches below the crest. Should this crack develop to the extent that the crest is lost in that area, the hydraulic performance of the dam will be greatly altered.

Observation of the hydraulic flow control systems indicated that it is doubtful whether any of the gates can be opened or if the controls can be repaired.

5.2 Evaluation of Hydrologic Features

a. Design Data

There were a limited amount of hydrological data at the time the dam was being designed. The designer applied stream flow records for nearby Rondout Creek to estimate the "maximum known flood" for Esopus Creek at the dam site. He used the 32,500 cfs flow of 26 August 1928 as his design flow, and designed the dam for a 14-foot maximum height of water over the main spillway. No other hydrological data used in the original design of the dam or its appurtenant structures are available.

b. Experience Data

In this study, data obtained from Hydrologic Flood Routing Model for Lower Hudson River Basin (USACE) were used to establish the Standard Project Flood (SPF). According to Mr. Thomas Smyth, hydrologist with the N.Y. District, USACE, the Probable Maximum Flood (PMF) is twice the SPF. In the Recommended Guidelines for Safety Inspection of Dams, Department of the Army, OCE, the Spillway Design Flood (SDF) for the size (small) and hazard (high) classification of the subject dam is also one-half the PMF. Therefore, for the Diamond Mills Paper Company Dam:

SPF = 52,260 cfs
PMF = 104,520 cfs
SDF = 52,260 cfs

Because of the extremely small reservoir to drainage area ratio (approximately 0.22 square miles to 423 square miles or 1:1923) it was not deemed necessary to route the SDF through the reservoir. The total SDF flow was used to evaluate the overtopping potential and to analyze the stability of the dam. (Refer to Appendix C.)

c. Visual Observations

Hearsay evidence of local residents puts the height of maximum flood above the "VI" marking on the right abutment. Although it was impossible to measure that distance accurately on the day of the inspection, it was estimated to be between 6 and 8 feet. Water marks were observed on the right abutment at levels which confirmed the hearsay evidence of the local residents.

Local residents also claim that there is a "sand bar" just upstream from the dam. This would indicate that a large amount of sedimentation has taken place. In addition to decreasing the storage capacity of the dam, such sedimentation, if it has occurred at the upstream face of the dam, would not only block the sluice gates but would also impose additional overturning moments on the dam. No measurements of siltation were made and no "sand bars" were observed; however, the water was not clear enough to see bottom from our closest vantage point.

d. Overtopping Potential

The height of water (11.75') going over the spillway during the SDF will be less than the design height (14'). Therefore, theoretically, the dam will not be overtopped by the SDF. Back computation reveals that it will pass approximately 65 percent of the PMF.

e. Spillway Adequacy

Theoretically, according to our computations, the main spillway is adequate to pass the Spillway Design Flood. However, that height of water over the main spillway would substantially raise the water level at the left abutment and possibly overstress either the side-channel spillway, the penstock gate or the support pier. There are no design computations available for any of these structures. In the absence of design computations and based on their observed poor condition, it is reasonable to assume that one or more of them will be overstressed by the SDF. If failure should occur, the dam will be breached at the left abutment.

f. Hazard Potential

Our inspection of the downstream shorelines revealed several houses and docks at or near the banks of the Esopus Creek within ¼ mile of the dam. About ½ mile downstream on the right bank, there is a small cluster of

homes, several two-story brick buildings (perhaps apartments), and a water supply pump. On the left bank about ½ mile downstream there is a Village of Saugerties Sewage Treatment Plant. Most of the buildings observed were permanent residences, and they and their inhabitants would be seriously affected by failure of the dam. Consequently, the "high" hazard potential designated for the Diamond Mills Paper Company Dam is considered appropriate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

Visual observation of the concrete gravity structure disclosed signs of structural distress which may endanger the stability of the dam and its appurtenant structures. These observations are as follows:

i. Spalling of concrete to a depth of from 3 to 6 inches over most of the downstream face of the main spillway section (Fig. 3, Appendix D) and along some sections of the spillway crest (Fig. 24, Appendix D). Some of this spalling may be of an unreported gunite resurfacing.

ii. Longitudinal cracking over much of the concrete gravity structure at all levels (Figs. 3, 5, 18, Appendix D). Because of the flow of water over the dam, we could not determine whether these were structural cracks or construction joints.

iii. Widening of monolith joints (Fig. 4, Appendix D).

iv. Possible offsets of monoliths (Figs. 13 and 23, Appendix D).

v. Seepage through and under side-channel spillway (Figs. 6, 7 and 23, Appendix D). Note white water at base of spillway near pier in Figs. 6 and 23.

vi. Seepage through walls and inward bulging of walls in turbine generator house.

vii. Inoperative condition of all control gates.

b. Design and Construction Data

Stability computations were performed as part of the original application for permit to build (refer to Appendix E). The analysis was performed for a 14-foot head of water on the spillway corresponding to the maximum observed flood of 32,500 cfs. As indicated previously, these computations are incorrect because the hydrostatic forces were taken to act on the downstream (inclined) face of the dam. There are no construction data available for the dam.

There are also no data, design or construction, available for any of the appurtenant structures except for 2 design drawings of the main spillway gates. One of these drawings is shown as Plate IV of this report.

The stability computations performed as part of this report are found in Appendix C. The analysis was performed for the SDF and its corresponding 11.75-foot head on the spillway. Although the factors of safety resulting from this analysis are lower than those recommended in the OCE guidelines, they are based on very conservative assumptions and, as such, are perhaps unrealistically low. (Refer to computations in Appendix C.) If the effects of tailwater, foundation keys and foundation anchors are neglected, and if full uplift pressure is considered, the computed factors of safety are:

i. Overturning stability: 1.3

ii. Sliding stability: 1.0

iii. Compressive stress: >10

These, of course, are theoretical values. It is impossible to assess the actual values at this time in view of the present deteriorated condition of the dam.

c. Operating Records

There are no formal operating records for the dam or any of its appurtenant structures.

d. Post-construction Changes

Although there is no formal record of the change, the crest of the side-channel spillway at the left abutment is approximately 1½ feet higher than the crest of the main spillway section. The two are shown at the same elevation on the design drawings. It is impossible to ascertain whether this change was made during or after construction.

e. Seismic Stability

The Diamond Mills Paper Company Dam is nominally located in Seismic Zone 1 according to the Algermissen Seismic Risk Map. Although earthquakes that cause minor damage can be expected to occur in this Zone, they are not likely to have a major effect on low fundamental period structures such as small, concrete gravity dams. Ordinarily, a dam of such a type that is stable under static

conditions is also considered to be stable under earthquake conditions in Zone 1. However, in view of the poor condition of the structures at the left abutment, it is possible that even a minor earthquake may trigger failure of one or more of those structures. No computations were performed to determine the effect of earthquakes on the subject dam and its appurtenant structures.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

A review of the available engineering data and theoretical analyses based on these data seems to indicate that the dam would perform satisfactorily under the conditions set by the OCE guidelines. However, visual inspection of the system reveals that actual conditions may be far different from those that formed the basis for the theoretical assessment, and that the safety of the Diamond Mills Paper Company Dam appears to be marginal at this time. This assessment is based on the observation of a number of deficiencies of varying degree of importance. A summary of these deficiencies is given below:

Structure	Observed Deficiency
Main Spillway:	
Downstream face	Concrete deterioration (very severe); longitudinal cracking; possibly large amount of leakage; open joints; monoliths possibly offset.
Crest	Concrete spalling, longitudinally and at joints.
Outlet works	Inoperative and possibly beyond repair. Gates may be leaking.
Left Abutment:	
Side-channel spillway	Concrete severely spalled and scaled; erosion at junction with main spillway; obvious leakage through and under spillway; large longitudinal cracks.

Outlet works	Inoperative and possibly beyond repair. Gate probably leaks.
Step-tapered pier	Severe erosion of concrete at base; moderate spalling on steps; large crack at base.
Turbine generator house	Walls bulging inward; obvious leakage through upstream wall and wall bordering on left side of channel; leakage beneath foundation and erosion of foundation materials; leakage from penstock pipes.
Access structures	Wooden boards on bridges and stairways leading to gate control platform and turbine generator house are rotted and overgrown with vegetation. Steel rail leading to side-channel spillway rusted out.
By-pass Channel:	
Channel	Choked by sediment and debris upstream from control section. Overgrown with vegetation downstream from control section.
Controls	Inoperative and probably beyond repair.
Other:	
Operation procedures	None.
Maintenance procedures	None; no responsible party in charge.
Emergency warning procedures	None; no responsible party in charge.

Channel	In some areas along the crest of the cliffs near the dam (most pronounced at right abutment), there is no fence to prevent people from inadvertently walking or driving off the edge of the cliff into the channel.

Because of these deficiencies, the safety of the Diamond Mills Paper Company Dam can be seriously questioned.

b. Function

Since the original purposes of the dam (to generate power for Martin Cantine Company and provide water to Diamond Mills Paper Company for industrial processes) are no longer relevant, and since the dam is not needed for flood control and does not provide a major impoundment for recreational purposes, it is questionable whether the dam is needed any longer. There is a possibility, however, that farming interests upstream require the backwater elevations for irrigation purposes. (Refer to letter from Mr. Schirmer to Mr. Koch dated 20 June 1978, Appendix E.) In any case, further need for the dam should be evaluated.

c. Adequacy of Information

The information available to us was adequate to make a preliminary assessment of the main section of the dam. There were no data available for an assessment of the by-pass channel near the right abutment or the structures composing the left abutment. The visual inspection, however, disclosed many deficiencies in each of these components that altered the preliminary assessment made on the basis of design data alone.

d. Urgency

There is an urgent need to perform a detailed investigation of the subject dam and its appurtenant structures, to evaluate more exactly the seriousness of the deficiencies noted, and to reassess the safety of the dam in light of this evaluation. If the deterioration of the structures noted in Section 7.1a is allowed to continue, it is our opinion that the dam will eventually fail even under less than SDF conditions. It is also our opinion

that these structures may fail even in their present state of deterioration and disrepair should the SDF occur. Therefore, the recommendations presented below should be implemented immediately.

e. Necessity for Further Investigation

Further investigations are necessary to assess more precisely the seriousness of the deficiencies noted in Section 7.1a. This investigation should include but not be limited to the following:

1. Establish which, if any, of the control structures can be operated.

2. Inspect the upstream and downstream face of the main structure without water flowing over the dam.

3. Determine the amount of leakage that takes place through monolithic joints and under the dam.

4. Perform a detailed inspection and evaluation of the competence of the left abutment area including the side-channel spillway, the step-tapered pier, the penstock and penstock gate, and the turbine generator house.

5. Reassess the safety of the dam in the light of the results of the investigation and determined the need for, and type of, mitigating measures.

7.2 Recommendations

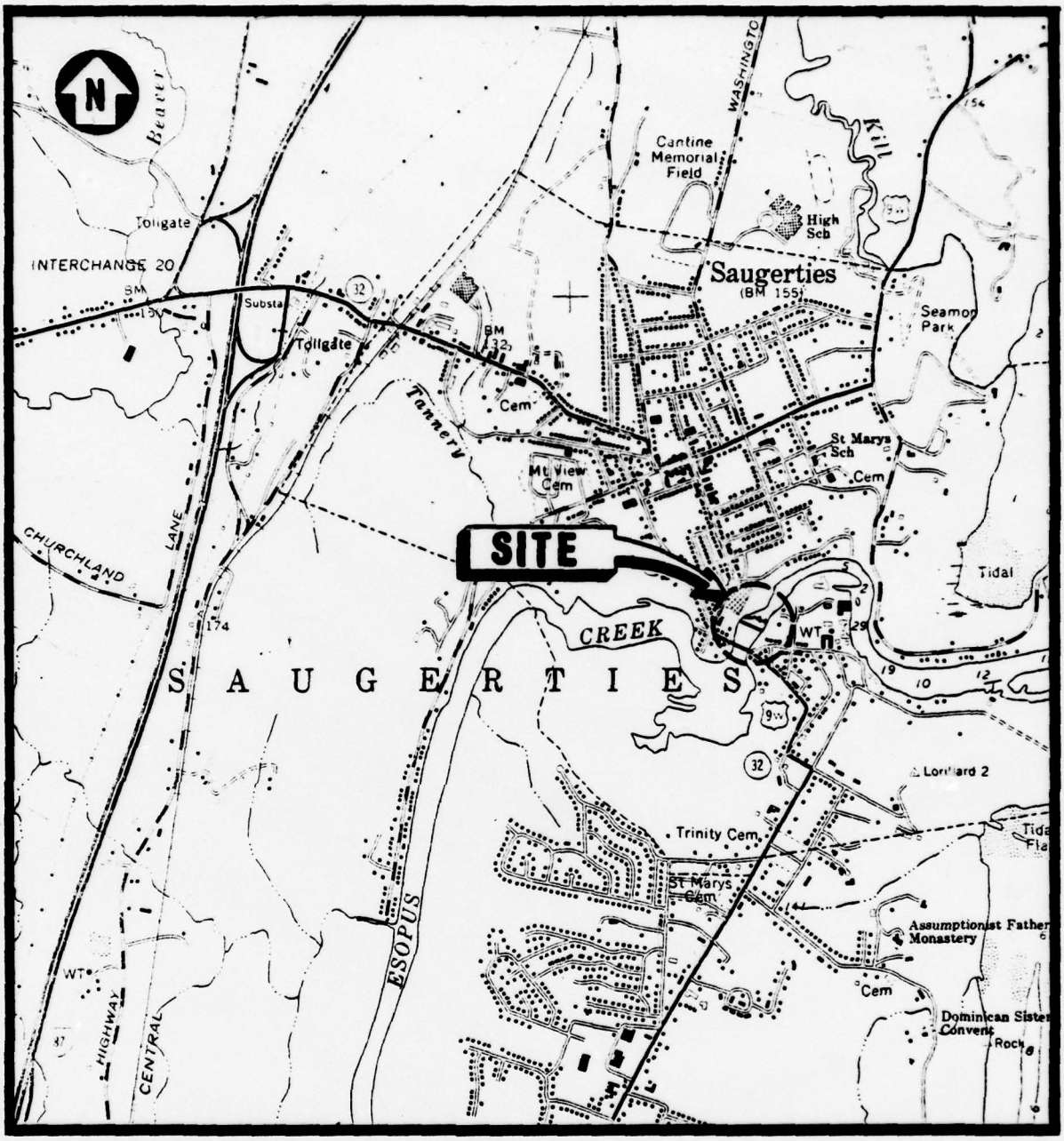
In order to perform the investigation recommended in Section 7.1e satisfactorily, it will be necessary to lower the reservoir substantially. This, of course, will entail the operation of either the gates controlling the two sluice pipes in the main spillway, or the gate controlling flow through the penstock at the left abutment. In either case, there is a possibility that, once opened, the gates may not be able to be closed either because of mechanical difficulties or because of sedimentation at the closure face. Alternatives, therefore, should be considered prior to diverting the stream in the event that the gates require repair. Of course there is a possibility that the investigation may reveal that the entire structure needs to be replaced, or that the dam can be removed without replacement. In those cases, repair of any of the components would be unnecessary.

If the gate at the left abutment is used to lower the reservoir, there is an additional danger that

the turbine generator house may be lost because of the poor condition of the penstock pipe and flow system in that structure. Therefore, if lowering of the reservoir is to be accomplished by opening the gate at the left abutment, a detailed investigation of that structure and its associated piping and controls is recommended prior to such lowering.

A recommendation for immediate action is that fences be built near the cliffs on the site of the old Martin Cantine Company Mill and on the opposite side of the channel above and upstream from the dam to prevent the public from inadvertently walking or driving off the cliffs. This fence will also serve to keep people, especially children at play, away from the dangerous stairs, walkways and turbine house at the left abutment.

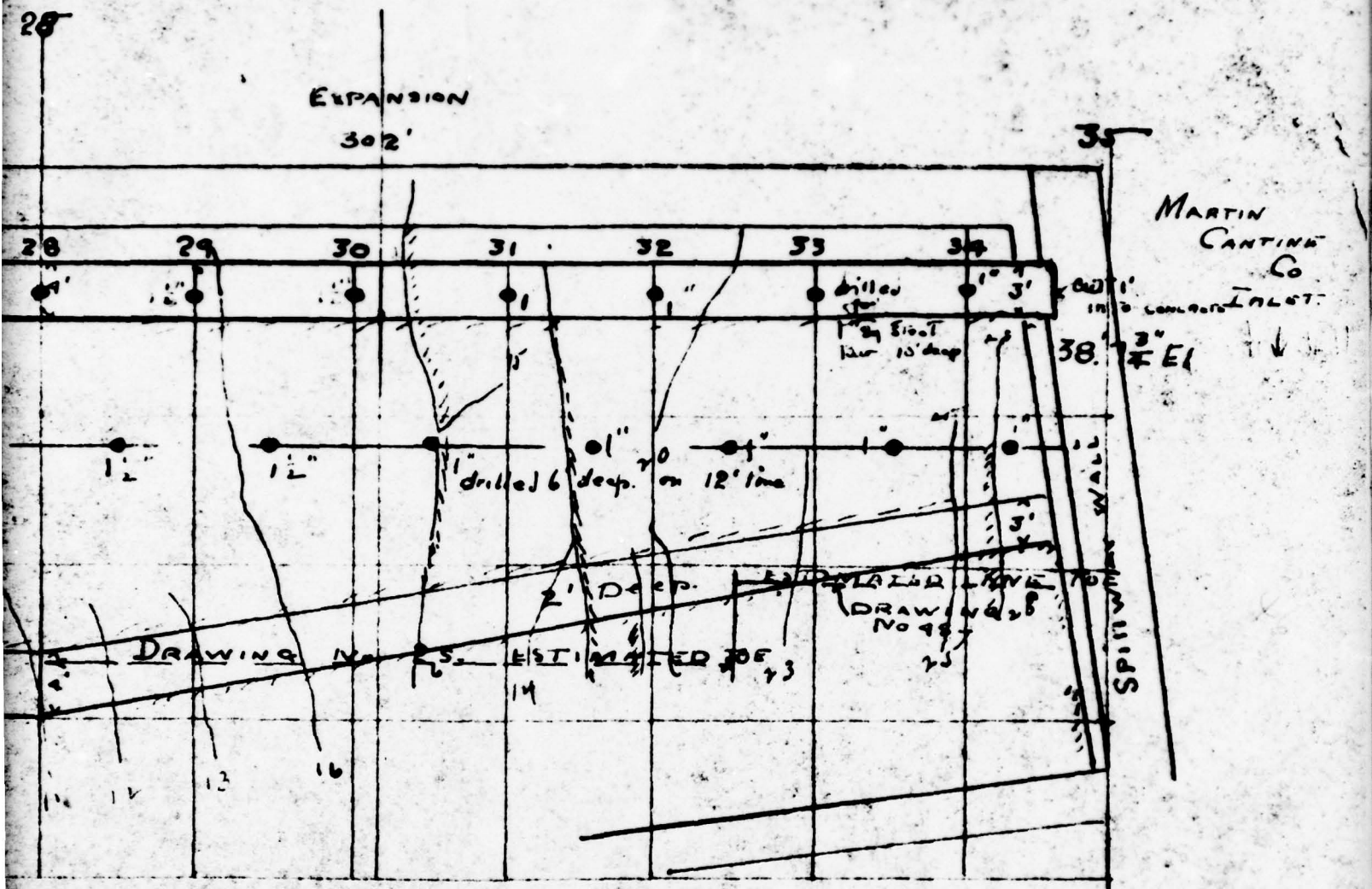
Before any of the above recommendations are implemented, an attempt should be made to resolve the ownership question. All legal implications of the proposed actions should be established, including the legal rights of any farmers upstream for irrigation water (Refer to letter from Mr. Schirmer to Mr. Koch dated 20 June 1978, Appendix E). However, we recommend that the lake be substantially lowered before the end of October 1978 for a proper engineering evaluation of the structure.



SCALE: 1"=2000'

MAP SOURCE: BASE MAP WAS ADAPTED FROM U.S. GEOLOGICAL SURVEY MAP, SAUGERTIES, N.Y. QUADRANGLE, 7.5 MINUTE SERIES, 1963. (BASE MAP MAY NOT REFLECT RECENT CARTOGRAPHIC CHANGES)

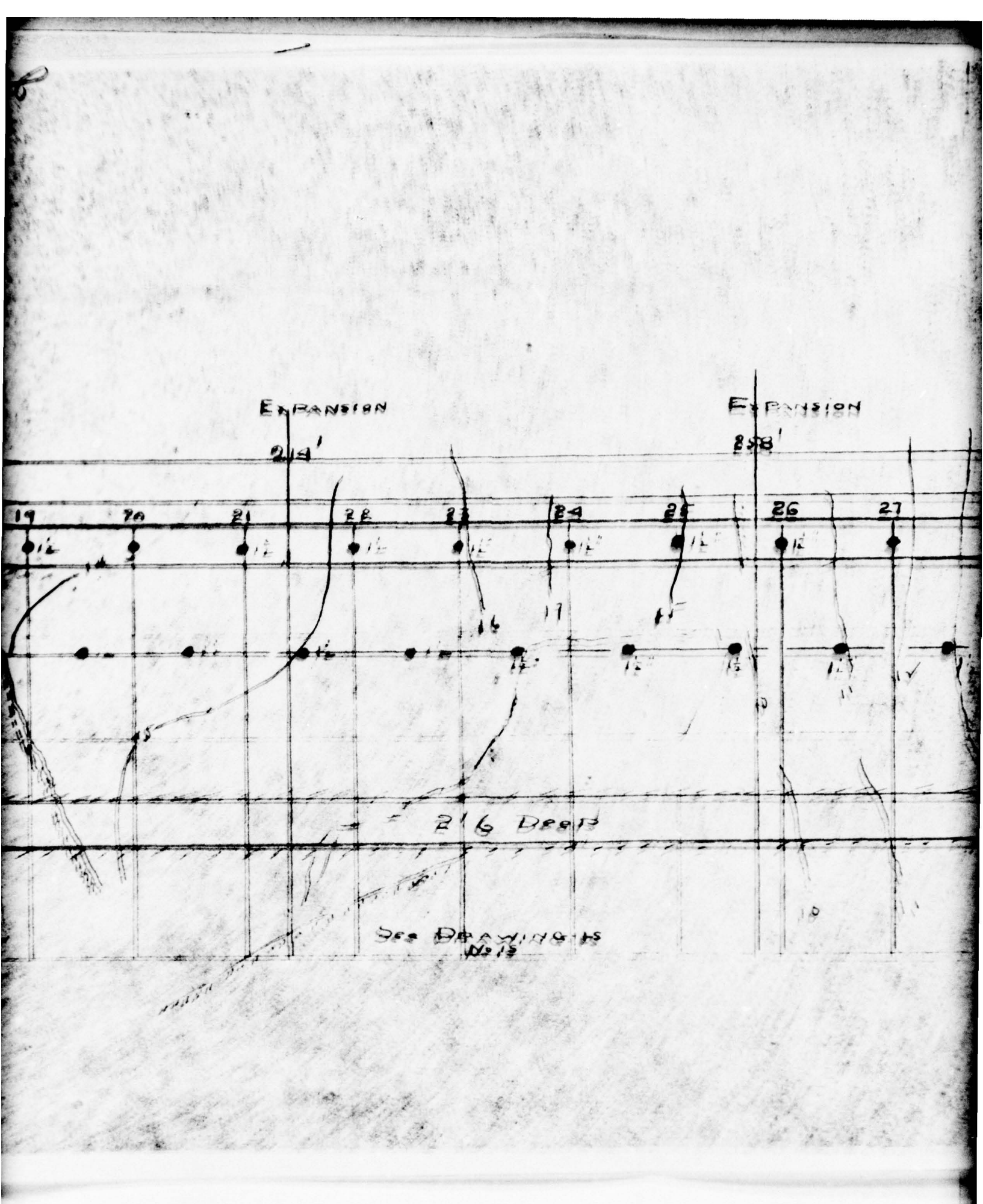
PLATE I SITE LOCATION MAP



DRAWING-NO 65

CORRECTIONS
TRANSFER
SECTION-28
TO
SECTION-26

PLATE II AUG. 1978

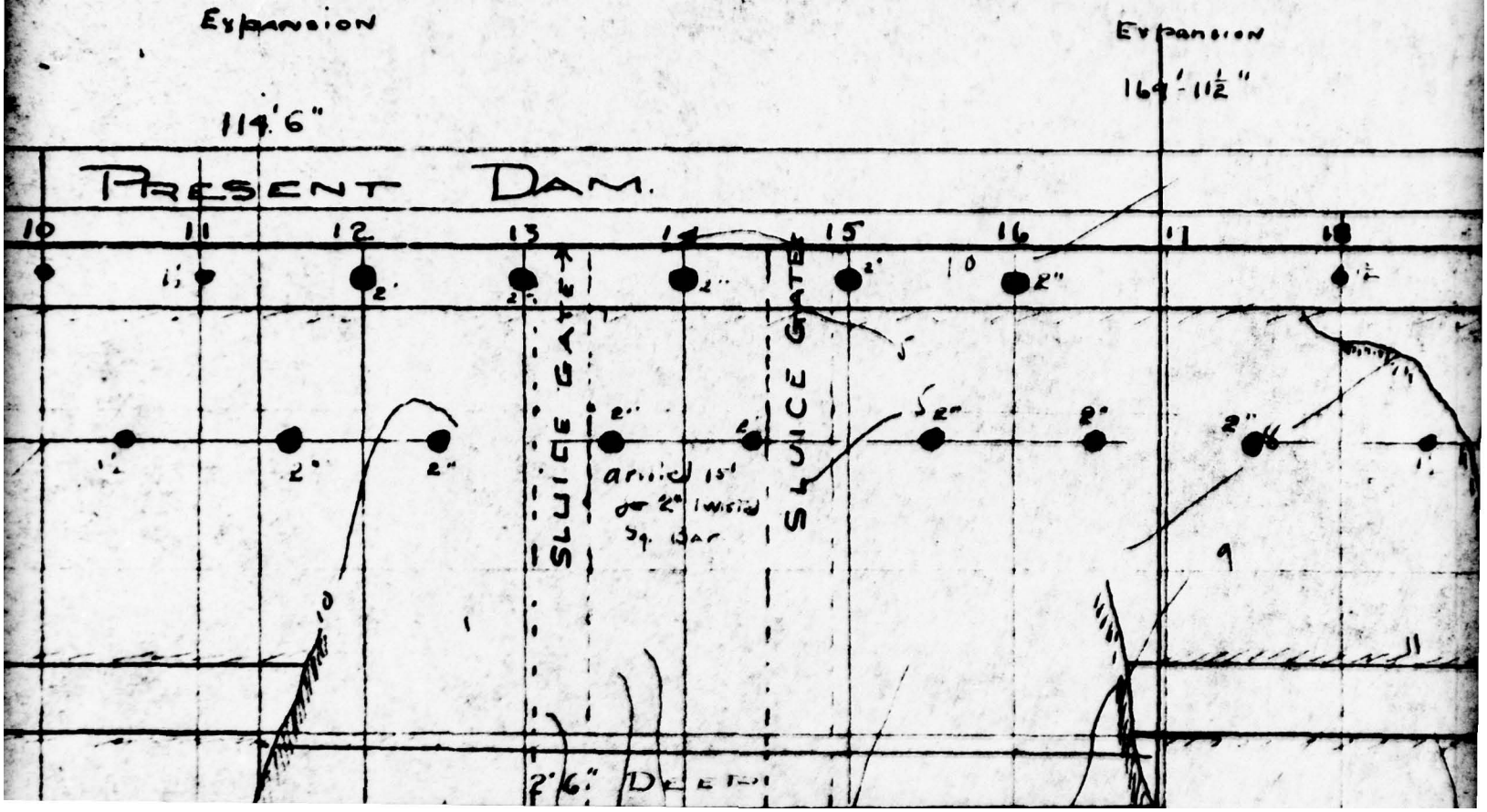

EXPANSION
EXPANSION
19
20
21
22
23
24
25
26
27
216 Deep
See Drawing No 13

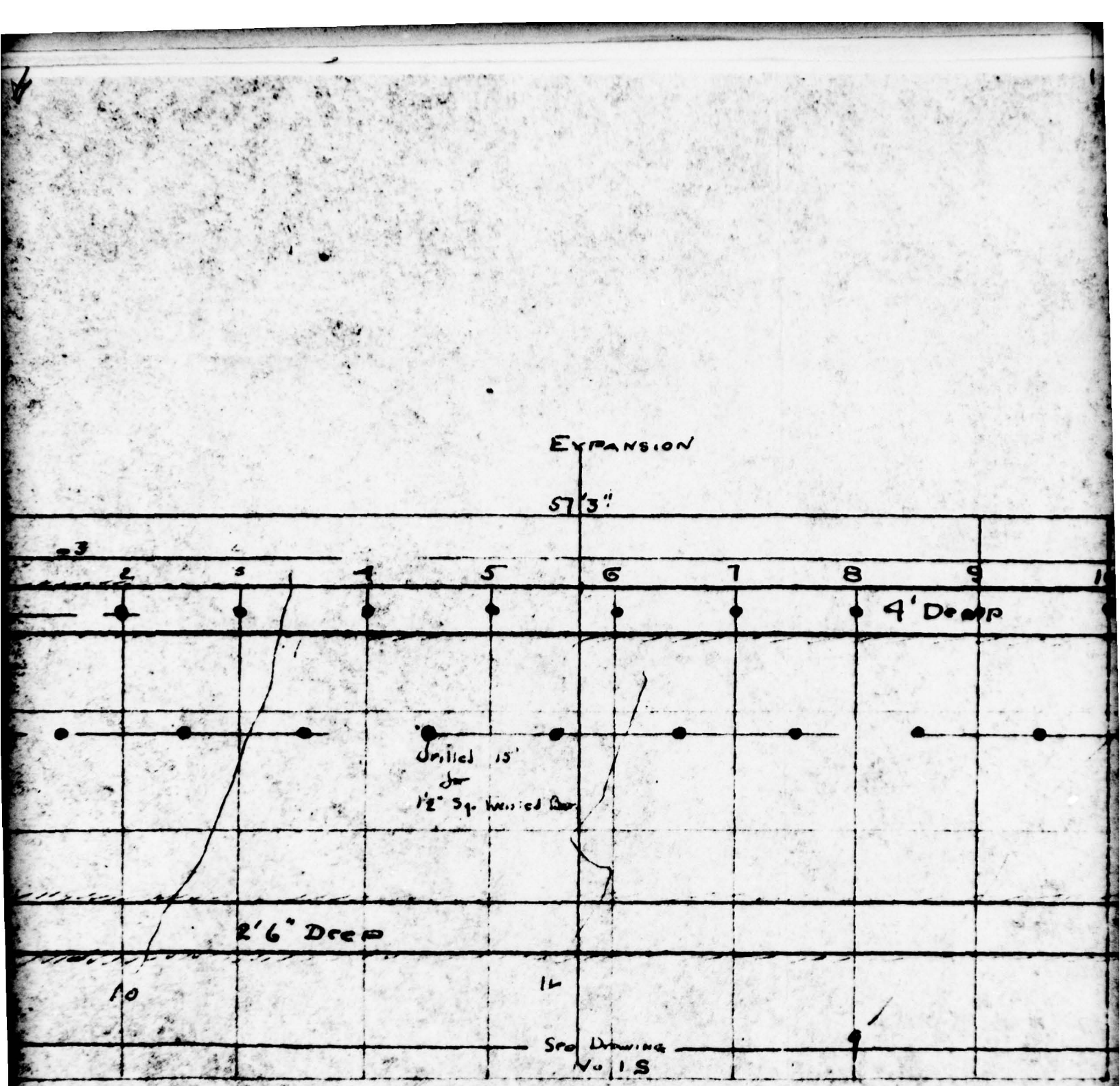
E

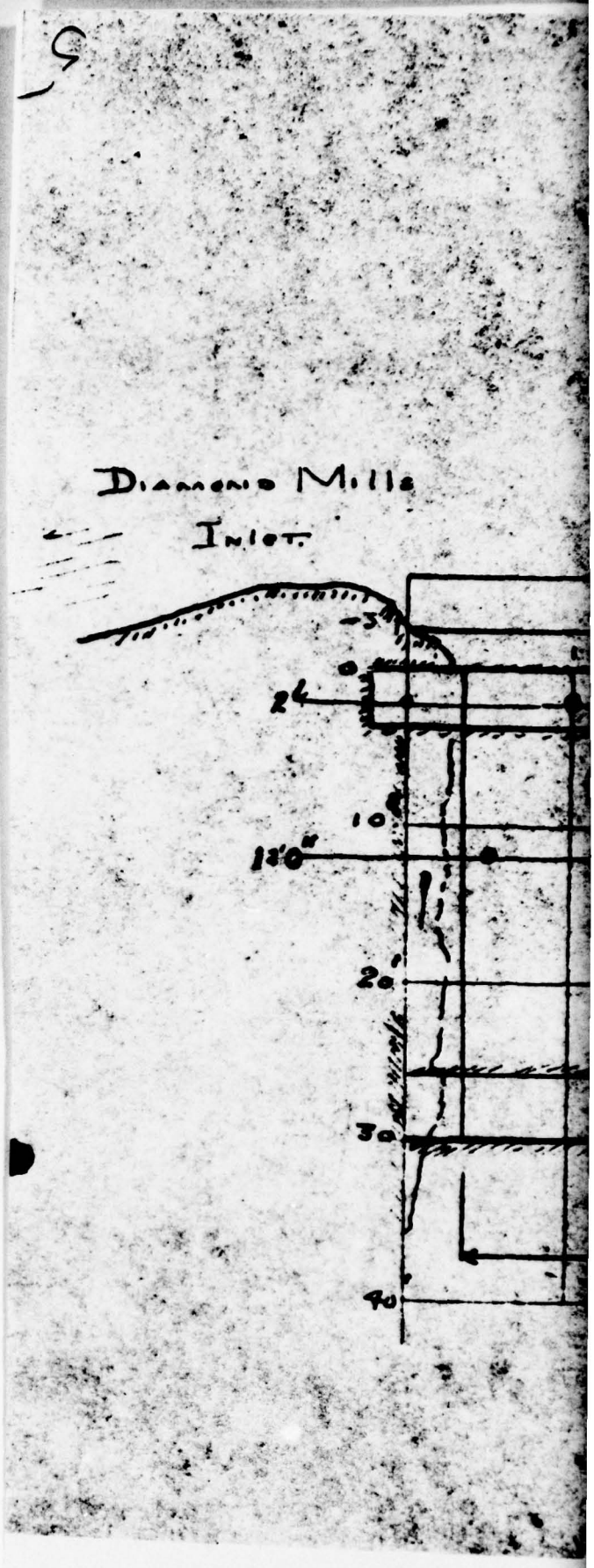
DIAMOND MILLS PAPER CO
MARTIN CANTINI CO.

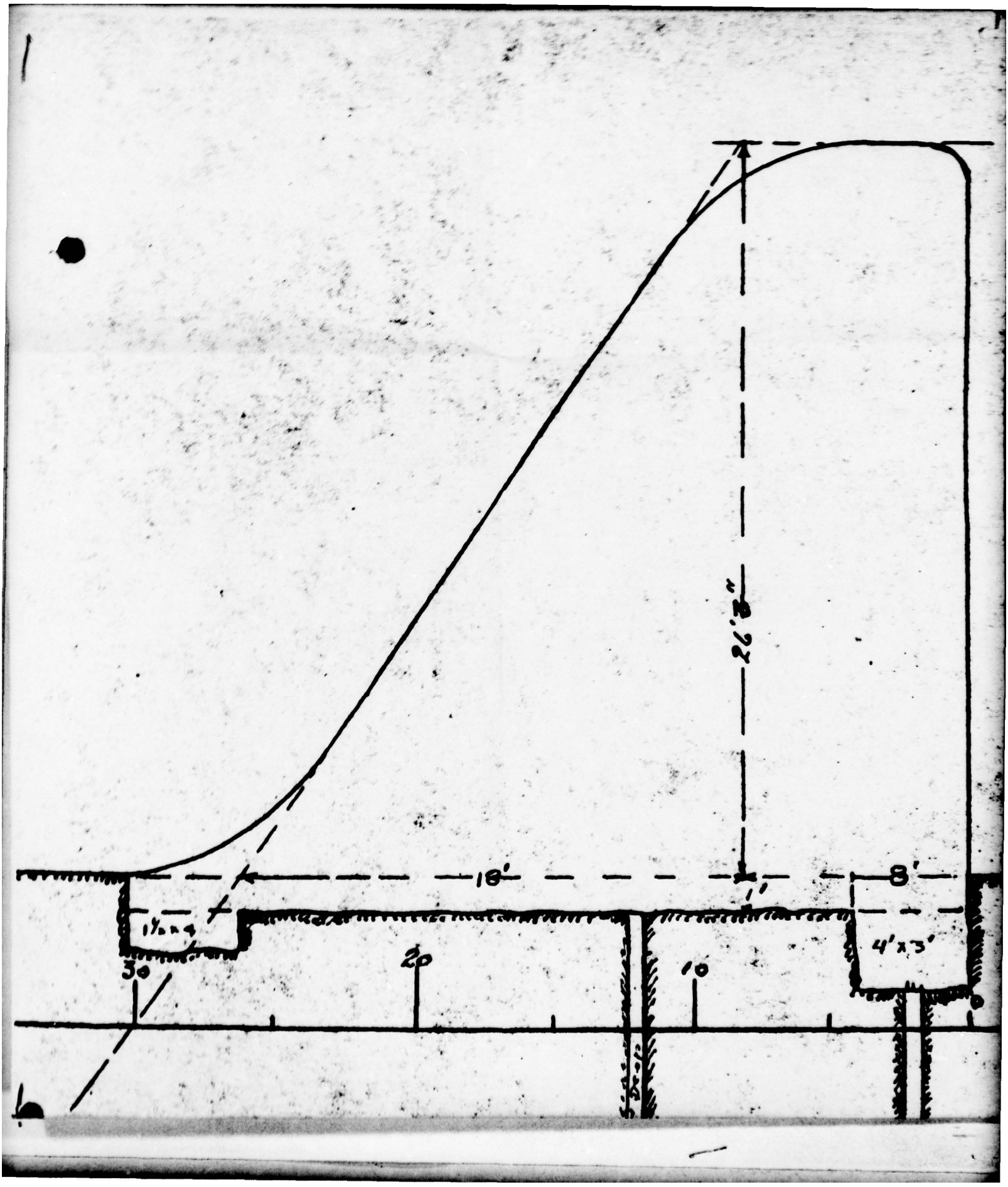
Forbes Sanborn Mgr

DRAWING NO. 75




EXPANSION
57'3"
2
3
4
5
6
7
8
9
4' Deep
Drilled 15"
for
1'2" Sq. twisted Bar
2'6" Deep
10
12
See Drawing
No. 15


Diamond Mills
Inlet
-3
0
24
10
120"
20
30
40


26'3"
18'
8'
1½ x 4
4'x3'
30
20
10

2

38' 7 3/4"

30

SECTIONS
ON LINE XY 17. to 28
DIAMOND MILLS PAPER CO
MARTIN CANTINE CO
PROPOSED DAM.
DRAWING NO. 1. S.

20

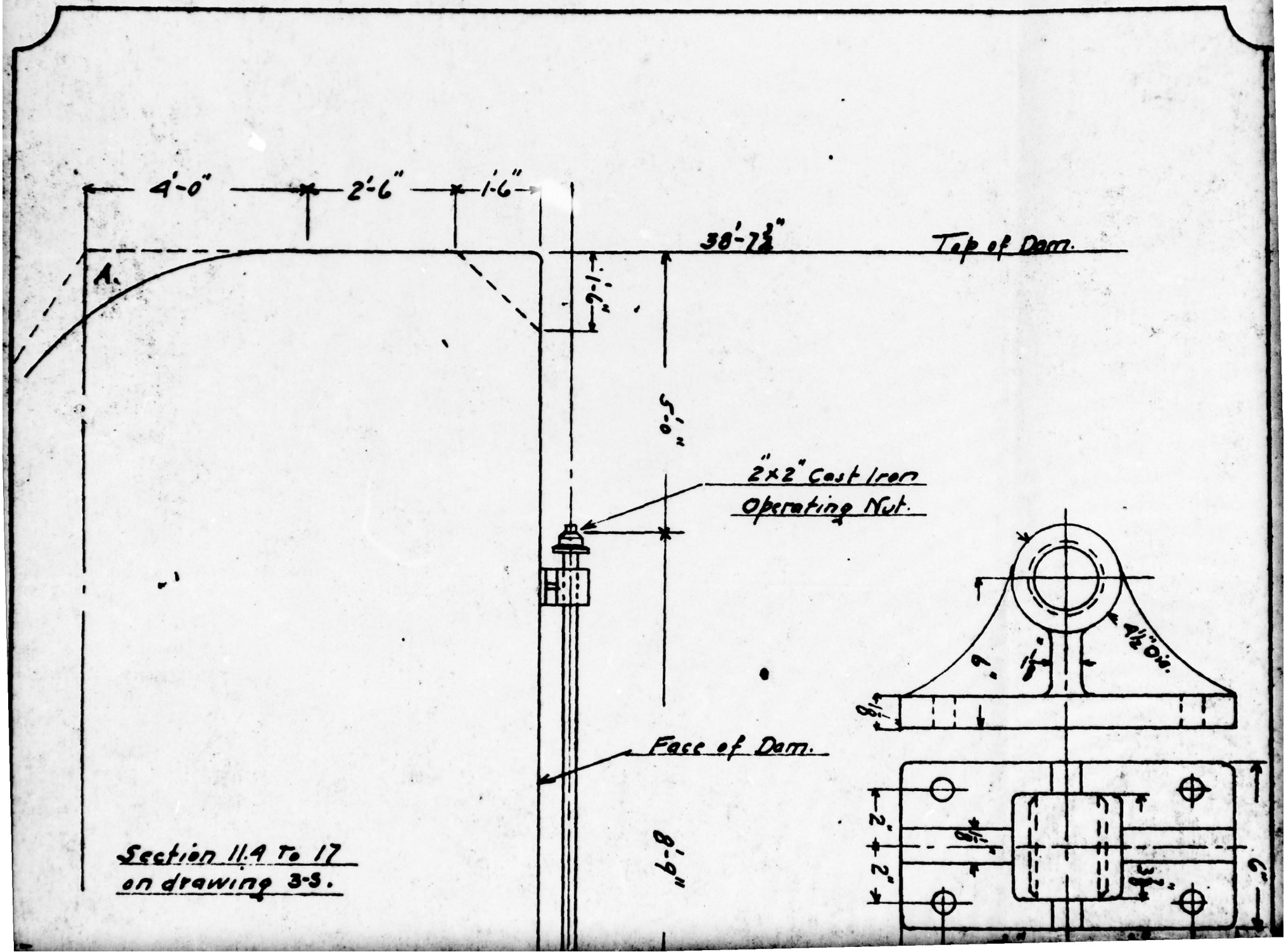
Rock line 12' 4 3/4"

10

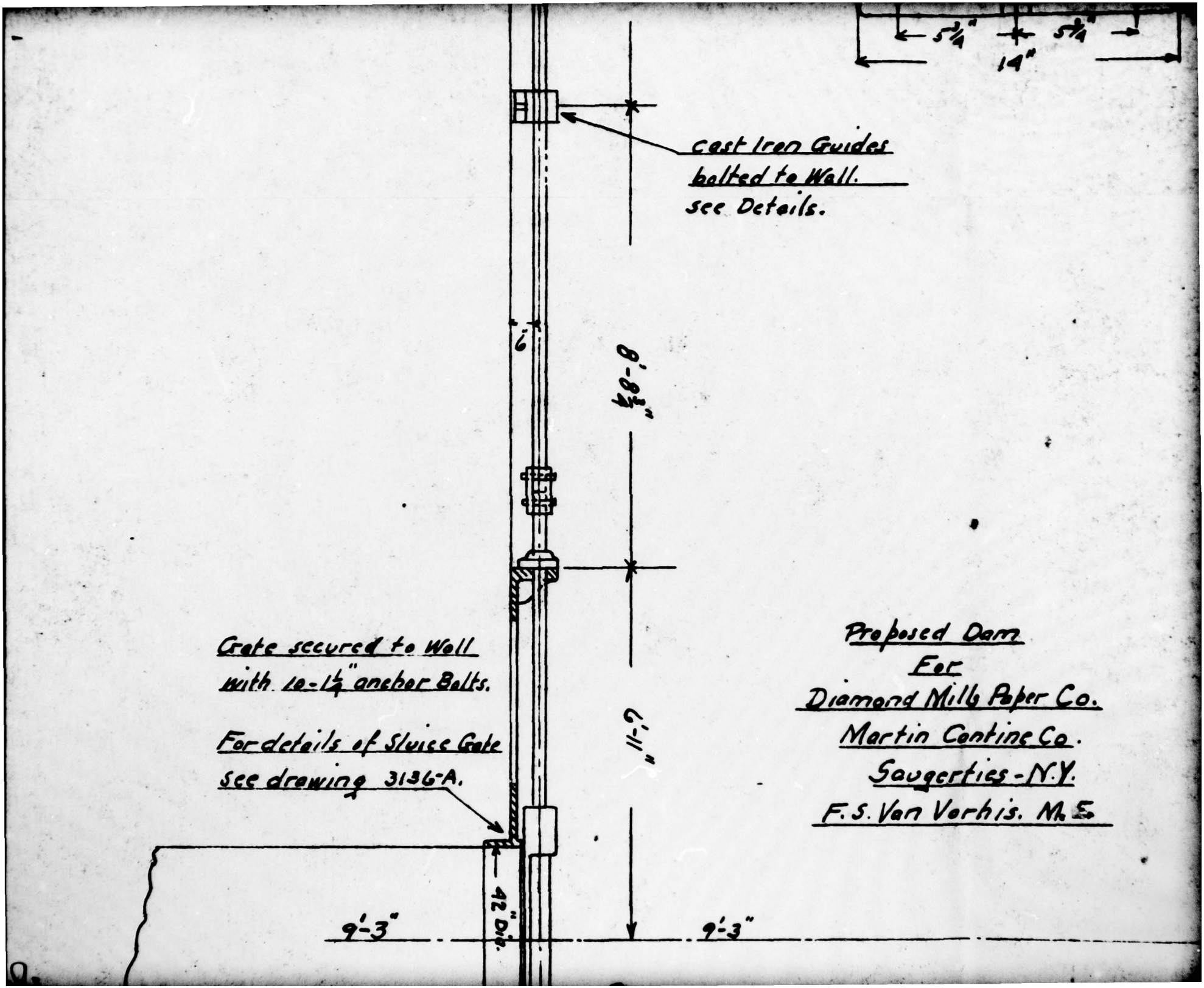
SCALE ½" = 1'

JOSEPH S. WARD
AND ASSOCIATES
CONSULTING ENGINEERS
81 ROOSEVELT AVE.
CALDWELL, NEW JERSEY

PLATE III AUG. 1978



Section 11.4 To 17
on drawing 3-S.


5¾"
14"
5¾"
Cast Iron Guides
bolted to Wall.
see Details.
6"
8'-8¾"
11'-2"
Gate secured to Wall
with 10-1¼" anchor Bolts.
For details of Sluice Gate
see drawing 3136-A.
42" Dia.
9'-3"
9'-3"
Proposed Dam
For
Diamond Mills Paper Co.
Martin Contine Co.
Saugerties-N.Y.
F.S. Van Vorhis. M.E.

JOSEPH S. WARD
AND ASSOCIATES
CONSULTING ENGINEERS
91 ROSELAND AVE.
CALDWELL, NEW JERSEY

PLATE IV AUG. 1978

No. 4648.

Details of 42" Sluice Gate

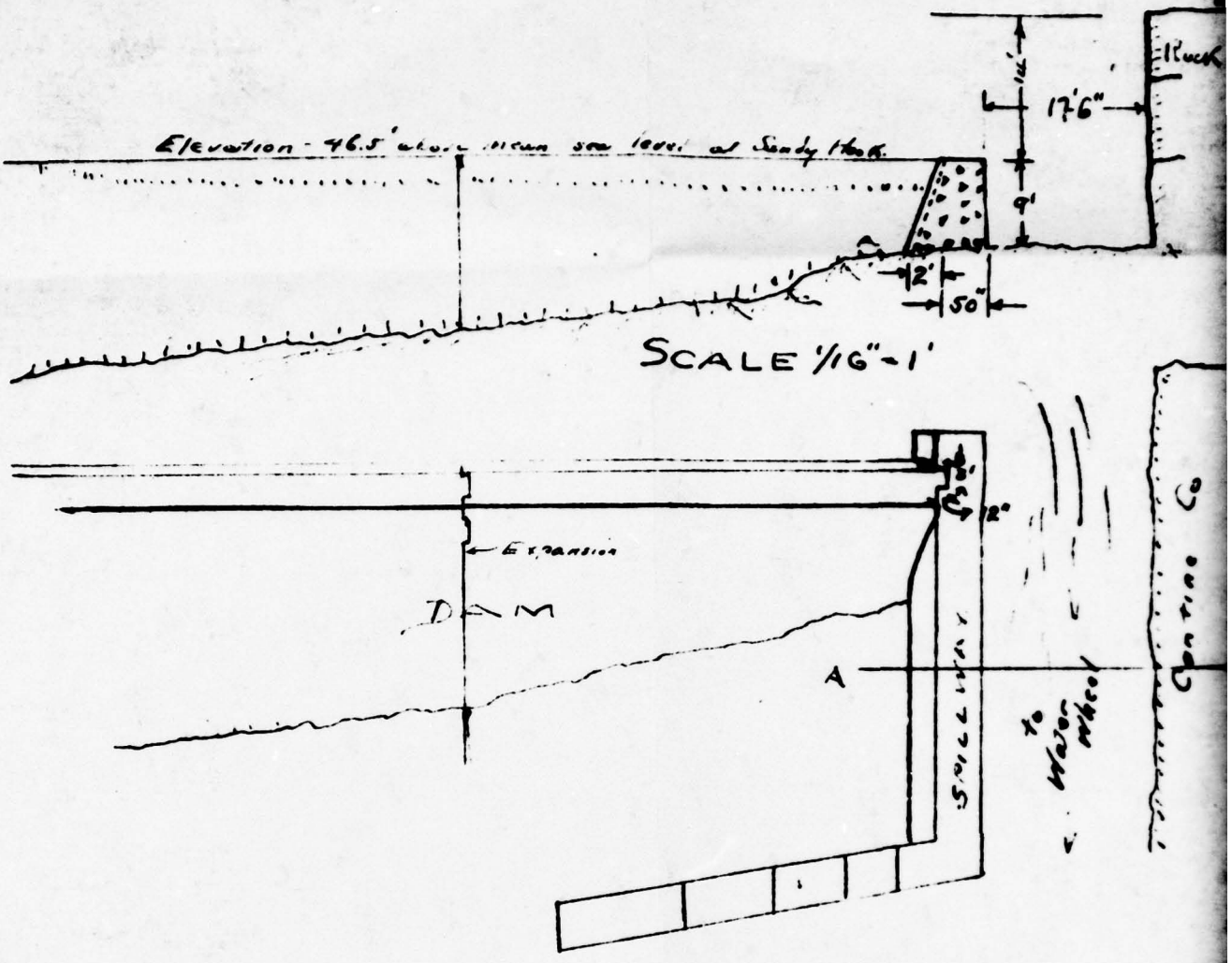
Scale ½" = 1 Ft.

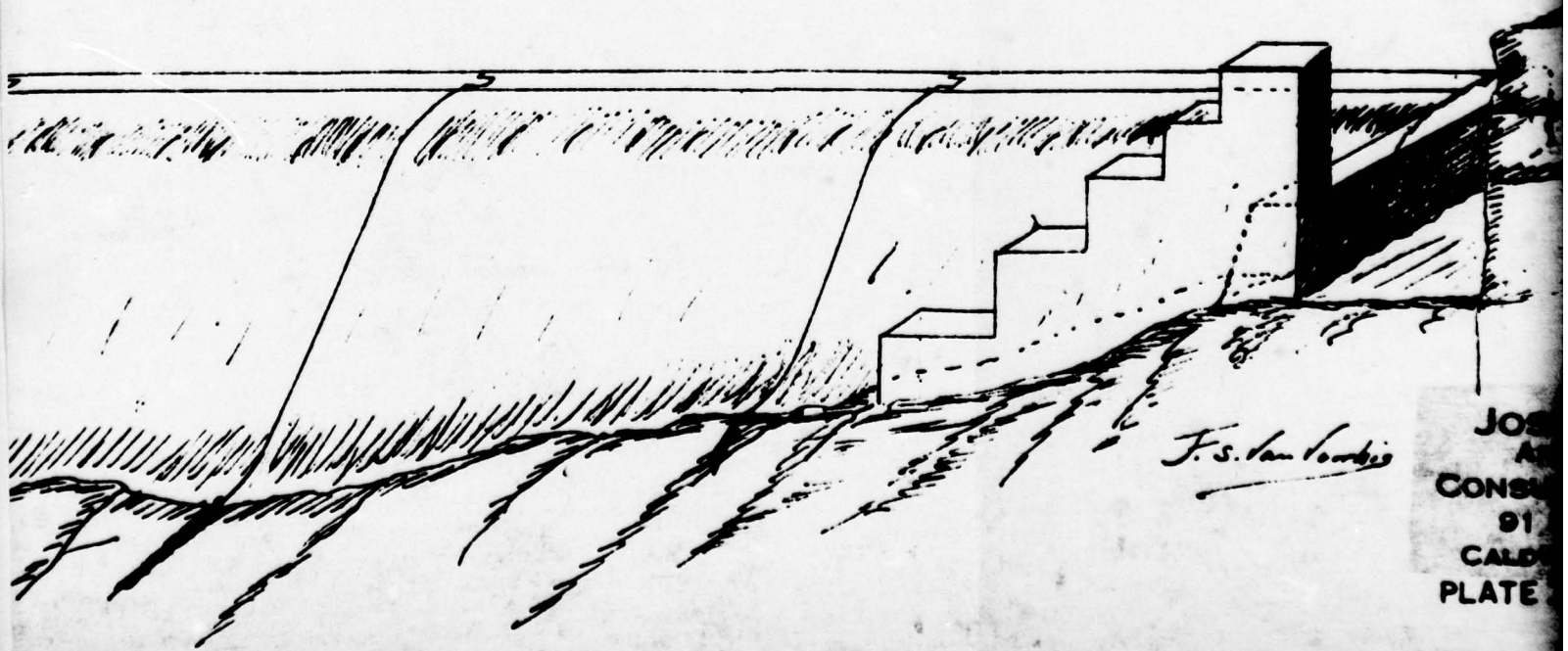
March 9,1

THE

LUDLOW VALVE MFG.

TROY - N.Y.





JOS
A
CONSU
91
CALD
PLATE

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A

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APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

NAME OF DAM: Diamond Mill Paper Company NDS ID NO.: NY 89

RATED CAPACITY (ACRE-FEET) 826 NYS DEC ID NO.: 210-829

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 46.5

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 46.5

ELEVATION MAXIMUM DESIGN POOL: 60.5

ELEVATION TOP DAM: 46.5

CREST:

a. Elevation 46.5
b. Type Ogee
c. Width Rounded-crest - approximately 8 feet
d. Length 346 feet
e. Location Spillover Entire length of dam
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 2 - 42" diameter sluice pipes with control gates.
b. Location Approximately 135' and 145' from right abutment.
c. Entrance inverts Elevation 15.25
d. Exit inverts Elevation 15.25
e. Emergency draindown facilities 2-42" diameter pipes: 60" diameter penstock pipes at left abutment

HYDROMETEOROLOGICAL GAGES:

a. Type -
b. Location -
c. Records -

MAXIMUM NON-DAMAGING DISCHARGE: 32,500 cfs (Design)

OUTLET WORKS: There is a vertical sliding gate with trash rack grill at the left abutment that leads to the penstock of a 27" Smith-McCormack turbine generator located below the left abutment. No information was available on this facility. The penstock inlet pipe was unaccesible as were the two outlet pipes. They appeared to be approximately 5 feet in diameter. The gate is controlled electrically but the motors and mechanical drives are inoperative.

OUTLET WORKS: There is a by-pass channel approximately 15 feet wide cut through the cliffs just upstream from the right abutment. The control gates of this channel are inoperative.

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Diamond Mill Paper Company

NDS ID NO.: NY 89 NYS DEC ID NO.: 210-829

ITEM	REMARKS
DRAWINGS	Twelve design drawings and one location drawing are available.
REGIONAL VICINITY MAP	Dam shown on USGS 7 1/2-minute quadrangle sheet of Saugerties, NY, (N4200 - W7352.5)
CONSTRUCTION HISTORY	None available.
TYPICAL SECTIONS OF DAM	Shown on six of the twelve design drawings. Elevations not referenced to MSL.
HYDROLOGIC/HYDRAULIC DATA	Some hydrologic data available for original design. Current hydrologic data available for Esopus Creek in USACE publication. Two of the 12 design drawings contain details of the 42" diameter gates.

ENGINEERING DATA

ITEM	REMARKS
OUTLETS: Plan Details Constraints Discharge Ratings	Plan and details of 42" gate are available-no constraints or discharge ratings given. No engineering data available on power supply penstock or control gates of by-pass channel.
RAINFALL/RESERVOIR RECORDS	Available for Esopus Creek in USACE Hydrologic Flood Routing Model for Lower Hudson River Basin.
DESIGN REPORTS	None
GEOLOGY REPORTS	No formal reports. Comments on geology at dam site contained in designer's transmittal letter and Application for Permit filed with New York State.
DESIGN COMPUTATIONS: Hydrology & Hydraulics Dam Stability Seepage Studies	Hydrology and Hydraulics: none. Dam stability: yes, but incorrect. Seepage studies: none, but measures taken to prevent seepage are described in transmittal letter referred to above.

ENGINEERING DATA

ITEM	REMARKS
MATERIALS INVESTIGATIONS Boring Records Laboratory Field	None
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Not applicable
MONITORING SYSTEMS	None
MODIFICATIONS	Possible modification to side-channel spillway at left abutment since crest as observed is not at same elevation as indicated in design drawings.

ENGINEERING DATA

ITEM	REMARKS
HIGH POOL RECORDS	No formal records; hearsay evidence from local residents and observation of water stains on channel walls.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM Description Reports	None reported
MAINTENANCE AND OPERATION RECORDS	None
SPILLWAY: Plan Sections Details	Plan, sections and details available for main spillway section, plan and section available for side-channel spillway.(no details)

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT: Plans Details	Plans and details available for 42" diameter sluice gates. No plans or details available for any of the other operating equipment.
PREVIOUS INSPECTION Date: Findings	Inspections are performed periodically by NYSDEC. The latest one was on 9 May 1978: "Condition of Spillway - Some conc. deterioration-too much flow to inspect properly." "Condition of Non Overflow Section - In need of repair or maintenance." "Condition of Mechanical Equipment - In need of repair or maintenance." "Remarks: Needs re-inspection during low water."
	(Refer to Appendix E)

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

NAME OF DAM: Diamond Mills Paper Co. County: Ulster State: NY NDS ID No.: NY89

Esopus Creek NYS DEC ID No.: 210-829

Type of Dam: Concrete gravity Hazard Category: High

Date(s) Inspection: 29 June 1978 Weather: Sunny & Warm Temperature: 88°F

Pool Elevation at Time of Inspection: 46.75 ± msl

Tailwater at Time of Inspection: 14.85 ± msl (estimated)

Inspection Personnel:

E. A. Nowatzki (JSW)	K. Harmer (NYSDEC)	
G. S. Salzman (JSW)	F. Nuffer (NYSDEC)	

E. A. Nowatzki Recorder

Remarks:

CONCRETE/MASONRY DAMS

Sheet 1 of 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Seepage through and under small side channel spillway at left abutment could not tell if seepage occurs (Refer to Sheet 3)	
JUNCTION OF STRUCTURE WITH Abutment Embankment Other Features	OK at right abutment (massive rock with vertical and horizontal fractures that appear tight.) Main spill- (Refer to Sheet 3)	
DRAINS	Not visible - none shown on plans.	
WATER PASSAGES	Side channel spillway at left abutment in very bad condition. Gate closed - leaks. No visible means of opening (Refer to Sheet 3)	By-pass channel will probably not be able to pass much water in its present condition.
FOUNDATION	Looks to be on generally massive rock. Some fractures and folds in rocks downstream	Does not appear to be an important factor.

CONCRETE/MASONRY DAMS

Sheet 2 of 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES: Surface Cracks Spalling	Very severe spalling 2 - 3" thick with wire reinforcement over about 30% of face. Hard to determine accurately due to overflow.	
STRUCTURAL CRACKING	Numerous longitudinal cracks on downstream face. One seen on upstream face about 12" from crest. Many small (Refer to Sheet 4)	
VERTICAL AND HORIZONTAL ALIGNMENT	Horizontal may be out for some sections. Difficult to tell vertical because of spalls on crest. Not bulging.	
MONOLITH JOINTS	Very bad. No caulking - open, spalled badly, some along crest. Where spalls occur at joints along crest water flows through V-notch openings.	
CONSTRUCTION JOINTS	None visible	
RECORDING INSTRUMENTATION	None	

CONCRETE/MASONRY DAMS

Sheet 3 of 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	through main section of dam since water was flowing several inches over crest. Minor seepage noticed on downstream face of gate structure and in turbine building where walls were actually bulged. Right abutment looks	OK.
JUNCTION OF STRUCTURE WITH Abutment Embankment Other features	way crest badly deteriorated at junction with side channel spillway at left abutment - Turbine intake structure probably leaks since water was noticed coming from penstock outlets. Turbine	
	gate could not be opened. Left wall of side channel spillway looks OK - Ledge rock and masonry. Water in side channel stagnant.	
WATER PASSAGES	2 sluice pipes - near center of main dam section. By-pass channel (entrance just upstream of right abutment) is filled with debris and silt; its control structures are completely inoperative.	

CONCRETE/MASONRY DAMS

Sheet 4 of 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
STRUCTURAL CRACKING	to large spalls along entire downstream face.	

OUTLET WORKS

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet structure on left abutment moderately cracked, some moderate spalling. Water was noticed leaking through some of the cracks.	Accessibility to this structure restricted by vegetation and badly maintained catwalks.
INTAKE STRUCTURE	Gate controls on left abutment may not be operative even if electric power were available. (Refer to Sheet 2)	
OUTLET STRUCTURE	2-42" sluice pipes unobstructed by debris downstream but condition could not be observed because of (Refer to Sheet 2)	
OUTLET CHANNEL	None - natural riverbed is outlet channel. Refer to observation under "Concrete/ Masonry Dams - Water Pas- (Refer to Sheet 2)	
EMERGENCY GATE	See note above on intake structure. None of the control gates are operable.	

OUTLET WORKS

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
INTAKE STRUCTURE	Controls to the 2 - 42" sluice pipes are inaccessible and not visible. Old time resident interviewed at site says they are where design drawings indicate.	
OUTLET STRUCTURE	flow. Outlet through turbine house blocked (gate closed) but leakage is indicated by flow observed coming from 2 - 5 ' ± diameter discharge pipes at tailrace.	
OUTLET CHANNEL	sages" for description of by-pass channel.	

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete on main section badly deteriorated. Refer to "Concrete/Masonry Dam." Concrete on side channel (See Below)	
APPROACH CHANNEL	OK - Massive rock left and right abutments. Natural approach channel. Highway bridge about 250' upstream.	Highway bridge probably high enough so as not to be affected even by PMF.
DISCHARGE CHANNEL	Natural channel, massive rock, trees - negligible obstruction.	
BRIDGE AND PIERS	None	
CONCRETE WEIR	spillway at left abutment is badly spalled both upstream and downstream.	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None visible	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

RESERVOIR

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Right Abutment vertical upstream for about 300' to height of 20'-30' above spillway crest. Left abutment vertical upstream for about 50' to height of 5' (See below)	
SEDIMENTATION	Reported by long-time resident (Mr. William Morgan) to be substantial; could not visually detect. Mr. Morgan spoke of "sand bars" in reservoir	Perform sedimentation survey to verify.
SLOPES	above spillway crest. Beyond vertical slopes - shoreline recedes at about 1 vertical to 5 horizontial.	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION Obstructions Debris Other	Negligible obstructions. Negligible debris.	
SLOPES Cover Stability	Vertical rock cliffs form right and left abutments for 1/4 mile downstream to height of 20' - 30' above spillway crest. Some portions of cliffs are moder- (See below)	Overall stability problem although rockfalls (talus) noticed.
APPROXIMATE NUMBER OF HOMES AND POPULATION	Numerous homes and docks about 1/4 - 1/2 mile downstream. Noted apartment houses, water supply pumps, and other essential facilities (treatment plant, oil storage plant, lighthouse) further downstream.	High hazard potential.
SLOPES Cover Stability	ately fractured. Beyond 1/4 mile downstream slopes become flat ± 5 horizontal to 1 vertical.	

APPENDIX C

COMPUTATIONS

JOSEPH S. WARD
91 ROSELAND AVE. CALDWELL, N. J.

$H_o = 14'$
$P = 32'$

$\frac{P}{H_o} \cong 0.44$; $C_o = 3.77$ (p. 379 BUREC Design of Small Dams)

$Q = C_o L H_o^{3/2}$

$Q = 3.77\ (346')\ (14)^{3/2} = 68330$ cfs - Design flood by our comps; about double that noted in original design (32500 cfs)

PMF = 104520 cfs (See Sect. 5.26)
From NY District Corps of Engineers Study
Design Flood = 68330 cfs.

% PMF ≈ 65%

JOSEPH S. WARD
91 ROSELAND AVE. CALDWELL, N. J.

For stability analysis estimate height of overflow at SPF which for subject dam is SDF.
From USACE model study report on Lower Hudson River Basin SPS at Saugerties is 52260 cfs.

Use equation for Ogee spillway

$$Q = C_0 L H_0^{3/2}$$ (refer to BUREC "Design of Small Dams" p. 378)

For SPF assume $P/H_0 \geq 1$
Assume $C_0 = 3.9$
$L = 346'$

$$\therefore H_0^{3/2} = \frac{52260}{3.9 \times 346} = 38.73$$

$$H_0 \cong 11.5'$$

Check for deepest section (Section 11.4 → 17)

$$\frac{H_0}{P} = \frac{11.5'}{32'} \cong 0.4 \quad \therefore \text{N.G.}$$

Assume $H_0/P = 0.4$ for which $C_0 \cong 3.75$

$$\therefore H_0 = \left(\frac{52260}{3.75 \times 346}\right)^{2/3} \cong 11.75'$$

Use $H_0 = 11.75'$

What is depth of tailwater? Assume flow at critical depth
From Fig. 252 on p. 380 of BUREC "Design of Small Dams" obtain for

$$\frac{h_d + d}{H_c} = \frac{32 + 11.75}{11.75} = 3.7$$

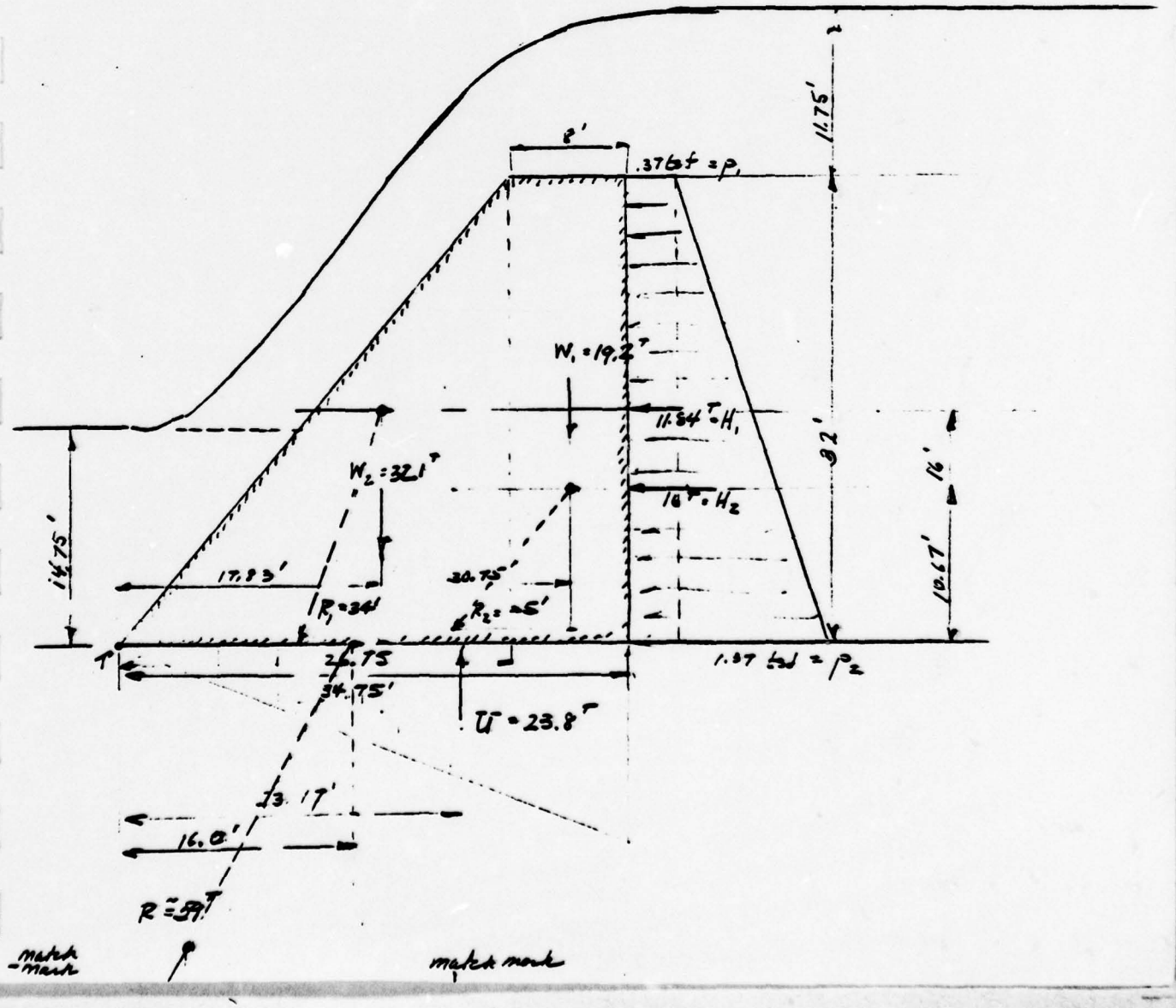
that

$$\frac{h_d}{H_c} \cong 2.5$$ by extrapolation along critical flow line

$$\therefore h_d = 11.75 \times 2.5 \cong 29' \quad \text{or}$$
$$d = (32 + 11.75) - 29 = 14.75'$$

BOX 91-91 ROSELAND AVENUE
CALDWELL, NEW JERSEY 07006

BY: ETAN DATE: 6/28/79 SHEET 2 OF 4
SUBJECT: Stability Analysis - Sunnyerties (Esopus Creek) Dam / Diamond Mills Paper Co. JOB # A7805-11A
NDD 7/11/78



BY EAW DATE 6/28/78 | JOSEPH S. WARD | SHEET NO. 3 OF 4

CHKD. BY HDD DATE 7/11/78 | 91 ROSELAND AVE. CALDWELL, N. J. | JOB NO. A7805-11A

SUBJECT Stability Analysis - Saugerties (Esopus Creek) Dam
Diamond Mills Paper Company

$p_1 = \frac{11.75' \times 62.4\ pcf}{2000\ p/t} = 0.37\ tsf$

$p_2 = \frac{43.75' \times 62.4\ pcf}{2000\ p/t} = 1.37\ tsf$

Assume full uplift

$U = \frac{1.37\ tsf}{2} \times 34.75 \times 1 = 23.8^T$

$H_1 = 0.37\ tsf \times 32' = 11.84^T$

$H_2 = \frac{1}{2}(1.37 - 0.37)\ tsf \times 32' = 16^T$

$N_1 = \frac{8' \times 32' \times 150\ pcf}{2000\ p/t} = 19.2^T$

$N_2 = \frac{1}{2}\frac{(26.75') \times 32' \times 150\ pcf}{2000\ p/t} = 32.1^T$

1) Overturning Stability (take moments about toe, T)
(Neglect weight of water on dam & assume no tailwater)

OT moments = $11.84^T(16') + 16^T(10.67') + 23.8^T(23.17') \cong 912^{T\text{-}ft}$

Resisting moments = $19.2^T(30.75') + 32.1^T(17.83') \cong 1163^{T\text{-}ft}$

$FS = \frac{1163}{912} \cong 1.3$ OK (conservative)

Do not consider tailwater since it would increase FS.
Also there are some drains under dam so value of U is high.

2) Sliding Stability (Neglect keys, anchors and embedment. Assume coef of friction between rock and concrete to be 0.65 and assume no tailwater but consider weight of water on spillway - consider full uplift)

Actuating horizontal force = $11.84^T + 16^T = 27.84^T$

Resisting force = $0.65\left(19.2^T + 32.1^T - 23.8^T + \frac{11.75' \times 62.4\ pcf \times 34.75'}{2000\ p/t}\right)$

$= 0.65(19.2 + 32.1^T - 23.8 + 12.7) \cong 26.13^T$

$FS \cong 0.94 \rightarrow 1.0$ OK (very conservative)

BY EMW DATE 6/22/73
CHKD. BY ADD DATE 7/4/78

JOSEPH S. WARD
91 ROSELAND AVE. CALDWELL, N. J.

SHEET NO. 4 OF 4
JOB NO. A7805-11.A

SUBJECT Stability Analysis - Saugerties (Esopus Creek) Dam
Diamond Mills Paper Company

3) Max stress in foundation material (Neglect all forces except weight of dam and hydrostatic force of water - resultant R is then within middle 1/3 of section i.e. ≈ 16.0' from toe)

This location is close enough to assume uniform distribution of bearing stress is.

$$\sigma = \frac{R_v}{34.75' \times 1'} = \frac{51.0^T}{34.75 ft^2} \cong 1.5 tsf \quad \text{which is} <<<$$

Compressive strength of rock material in fdn.

∴ OK

A7805-11A
Sheet 1 of 1

By: EAN Date: 6/28/78 Subject: Summary of sections for Saugerties (Esopus Creek) Dam.

Section	Crest Elev.	Crest Width	Base Elev at rockline (at base)	Base Width	Water Height (Total)	Rock Embed	Steel Anchors	Key(s) (w x d) (d = depth below embedment)
0 - 0.4	43'7 3/4" (51'6")	8'	12'4 3/4" (20'3")	31' (35'6")	31'3" (31'5")	2"	None	At heel (4'x3')
0.4 - 11.4	38'7 3/4" (46'6")	8'	12'4 3/4" (20'3")	26' (30')	26'3" (27'3")	1'	15' ↓ heel 15' ↓ cent	At heel (4'x3') At toe (4'x1½')
11.4 - 17.0	38'7 3/4" (46'6")	8'	6'7 3/4" (14'6")	38' (34'9")	32'0" (32'1"	1"	10' ↓ heel 15' ↓ center	At heel (4'x3') At toe (4'x½')
17 - 26.0	38'7 3/4" (46'6")	8'	12'4 3/4" (20'3")	26' (30')	26'3" (27'3")	1'	15' ↓ heel 15' ↓ center	At heel (4'x3') At toe (4'x1½')
26.0 - 32.6	38'7 3/4" (46'6")	8'	17'7 3/4" (25'6")	22'6" (23'6")	21'0" (22'0")	1'	15' ↓ heel 15' ↓ center	At heel (3½'x3') At toe (4'x1½')
32.6 - 34.6	38'7 3/4" (46'6")	8'	24' - 28' (32' - 36')	17'6" (21'6")	13'6" (14'6")	1'	10' ↓ heel 6' ↓ cent	At heel (3'x3') At toe (4'x1')

Δ = 7'10 1/4" add to drawing elevations to obtain USGS elevation

JOSEPH S. WARD, INC.
BOX 91-91 ROSELAND AVENUE
CALDWELL, NEW JERSEY 07006

APPENDIX D

PHOTOGRAPHS

FIGURE 1 OVERVIEW OF DAM LOOKING DOWNSTREAM FROM HIGHWAY BRIDGE

FIGURE 2 OVERVIEW OF RESERVOIR TAKEN FROM HIGHWAY BRIDGE

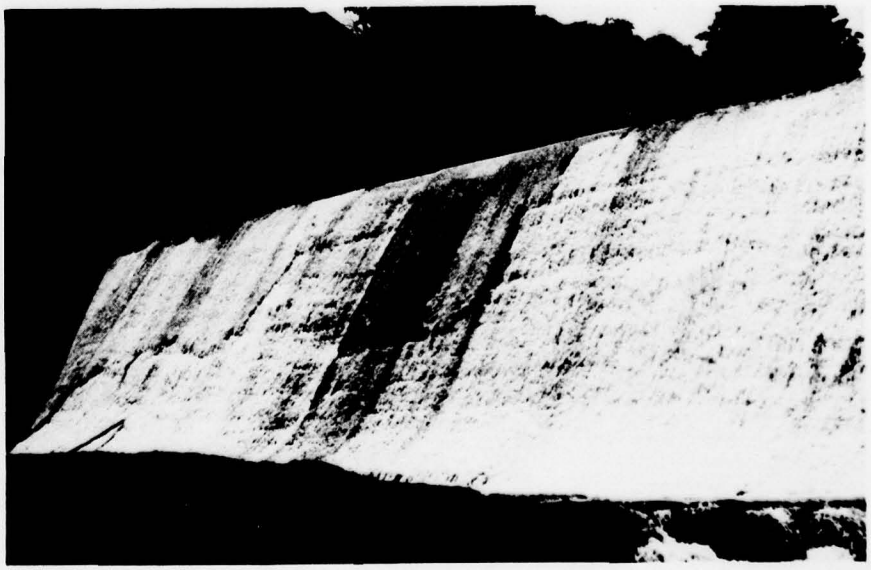


FIGURE 3 DOWNSTREAM FACE NEAR RIGHT ABUTMENT

FIGURE 4 WATER SPLASH IN OPEN JOINT

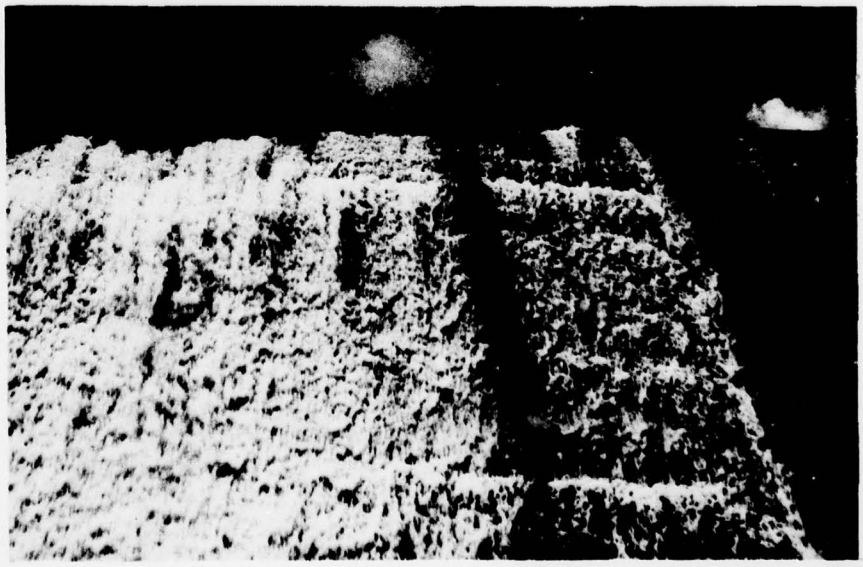


FIGURE 5 WATER SPLASH OVER CRACKS AND SPALLS ON UPSTREAM FACE AND ALONG CREST

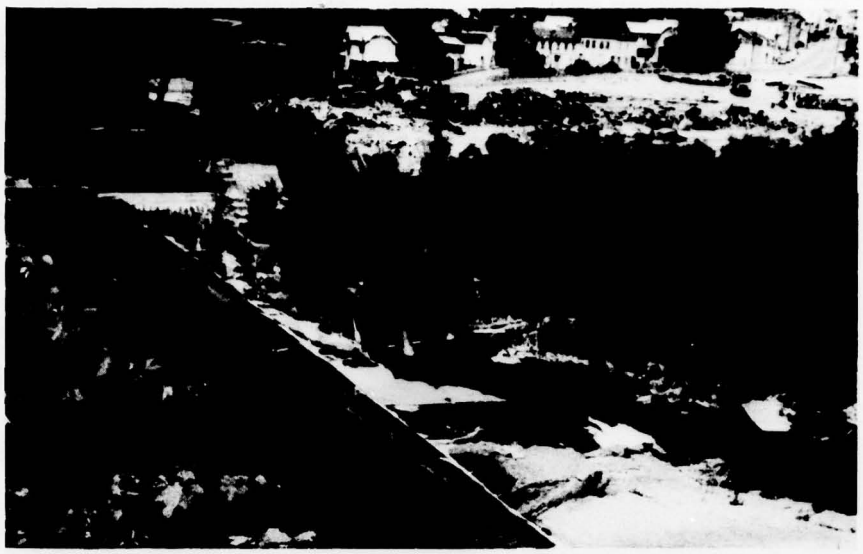


FIGURE 6 LEFT ABUTMENT AREA SHOWING SPALLS ALONG CREST

FIGURE 7 SEEPAGE THROUGH SIDE CHANNEL SPILLWAY

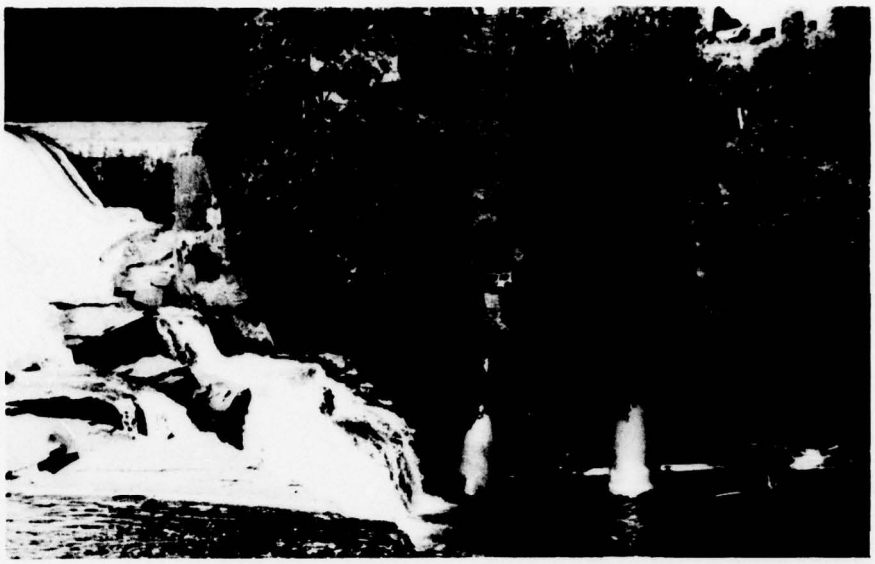


FIGURE 8 LEFT ABUTMENT AREA AND TURBINE GENERATOR HOUSE

FIGURE 9 STEP-TAPERED PIER AT LEFT ABUTMENT

FIGURE 10 EROSION AT BASE OF LEFT ABUTMENT PIER

FIGURE 11 LEFT ABUTMENT AREA AND ACCESS STRUCTURES

FIGURE 12 GATE CONTROL AT LEFT ABUTMENT

FIGURE 13 DOWNSTREAM FACE SHOWING POSSIBLE MONOLITH OFFSET

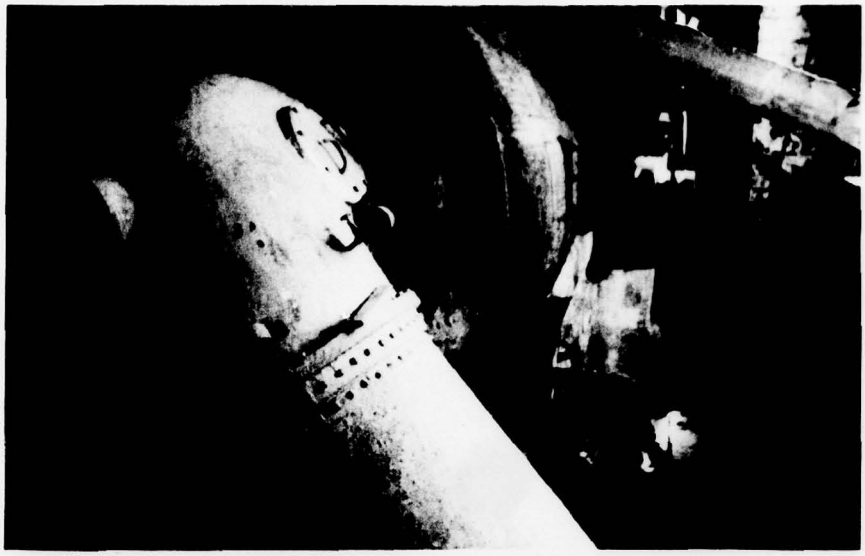


FIGURE 14 TURBINE WORKS

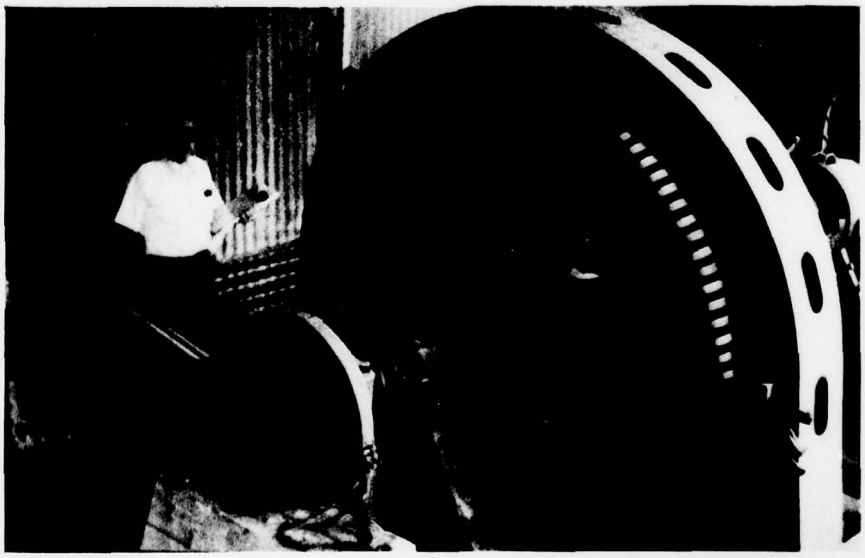


FIGURE 15 TURBINE

FIGURE 16 TURBINE OUTLET AT TAILRACE

FIGURE 17 SEEPAGE UNDER TURBINE GENERATOR HOUSE FOUNDATION

FIGURE 18 EXIT PORTALS OF TWO SLUICE PIPES ON DOWNSTREAM FACE

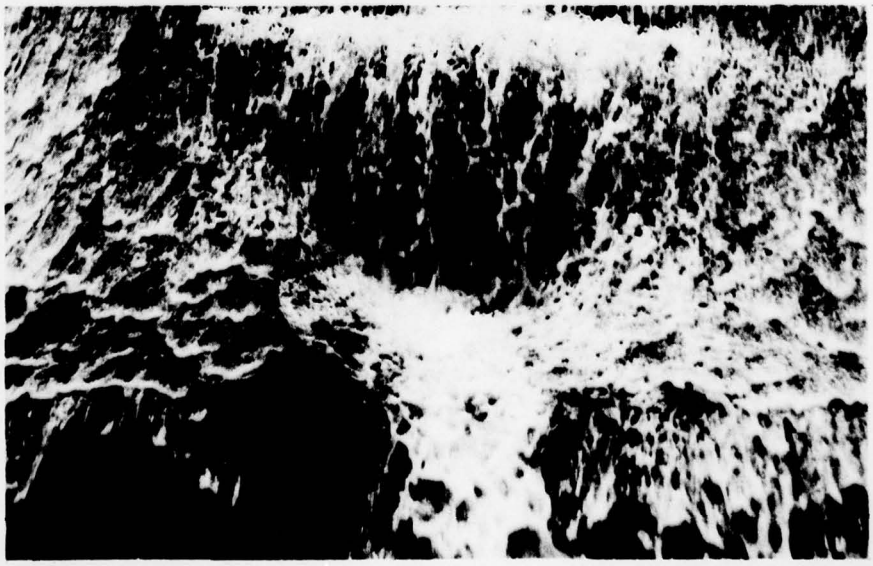


FIGURE 19 EXIT PORTAL OF SLUICE PIPE (CLOSE-UP)

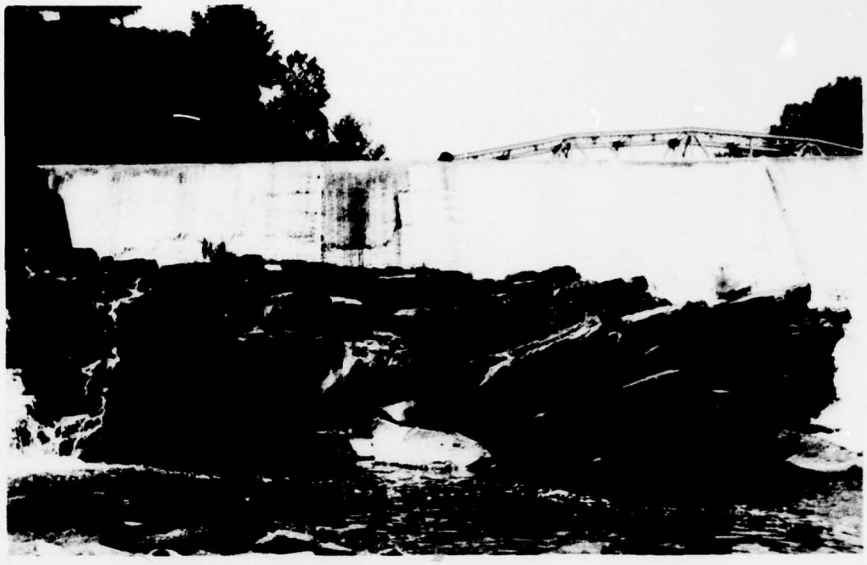


FIGURE 20 ROCK BENCH DOWNSTREAM FROM RIGHT ABUTMENT

FIGURE 21 ROCK BENCH DOWNSTREAM FROM LEFT ABUTMENT

AD-A073 607 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/2
NATIONAL DAM SAFETY PROGRAM. DIAMOND MILLS PAPER COMPANY DAM (N--ETC(U)
AUG 78 E A NOWATZKI, G S SALZMAN DACW51-78-C-0035

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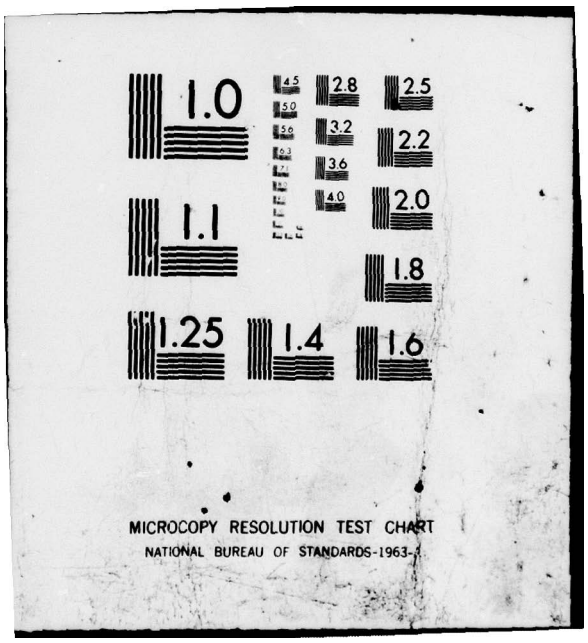

1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FIGURE 22 DOWNSTREAM CHANNEL

FIGURE 23 DOWNSTREAM FACE SHOWING POSSIBLE MONOLITH OFFSETS AND LEAKAGE BENEATH AND THROUGH SIDE CHANNEL SPILLWAY

FIGURE 24 ENERGY DISSIPATOR APRON AND LARGE LONGITUDINAL SPALL ON CREST OF DAM

APPENDIX E

RELATED DOCUMENTS

14' on dam

J. THOMPSON, PRESIDENT — E. VAN VOORHIS, TREASURER — C. G. VAN GILDER, SECRETARY — H. P. VAN GILDER, ASST. SECRETARY

Newton

Diamond Mills Paper Co.

ESTABLISHED 1872.

BY G.W. THOMPSON

Manufacturers of

FOURDRINIER AND CYLINDER TISSUES.
WHITE AND COLORED TISSUES.
PARCHMENT, WHITE, BUFF AND RAILROAD
WRAPPING PAPERS, GRASS BLEACHED SILVER
TISSUE, WHITE AND CREAM STEREOTYPE
TISSUE, CARBON AND MANIFOLD PAPERS.
CIGARETTE PAPER,
BROMO, GLEN MILLS
AND OTHER TOILET PAPERS, ETC. ETC.
CABLE ADDRESS, "MONDIA, NEW YORK.
TELEPHONE
BARCLAY 6139
2475

Executive Offices

Mills: Bloomfield, N.J. / Millburn, N.J. / Saugerties, N.Y.

Operating: The American Vitrified Paper Co. Mfrs. of Plain and Decorated Crepe Paper and Napkins.

WAREHOUSE
36 MURRAY STREET, N. Y.

New York, _____ 19____

☞ PRICES SUBJECT TO CHANGE WITHOUT NOTICE AND WE RESERVE THE RIGHT TO CANCEL QUOTATIONS AND ORDERS WHEN CONDITIONS ARISE WHICH ARE BEYOND OUR CONTROL.

Saugerties, N.Y., Feb. 20, 1929.

Dept. of Public Works,
Division of Engineering,
Albany, N. Y.

Gentlemen:-

I respectfully submit herewith application of Diamond Mills Paper Company and Martine Cantine Company, Saugerties, N. Y., for the construction of a concrete dam to be located about four feet (4') north of wooden dam.

This is a solid gravity type dam.

The foundation and the sides are apparently of sand stone badly fissured and there is considerable leakage through the rock and it is going to be very difficult to make a tight dam as it will be almost impossible to determine where the water goes through the seams. However, the rock foundation is structurally capable of withstanding this load, but much of the leakage will be stopped by the heel in the dam which is designed to a depth which is considered the solid strata, In order that the concrete may be practically water tight and intergration may be minimized, it will be necessary that a first class qualit

of cement be used.

To obtain a still higher degree of water tightness it will be necessary to increase the density of the concrete, this will require the addition of Celite or Hydrate of Lime or some other flux. Then to obtain a still more high degrce of water tightness, it will be necessary to waterproof the Upstream face of the dam with Intertol or Hardwear.

The Expansion and Contraction Joints are shown in the drawing and also a drain is to be made so that there will be no water between the joints.

The other details of the construction is shown in the drawings and we take pleasure in submitting same to you for your approval. If there is anything we have not made clear we shall be glad to come to Albany and go over this matter with you in detail and would appreciate very much hearing from you promptly relative to this application in order that we may go ahead and receive the bids on this job.

Respectfully submitted,

Fred S. Van Voorhis, M. E.

Saugerties, N. Y.

6-8-27-300 (6-7068)

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING
ALBANY

Received Feb. 23, 1929 Dam No. 210-829
Disposition Approv. Mar. 15, 1929 Watershed Lower Hudson
Foundation inspected
Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the Superintendent of Public Works, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended and amendatory laws for the approval of specifications and detailed drawings, marked Proposed Dam of DIAMOND MILLS PAPER COMPANY & MARTIN CANTINE COMPANY, herewith submitted for the { ~~construction~~ / reconstruction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about Sept. 15, 1929 (Date)

1. The dam will be on Esopus Creek flowing into Hudson River in the town of Saugerties, County of Ulster and 350 ft. North of Saugerties Bridge (Hill Street)
(Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. The name and address of the owner is Diamond Mills Paper Co., / ~~Martin Cantine Co.~~ Saugerties, N. Y.

3. The dam will be used for Storage of Water

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

5. The watershed at the proposed dam draining into the pond to be formed thereby is 175 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 140 acres and will impound 36,000,000 cubic feet of water.

7. The lowest part of the natural shore of the pond is 3.5 feet vertically above the spillcrest, and everywhere else the shore will be at least 12 to 30 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was 32,500 cubic feet per second on 1926 (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam Would flood about 3 ft. over docks of the Diamond Mills, Saugerties Steamboat Co., Martin Cantine Co. & Stone Docks

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Layers Blue Sand Stone (Fine Grain)

11. The material of the right bank, in the direction with the current, is Rock; at the spillcrest elevation this material has a top slope of 45 ft. ~~inches~~ vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of 300 feet, and the top surface extends for a vertical height of 35 feet above the spillcrest.

12. The material of the left bank is Rock; has a top slope of 15 ft ~~inches~~ to a foot horizontal, a thickness of 100 feet, and a height of 15 feet

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc The bed and banks are all fine grain blue stone rock intercalated with layers of rather soft shale

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

15. What is the thickness of the layers? 3 to 6 ft. approx.

16. Are there any porous seams or fissures? There is fissured rock as shown in drawing

17. WASTES. The spillway of the above proposed dam will be 340 feet long in the clear; the waters will be held at the right end by a Cliff the top of which will be 35 feet above the spillcrest, and have a top width of 300 feet; and at the left end by a Concrete-Spill-way the top of which will be 0.0 feet above the spillcrest, and have a top width of 5 feet.

18. There will be also for flood discharge a pipe 60 inches inside diameter and the bottom will be 9 feet below the spillcrest, ~~a~~ 2 sluice or gate 3'6" feet ~~wide in the clear by ..... feet high,~~ diameter and the bottom will be 30 feet below the spillcrest.

19. APRON. Below the proposed dam there ~~will~~ is be an apron built of Natural Rock, 600 feet long across the stream, 300 feet wide and 20 feet thick. The downstream side of the apron will have a thickness of 3 to 20 feet for a width of 300 feet. with high banks of Rock on each side

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

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

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

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

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

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

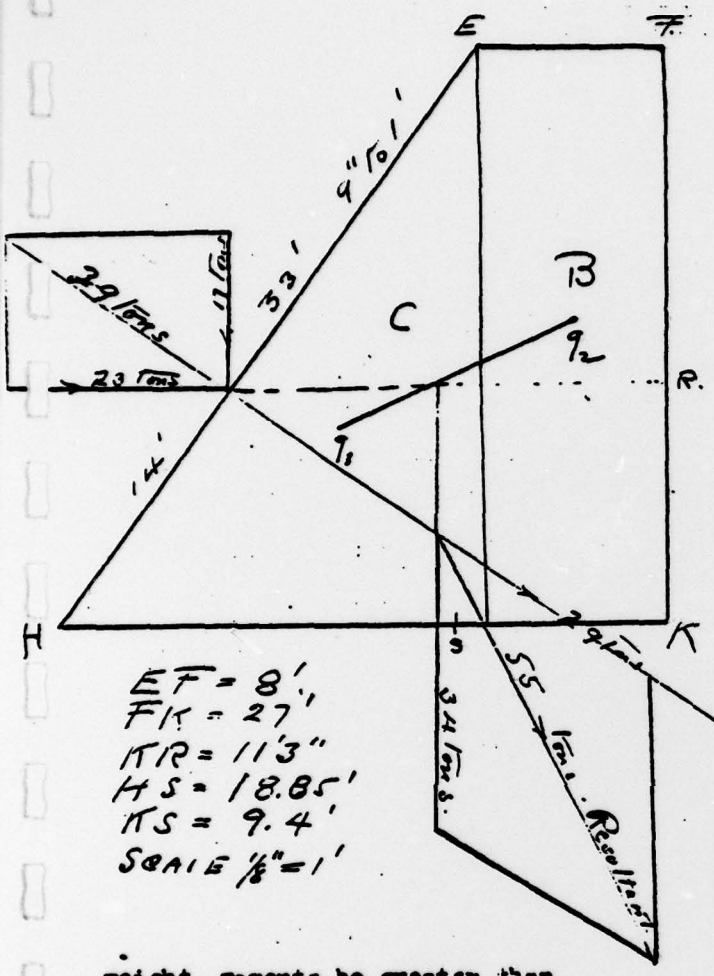
23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over ½ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. INSPECTION. State how inspection is to be provided for during construction. A competent Inspector will be on the job at all times during construction.

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

SKETCH of SECTION

SHOWING STABILITY



Assumed-a flow- of 14' max. over dam which would be the amount of water if cloud-burst of Aug. 26, 1928, was discharged in Esopus Creek instead of Rondout Creek.

K H E F is section of Dam

Area= B= 27 X 8= . 216
" C= $\frac{27 \times 20.25}{2}$ = 273

Total Area = 489 sq. ft.

Center of Water Pressure and is 11:3 from Base

489 X 140 lbs. per cu. ft. for concrete = 34.2 tons

Water Pressure.

Upstream inclined back of Dam = 29 tons
Horizontal Pressure on Dam = 23.2 "
Downward Pressure on Dam = 17.3 "

Resultant of Forces.

is 55 tons- acting in direction shown cutting base 8'.6 from K and within first third of base or Ks which is 1/3 of KH

Moments of Leverage.

or conditions of Stability require that Water Pressure Moments- [illegible] weight moments be greater than

Weight Moments = 34 ton X 10 ft. = 340. Foot Tons
Water Moments = 23 " X 11.3 ft. = 262. " "
Hence- 340 is greater than 262. and Dam is Stable.

The placing of the steel- square twisted rods- 15' deep in rocks and cement the 4 ft. heel and toe in the rocks will give the dam not only enough strength to overcome the ice and water pressures which is not needed but is used as a factor of safety and the heel is also used to make the dam water tight, thereby causing less pressure from below. The rods will also work on this strain and will also be of great benefit to the foundation of the Dam. The drains under the expansion joints will also aid in keeping the dam dry underneath.

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

Fred S. Van Sonlen
(Address of signer)

Feb 19th 1929
(Date)

The Master Contract Co. Inc.
By Fellows, Pres.
[illegible]
(A person signing for firms should indicate his title or authority)

Sub: Specifications for Dam.

Diamond Mills Paper Company.
Martin Cantine Co.

The concrete to be used is to be made in the following proportion:

1 Part Portland Cement (Tested)
3 Parts Sand (Approved)

10 % of above mixture to be Celite
6 parts hard stone (Approved)

The bottom of the dam is to be grouted with a thin covering, filling up holes, etc., before pouring the cement. This is done only to avoid leakage.

CONCRETE

The concrete is to be re-enforced as per drawings with,

12-- 2" Square Twisted Steel Rods 30 ft. long.

49-- 1½" Square Twisted Steel Rods 30 ft. long.

4-- 1" Square Twisted Steel Rods 20 Ft. long.

5-- 1" Square Twisted Steel Rods 12 ft. long.

These rods are to be grouted as shown in drawing and a liberal allowance is made for same.

The face of the dam on Upstream side is to be covered with Inertol or Hardwear, or some similar suitable waterproofing compound.

SLUICE GATES

2-- 42" Circular Opening, iron body, bronze mounted, non-rising stem, Sluice Gates, will be furnished by The Ludlow Valve Company and they have already given us approximate estimate of $ 575.00 per gate. We have allowed $ 1500.00 for the gates erected on the job.

Expansion

The Expansion Joints are shown on the drawing and we have made an extra allowance for these.

OLD DAM

We have included approximate estimate of removing 8 ft. off of the old dam and taking above material away from the creek.

We expect all material on this dam cleaned up so that the material cannot float down the creek and interfere with navigation in any way.

DIVERSION

The natural flow of the Esopus Creek between Ashokan and the Diamond Mills Paper Company and Martin Cantine Company's dam for 1907 to 1912 was as follows:
(N. H. Hill)

1907-

May	215 million gallons per day
June	139
July	44
August	11
Sept.	270

1908-

May	487 million gallons per day
June	97
July	65
August	26
Sept.	2

1909-

May	258
June	167
July	38
Aug.	37
Sept.	24

1910-

May	201
June	217
July	33
Aug.	24
Sept.	17

DIVERSION.

1911-

May	33
June	189
July	37
August	38
Sept.	66

1912-

May	281
June	71
July	22
August	64
Sept.	46

Since that time the stream has decreased in flow instead of increased, so we are safe in using these figures, and in order to build the dam at the minimum expenses we have selected the months of July and August, as the flow during these months will not average over 65 millions gallons per day.

Our Sluice Gates are 3½ feet in diameter and will discharge 175 milliom gallons per day with 5 feet of water in the bottom of the lowest section of dam.

This will allow the Sluice Gates to be built first and the old dam can be used for diversion with very little expense during the construction of this section.

Ellsworth

Approximate Estimate Cost.

Rock Excavation-				
600 cu. yds.	Sand Stone Rock	4.00		2400.00
215 cu. yds.	Fissured "	2.00		430.00
Drilling--				
12-- 3" Holes	15 ft. deep			
49-- 2½" "	15 ft. deep			
4-- 2" "	10 ft. deep			
5-- 2" "	6 ft. deep	1014 ft.		1000.00
Grouting-- Holes	9 cu. yds.	@ 30.00		270.00
Concrete-- 6250 cu. yds.		@ 12.00		75000.00
Sluice Gates-(2) (Bid $575.00 F.O.B.(1) Troy				1500.00
Expansion Joints--	50.00			300.00
Surface Protection Inertol	8000 Sq. ft. @ .10			800.00
Water Control				500.00
Removing Old Dam 8'				2000.00
Estimated				$ 84,200.00

Payments--

On or about the First day of each month and also on or about the 15th of each month, 90 % of the value, based on the Contract Prices of labor and material incorporated in the work up to the First and Fifteenth of each month, as estimated by the Engineer.

The final payment shall be due 30 days after substantial completion of the work, provided the work be then fully completed and contract fully performed.

Before issuance of final certificate for payment the contractor shall submit evidence satisfactory to the engineer that all Pay Rolls, Material Bills and other indebtedness connected with the work have been paid.

E. S. Sandwich

PRESIDENT TREASURER SECRETARY ASST SECRETARY

Diamond Mills Paper Co.

ESTABLISHED 1872.
BY
G.W. THOMPSON

Executive Offices

Manufacturers of

URDRINIER AND CYLINDER TISSUES.
WHITE AND COLORED TISSUES.
PARCHMENT, WHITE, BUFF AND RAILROAD
OPYING PAPERS, GRASS BLEACHED SILVER
SSUE, WHITE AND CREAM STEREOTYPE
SSUE, CARBON AND MANIFOLD PAPERS.
CIGARETTE PAPER,
BROMO, GLEN MILLS
ID OTHER TOILET PAPERS, ETC. ETC.
ABLE ADDRESS, "MONDIA, NEW YORK.
TELEPHONE
BARCLAY 6139
2475

Mills: Bloomfield, N.J.
Millburn, N.J.
Saugerties, N.Y.

Operating: The American Novelty Paper Co.
Mfrs. of Plain and Decorated Crepe Paper and Napkins.

WAREHOUSE
38 MURRAY STREET, N. Y.

New York, _____ 19____

☞ PRICES SUBJECT TO CHANGE WITHOUT NOTICE AND WE RESERVE THE RIGHT TO CANCEL QUOTATIONS AND ORDERS WHEN CONDITIONS ARISE WHICH ARE BEYOND OUR CONTROL.

Saugerties, N. Y., Mar. 12, 1929.

Dept. of Public Works,
Division of Public Works,
Albany, N. Y.

Mar 15 29
Newton

Gentlemen:-

I am enclosing three (3) Sets of Drawings of Sluice Gates in detail and also connection of Cantine Spillway to proposed dam of Martin Cantine Company and Diamond Mills Paper Company, which you asked me to make.

On the line of your suggestion in regard to the Mixture 1--2½--5 and also 1--2--4, I have asked the contractor to figure accordingly and have omitted the Hydrated Lime in concrete mixture as you suggested and trust this will now be satisfactory to you.

Will you kindly insert these drawings in the drawings which you have on hand and accept my thanks for doing this and greatly oblige,

Yours truly,
Diamond Mills Paper Company.
Ffed S. Van Voorhis, M. E.

.BA111(1419)(4-017557D017-C01)PD 01/17/78 0826

IPNABYB ALB

.SPECTED DUPLICATE: 4-010020E017 ABA 065 ICS IPNNTZZ CSP

9142462321 RELAY TDNT SAUGERTIES NY 01-17 0826A EST

PMS CHIEF ENGINEERING DIV US DEPT OF ARMY NEW YORK DISTRICT CORPS OF ENGINEERS

ALBANY FIELD OFFICE WUX

ALBANY NY 12207

BT

KINDLY INVESTIGATE IMMEDIATELY CONDITION OF ESOPUS CREEK DAM VILLAGE OF SAUGERTIES AS DISASTROUS FIRE ON ADJACENT MARTIN CANTINE COMPANY MILL APPEARS TO HAVE CAUSED POSSIBLE DAMAGE OR EXAGGERATED POSSIBLE DETERIORATION OF SAME CAUSING POTENTIAL THREAT TO LARGE NUMBER OF SYSTEMS IN VILLAGE OF SAUGERTIES BELOW DAM SITE

MAYOR GEORGE A TURNER JR

SF-1201 (75-03)

mcl

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, NEW YORK
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

NANEN-F CONSTRUCTION [illegible] 20 January 1978

Mayor George A. Turner, Jr.
Village of Saugerties
P.O. Box 96
Saugerties, New York 12477

Dear Mayor Turner:

Reference is made to your telegram dated 18 January 1978, concerning a request for an "immediate investigation" of a dam in the Village reported to have suffered additional deterioration as a result of a fire at the Martine Cantine Mill adjacent to the dam.

As per telephone conversation between yourself and Mr. Dioguardi of my staff on 18 January, you advised him that access to the dam site was hindered by snow accumulation and ice conditions and that no inspection should be scheduled until word is received from you that such an inspection could feasibly be made.

In further conversation, it was learned that water was spilling over the dam and that in order to make a proper inspection the water empoundment behind this dam should be lowered such that visual observation of the downstream face of the dam can be made. It is requested that you implement procedures to accomplish this.

We look forward to hearing from you regarding a date for an inspection.

Sincerely yours,

cc w/incl:
Mr. George Koch, NYS DEC ✓

J.A. WEISS
Chief, Engineering Division

May 11, 1978

Mayor George A. Turner, Jr.
Village of Saugerties
P.O. Box 96
Saugerties, NY 12477

RE: Dam #210-823
Lower Hudson
Esopus Creek Dam

Dear Mayor Turner:

The referred to structure was inspected by Department personnel on May 9, 1978. Water was spilling over the spillway thus making a thorough inspection impossible. The impoundment must be lowered so that the downstream face of the dam can be observed. Please inform this office as to when the water can be lowered along with the name and address of the owner.

If you have any questions, do not hesitate to contact either Mr. George Koch or myself, phone 518 457-1216.

Sincerely,

Kenneth Harmer
Dam Safety Program

cc: G. Danskin

1/2 owner { Partitions Street Corp
Chase Manhattan + Seamans Savings & L-Saugerties

SCHIRMER
& HRDLICKA

RMER
LICKA

33 WEST BRIDGE STREET
SAUGERTIES, N. Y. 12477
914/246-9596

June 20, 1978

New York State Department of
Environmental Conservation
50 Wolf Road
Albany, New York 12233

Attention: Mr. George Koch
Supervisor, Dam Safety Section

Re: Proposed inspection of Diamond
Mill Paper Company Dam

Dear Mr. Koch:

Your letter of June 16, 1978, to the Sawyer Savings Bank has been turned over to me, as attorney for Partition Street Corporation, for reply.

You should be advised that Partition Street Corporation seriously questions whether or not it has any title whatever to the dam and/or the water rights which are presumably companion to the title. Village of Saugerties attorney, William D. Brinnier, recently made a statement for the press to the effect that he had conducted his own title examination and that he had concluded, as a result thereof, that Partition Street Corporation had, at best, a one-half interest in the dam and no more. He further stated that the identity of the alleged owner of the remaining one-half interest was known to him, but that he could not reveal the identity of that party. While Partition Street Corporation does not necessarily concur with Mr. Brinnier's findings, it is obvious, if we assume their validity, that any attempt to open the dam upon the part of Partition Street Corporation exposes the corporation to the following possible repercussions:

1. A suit against Partition Street Corporation by other persons having an interest in the dam and/or any and all water rights agreements affecting the use of the water for trespass and/or damages for unlawful interference with the use of the dam and the water it impounds.

2. A suit or suits against Partition Street Corporation brought by the owners of upstream properties based upon interference with their Riparian rights. This item is almost a certainty inasmuch as I have personal knowledge of the fact that a number of upstream corn growers brought suit against the Martin Cantine

Company approximately ten years ago when it lowered the water level during the corn-growing season.

3. The possibility that it would be extremely difficult to open the gates for the purpose of lowering the water level, and further that the gates, once open, might be difficult, if not impossible, to close. This opinion was expressed again in the press by Village Engineers, Brinnier and Larios, of Kingston, New York.

For all of the reasons hereinabove set forth, Partition Street Corporation is reluctant to tamper with the dam. I confess that I am not familiar with the provisions of the National Dam Inspection Act; however, I can assure you that Partition Street Corporation will comply with any lawful Order issued pursuant to the provisions of that Act. If an Order is to be made, I would appreciate receipt of a copy of it, together with a copy of that portion of the Act which authorizes issuance of such an Order. If I am satisfied that the lowering of the water level can be accomplished pursuant to proper authority and that Partition Street Corporation, in acting in compliance with that authority, will be held harmless from any and all claims which might arise, as hereinbefore set forth, I can then see no reason why the water level cannot be lowered.

Very truly yours,

Robert P. Schirmer

Robert P. Schirmer dtg

RPS:dtg

7-15-4
(v 3/77)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DAM INSPECTION REPORT
(By Visual Inspection)

Dam Number	River Basin	Town	County	Hazard Class	Date & Inspector
10-829	L. Hudson	Saugerties	Ulster	d	5/9/78 I.D.H./Koch

Stream = Esopus Ck Owner =

Type of Construction

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

Use

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

Estimated Impoundment Size 140 Acres ## Estimated Height of Dam above Streambed ≥5 Ft.

Condition of Spillway

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

Explain: Some conc. deterioration - too much flow to inspect properly

Condition of Non-Overflow Section

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

Explain: _____

Condition of Mechanical Equipment

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

Explain: _____

Siltation [ ] High [ ] Low

Explain: _____

Remarks: Needs re-inspection during low water

Evaluation (From Visual Inspection)

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

APPENDIX F

GEOLOGY

APPENDIX F

GEOLOGY

Diamond Mills Paper Company Dam

1. General Geology

The damsite is located on Esopus Creek, at the northeastern edge of Ulster County, very near the west bank of the Hudson River. The bedrock belongs to the Normanskill Formation of the Trenton Group of middle Ordovician age. The members present in the area are the Austin Glen (graywacke sandstone and black and gray shales), the Mount Merino (black shale and chert), or the Indian River (red and green shales).

There are minor fault traces northwest and southwest of the damsite.

The surficial soils are classified as broken phase of the Hudson silty clay loam. The soils consist of brown, light brown or yellowish brown very granular silty clay loam. In the vicinity of the damsite, the material has been excavated for brickmaking, which has increased the natural steep slope.

2. Site Geology (Based on Air Photos)

The area adjacent to the damsite is heavily urbanized. A short distance downstream of the dam, Esopus Creek joins the Hudson River. The outlet channel appears to have been reinforced where the creek empties into the Hudson River. The entire downstream channel is unobstructed (as of 1968).

There is some siltation along the shoreline of the upstream channel, and a visible silt plume originating from a sand quarry some 1400± feet upstream of the dam. Otherwise, the channel is unobstructed for at least 1600 feet upstream of the dam (as of 1968). In the vicinity of the quarry, the left bank is unprotected and contributing sand and/or silt.

There is little or no glacial cover in the vicinity of the dam. Although no outcrops are plainly visible, the literature and field observations indicate the rock at the right dam abutment is the black shale of the Austin Glen member, Normanskill Formation, Trenton Group. Graywacke sandstone is also present locally.