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NATIONAL DAM SAFETY PROGRAM. WALDRICH BLEACHERY DAM (NJ-00143),--ETC(U)

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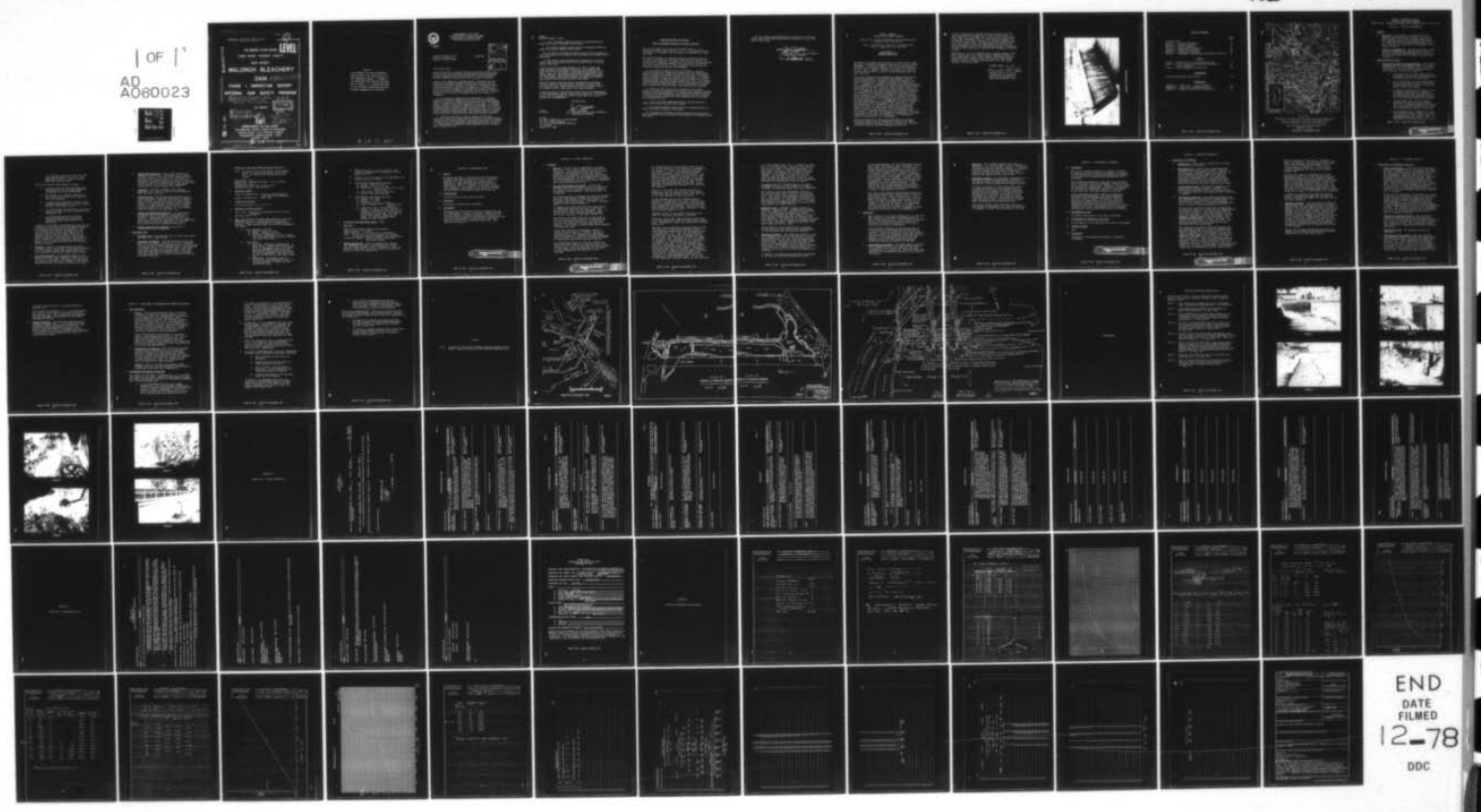

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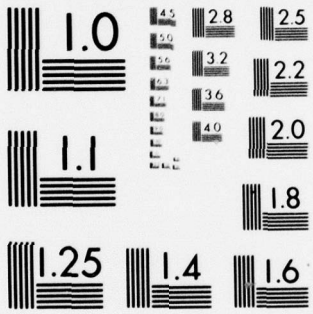

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DELAWARE RIVER BASIN

THIRD RIVER, PASSAIC COUNTY

NEW JERSEY

WALDRICH BLEACHERY DAM

(15) DACW61-78-C-0141

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

(6) National Dam Safety Program. Waldrich Bleachery Dam (NJ-00143), Delaware River Basin, Third River, Passaic County, New Jersey. Phase I Inspection Report.

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(9) Final rept.,

(10) Michael Baker, III

(11) Aug 78

(12) 81p.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

AUGUST 1978

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Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

21 SEP 1978

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Waldrich Bleachery Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given on the first four pages of the report.

Based on visual inspection, available records, calculations and past operational performance, Waldrich Bleachery Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in very poor overall condition. The spillway is considered inadequate since 35 percent of the 100-year flood would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant, engaged by the owner, using more sophisticated methods, procedures and studies initiated within one month and completed within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1979. In the interim, detailed emergency operation, drawdown and evacuation plans and a warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within one month from the date of approval of this report, engineering studies and analyses should be initiated to determine foundation conditions and structural stability. Alternative plans could be developed to drain the pond and demolish and remove appropriate portions of the dam. Any remedial measures or demolition found necessary should be initiated within calendar year 1979.

c. A plan of periodic inspections should be initiated within six months from the date of approval of this report.

d. The following remedial measures should be accomplished within six months of the date of approval of this report:

(1) The deposit of boulders and cobbles against the east abutment of River Road Bridge should be removed since this deposit will slightly restrict flood flows.

(2) The severely leaning retaining wall constructed in the stream channel south of River Road Bridge should be removed since it also will restrict flood flows.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Joseph Minish of the Eleventh District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia, 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely yours,

Joel T. Callahan

JOEL T. CALLAHAN
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

1 Incl
As stated

Cy furn:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
P.O. Box 2809
Trenton, NJ 08625

WALDRICH BLEACHERY DAM (NJ00143)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 20 June 1978 by Michael Baker, Jr., Inc. Consulting Engineers, under contract to the U. S. Army Engineer District, Philadelphia, in accordance with the National Dam Inspection Act, Public Law 92-367.

The Waldrich Bleachery Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in very poor overall condition. The spillway is considered inadequate since 35 percent of the 100-year flood would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant, engaged by the owner, using more sophisticated methods, procedures and studies initiated within one month and completed within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1979. In the interim, detailed emergency operation, drawdown and evacuation plans and a warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within one month from the date of approval of this report, engineering studies and analyses should be initiated to determine foundation conditions and structural stability. Alternative plans could be developed to drain the pond and demolish and remove appropriate portions of the dam. Any remedial measures or demolition found necessary should be initiated within calendar year 1979.

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APPROVED: Joel T. Callahan

JOEL T. CALLAHAN
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

DATE: 21 September 1978

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam - Waldrich Bleachery Dam (Yantacaw Pond),
Passaic County, New Jersey

River - Third River, Tributary to Passaic River
Date of Inspection - 20 June 1978

ASSESSMENT OF GENERAL CONDITIONS

The Waldrich Bleachery Dam consists of a masonry and timber spillway, a concrete and masonry dam section, and an earthen embankment. The total length of the dam is approximately 280 feet, with a maximum height of 12.3 feet. The spillway is 60.2 feet in length. The dam is owned by Mrs. Grace A. Anderson and is held in trust by Chase Manhattan Bank, New York, New York.

The visual inspection and engineering analyses made during June through August 1978 revealed the presence of many serious deficiencies. Because of these deficiencies, the overall condition of the dam is evaluated as being very poor. Consequently, immediate additional engineering studies are recommended to determine the stability and assess existing conditions of the dam, in detail, and to develop plans and specifications for its repair and modification. Alternately, it is recommended that engineering plans and specifications for demolition and removal of appropriate portions of the dam be prepared, including procurement of required permits. After the engineering and permitting is complete; the repair and modification work, or alternate demolition work should proceed immediately. It is recommended that formal emergency procedures be immediately implemented to operate or drain the impoundment in an emergency. The owner should assist public officials in initiating immediately an emergency evacuation plan for areas which will be affected in the event of imminent dam failure or when overtopping flood flows occur. Constant monitoring of the dam when heavy rain is forecast should also be implemented immediately. Periodic inspections of the dam, now existing or if subsequently repaired and modified, are recommended.

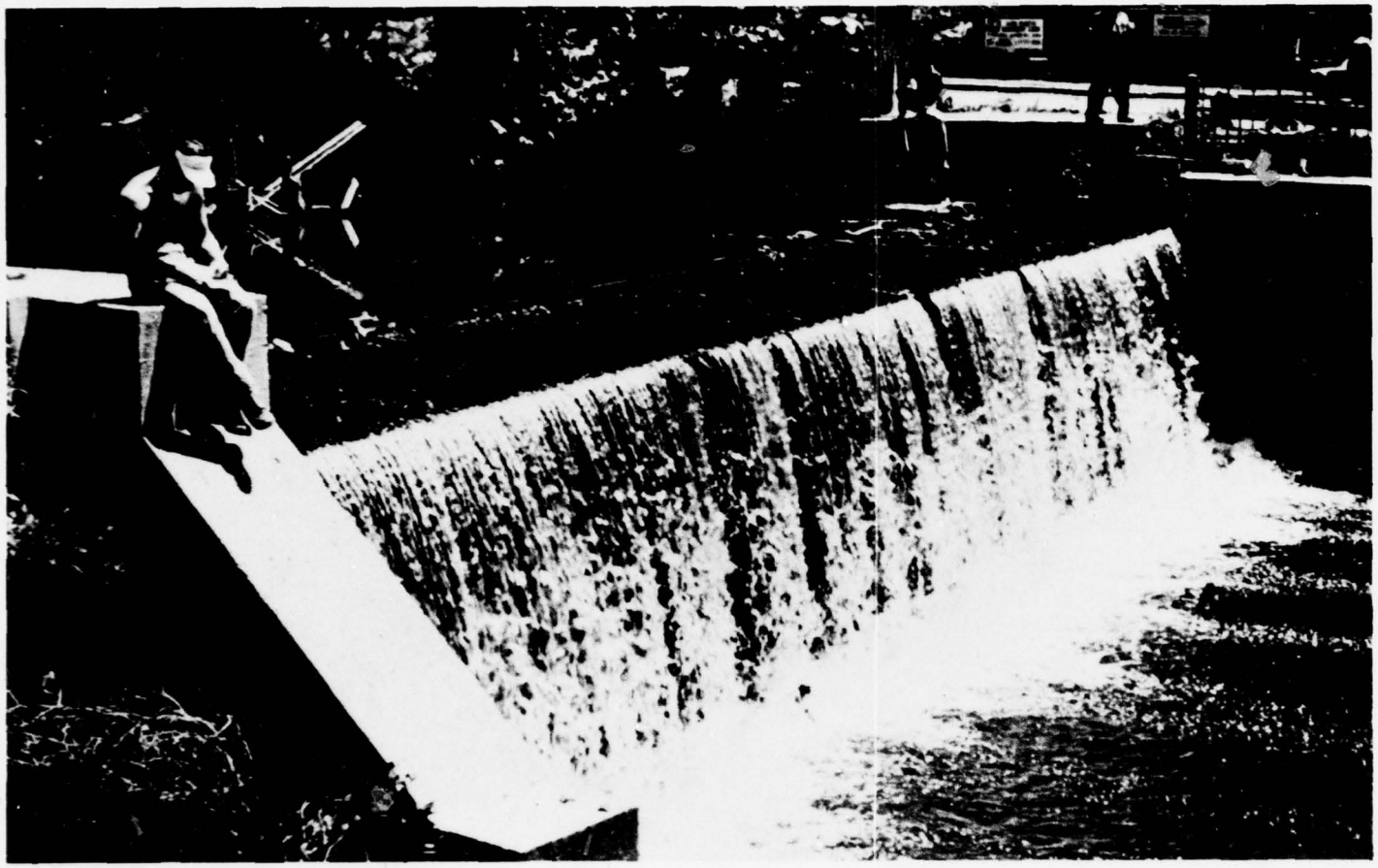
Hydraulic/hydrologic evaluations performed in accordance with established Corps of Engineers procedures for Phase I Inspection Reports revealed that the spillway will not pass a minimum required 100 year frequency flood flow.

In fact, calculations indicate that the spillway can only carry approximately 34 percent of the 100 year flood. A high flood flow in November 1977 caused a major overtopping of the dam, subsequent flow of water across a highway, and appreciable flood water damage to an adjacent business area. It is for these reasons, in combination with serious structural deficiencies; that the owner should be directed to perform immediate additional engineering studies to determine, in detail, the condition of this dam and necessary corrective action.

Additionally, it is recommended that a boulder deposit under River Road Bridge and a small severely leaning retaining wall constructed in the stream channel downstream from the bridge should be removed since they restrict flood flows. However, removal of these restrictions is not the responsibility of the dam owner.

MICHAEL BAKER, JR., INC.

Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer
Registration Number 13385



OVERALL VIEW OF DAM

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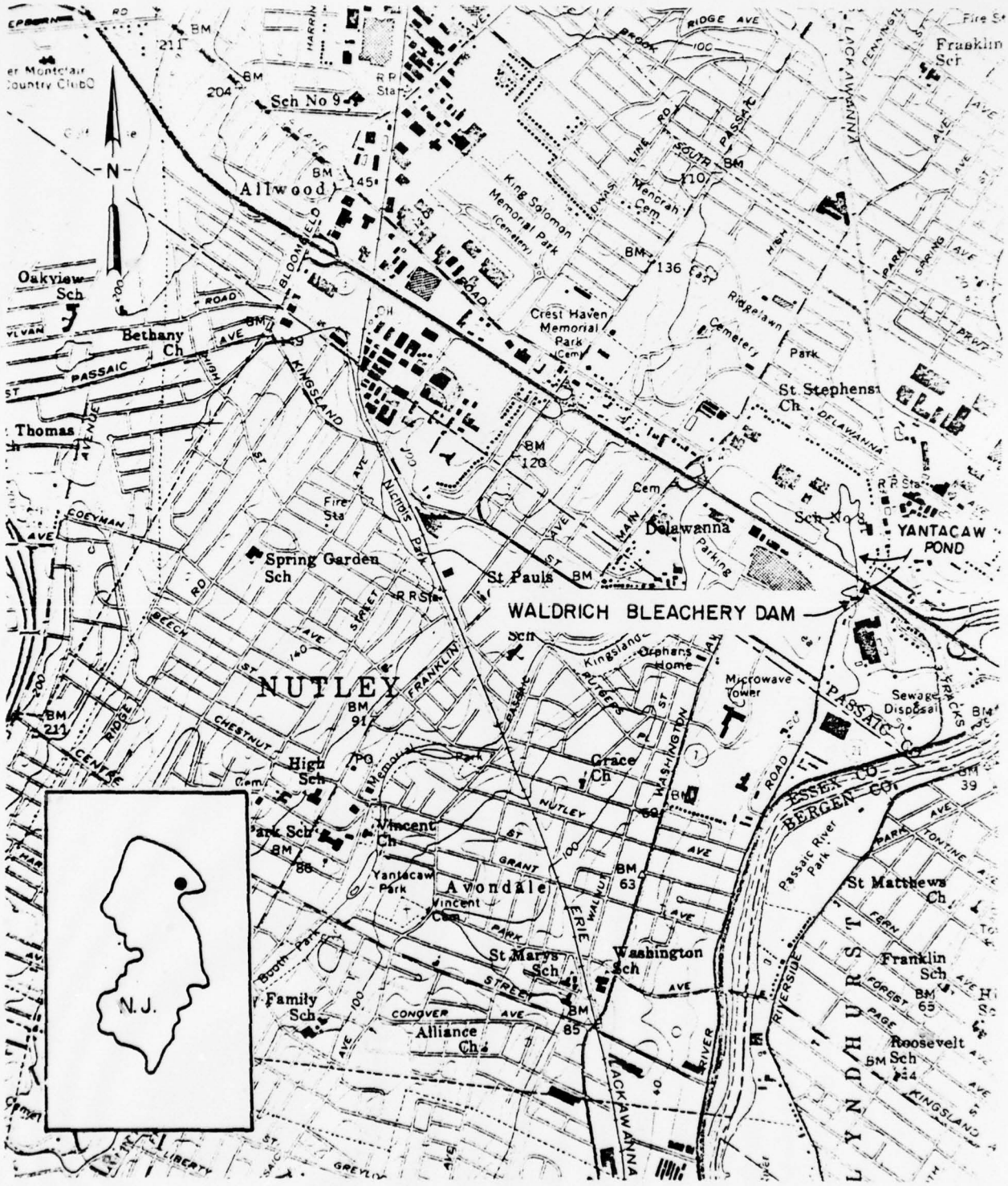

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LOCATION PLAN

WALDRICH BLEACHERY DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: WALDRICH BLEACHERY DAM (YANTACAW POND), ID# NJ 00143

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority - This report is authorized by the National Dam Inspection Act, Public Law 92-367, 92nd Congress, H.R. 15951 enacted 8 August 1972 and has been prepared in accordance with Contract No. DACW61-78-C-0141 between Michael Baker, Jr., Inc., and the U.S. Army Corps of Engineers, Philadelphia District.

b. Purpose of Inspection - The purpose of this inspection is to evaluate the general condition of Waldrich Bleachery Dam with respect to safety of the facility based upon available data and visual inspection.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances - The Waldrich Bleachery Dam was constructed in 1922 as a water supply dam for a silk bleachery which is no longer in operation. The dam, which retains Yantacaw Pond, consists, from left to right of:

1) A concrete left abutment containing two nonoperable sluice gate intakes measuring 48 inches wide and 36 inches high.

2) A 60.2 feet long, 9.6 feet high spillway with the face constructed of cut stone masonry and with a 6.75 to 7.5 feet wide crest covered with timber.

3) A complexly shaped section about 15 feet in length consisting of a concrete buttress and straight and curved walls of stone masonry and concrete with the top of this section paved with concrete.

4) A sluice gate with a 36 inch square opening with baffle boards to control the level of Yantacaw Pond during periods of low stream flow constructed in a six feet long concrete section of the dam.

5) An embankment area, a maximum 12.6 feet high, which has been recently filled in and regraded to form a wide nearly level proposed parking lot surface. The embankment is protected from wave action

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by a vertical stone wall about two feet wide and extending to the top of the embankment which is 2.65 to 2.95 feet above the spillway crest.

Additional existing appurtenances include:

1) A concrete wall on the downstream side extending from the left dam abutment to the abutment of River Road Bridge.

2) The remains of a concrete apron below the 36 inch by 36 inch sluice gate near the right abutment.

3) A concrete wall extending from the right abutment downstream to a 4.5 feet diameter concrete storm sewer outfall.

4) A 16 inch diameter outlet pipe, extending through the dam, and valve located on the downstream side.

5) A 14 inch pipe connecting the pond through the dam with an originally constructed pump house which is now demolished.

A sketch of the Waldrich Bleachery Dam representing conditions on 20 June 1978 is presented as Plate 3. It should be noted that during periods of high flow through the spillway, the opening of the sluice gates and 16 inch outlet pipe, even if possible, would have very little effect on the volume of the spillway discharge. During the field inspection, it was also noted that Yantacaw Pond is heavily silted including a substantial amount of silt behind the back face of the stone masonry spillway.

b. Location - Waldrich Bleachery Dam is located on the Third River in the town of Delawanna (population 30,000), Passaic County, New Jersey, about 0.4 mile upstream from the much larger Passaic River.

c. Size Classification - The maximum height of the dam is 12.6 feet. The reservoir volume to the top of dam is 68 acre-feet. Therefore, the dam is in the "Small" size category as defined by the "Recommended Guidelines for Safety Inspection of Dams."

d. Hazard Classification - Due to the proximity of commercial properties, a few homes, and a sewage treatment plant to the Third River downstream from the dam; there could be loss of a few lives and appreciable property damage in the event of failure. Therefore, this dam is considered in the "Significant" hazard category as defined by the "Recommended Guidelines for Safety Inspection of Dams."

e. Ownership - The dam is owned by Mrs. Grace A. Anderson, but is held in trust by Chase Manhattan Bank, New York, New York.

f. Purpose of Dam - The dam had been used for water supply during the years when the Waldrich Bleachery was in operation. However, the dam is no longer used for water supply and serves no useful purpose, except for a small amount of water which is piped directly to some sanitary facilities in a nearby building owned by E.C.U. Realty, Inc. and formerly leased to Advance Piece Dye Works, Inc.

g. Design and Construction History - It could not be determined during the Phase I investigation who designed or built the Waldrich Bleachery Dam. However, a representative of the owner, Mr. John Valenstein of the Trust Department of Chase Manhattan Bank, indicated that the dam was built in 1922 according to the best information available.

h. Normal Operational Procedures - The level of Yantacaw Pond is not regulated.

1.3 PERTINENT DATA

a. Drainage Area - The drainage area of Third River above the dam is 12.5 square miles.

b. Discharge at Damsite - The maximum known flow at the damsite is not known. However, the 8 and 9 November 1977 storm that produced a maximum flow of record at the New Milford Gage on the Hackensack River, also produced a discharge of 1950 c.f.s. at the gage on the Third River just upstream from Yantacaw Pond. This flow overtopped the Waldrich Bleachery Dam on 8 November 1977 and caused about 1.5 feet of flooding in the old bleachery buildings.

c. Elevation [feet above Mean Sea Level (M.S.L.)] -

Note: All elevations in this report are estimated; based on a reported elevation of 16.6 feet M.S.L. for top of curb on the River Road Bridge.

Top of Dam - 16.6
Maximum Pool (Design Discharge) - Not available
Normal Pool - 14.2
Streambed at Centerline of Dam - 4.35
Maximum Tailwater - Not available

d. Reservoir (feet) -

Length of Maximum Pool - Could not be determined with available information.
Length of Normal Pool - About 1800

e. Storage (acre-feet) -

At Spillway Crest (El. 13.95) - 41

f. Reservoir Surface (acres) -

Top of Dam - Could not be determined with available information.
Spillway Crest - 7.3

g. Dam - The Waldrich Bleachery Dam consists of an earth embankment section, a stone masonry and concrete gravity section, a stone masonry and timber gravity spillway. These sections have the following dimensions and slopes:

1) Earth Embankment Section -
   a) Length - About 200 feet
   b) Height - Maximum 12.6 feet
   c) Top Width - Embankment is now a nearly level regraded earth fill with a minimum top width of 100 feet.

2) Side Slopes -
   a) Upstream - Vertical at masonry wall which acts to prevent wave erosion; the depth of the masonry wall is not known. Upstream embankment slope below the masonry wall and normal pool elevation, if such an embankment slope does exist, was not visible due to very heavy siltation.
   b) Downstream - Downstream slope not discernible since embankment earth fill has been regraded to blend into the surrounding land.

3) Impervious Core - It is not known if the original embankment was constructed with an impervious core.

4) Cutoff - It is not known if the embankment was constructed with a cutoff.

5) Concrete and Stone Masonry Section -
   a) Length - About 15 feet
   b) Height - 12.0 to 12.5 feet
   c) Top Width - Varies from one foot to more than 20 feet
   d) Side Slopes - Most are vertical
   e) Cutoff - No data available

6) Stone Masonry and Timber Spillway -
   a) Length - 60.2 feet
   b) Height - 9.6 feet
   c) Top Width - 6.75 to 7.5 feet
   d) Slope of Exposed Face - Vertical stone masonry
   e) Impervious Core - No data available
   f) Cutoff - A nearly vertical line of cut timbers is located at the back face of the spillway at the top. The depth to which these timbers extend is not known, but they may extend deep enough to form a cutoff.

h. Diversion and Regulating Tunnel - None

i. Spillway -

Type - Wood timbers covering stone masonry
Length of Weir - 60.2 feet
Crest Elevation - 13.95 feet M.S.L. (estimated)
Gates - Two with 36 by 48 inch intakes are located in the left concrete abutment (not operational).
Downstream Channel - Rock and rubble bottom with stabilized slopes

j. Regulating Outlets - None are operational; however, the flashboards in the 36 inch square sluice gate near the right abutment could be removed to lower the pond 22 inches below the top of the spillway during periods of very low stream flow.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design drawings or calculations for the Waldrich Bleachery Dam were available for review. The only drawings that are available are those listed in Appendix B. These drawings do not show design or construction details. Because of the lack of any design data, it is not possible to evaluate and make firm judgements with regard to the stability of the concrete gravity and masonry portions of the dam.

2.2 CONSTRUCTION

No construction records were available.

2.3 OPERATION

No operating records were available.

2.4 EVALUATION

Available maps showing the Waldrich Bleachery Dam are not adequate for a safety evaluation. Additional data would be needed to properly evaluate the stability of the stone masonry spillway and adjacent concrete sections (including the geometric configuration of the dam), type of foundation and foundation conditions, and construction details.

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SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - The dam and its appurtenant structures were found to be in poor condition at the time of inspection. Many problems noted during the visual inspection are considered serious and require additional investigation, as discussed in Section 7. Deficiencies observed are described briefly in the following paragraphs, and are numbered to correspond with the numbered locations on the Visual Inspection Sketch Map, presented as Plate 3.

b. Dam and Appurtenant Structures - In the left abutment are two sluice gate intakes (1) measuring 48 inches wide and 36 inches high constructed in the concrete left abutment. The sluice gates are inoperable.

The retaining wall (2) between the left dam abutment and River Road Bridge abutment was observed to be seriously undermined up to 44 inches under the foundation near the spillway. This wall, otherwise, appears to be in good condition.

It appears that there may have been slope paving (3) extending from near the base of the above mentioned wall down into the streambed. Only 1.5 to two feet of this "concrete paving" remains. The rest is believed to have been washed away.

The masonry and timber spillway was observed to have a course of stone blocks (1.5 feet high and 8.7 feet in length) missing (4) just above the level of the tailwater, 40 feet from the left abutment. The course of stone blocks above appeared to be working loose.

Twenty feet from the left abutment, part of a course of stone blocks, 2.5 feet in length, is also missing (5) from the spillway just above tailwater elevation. Evidence of mortar deterioration is present in courses of stone block adjacent to those areas where the blocks are missing.

The downstream channel is seriously scoured out, seven feet deep, adjacent to the left end of the spillway (6). Scour of the channel bottom adjacent to the middle of the spillway may also be deep, possibly endangering the stability of the spillway.

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The downstream end of the concrete buttress wall (7) at the right end of the spillway is founded on the remains of a seven inch concrete slab which had formed an apron. The undermining extends under the downstream corner of the buttress. The buttress wall is cracked at the top with a crack width of one-sixteenth to one-eighth of an inch. The crack extends across the top of the adjacent concrete slab overlying the central part of the concrete and masonry section of the dam. Minor spalling of the buttress adjacent to the spillway was observed.

There is a six feet wide concrete section (8) adjacent to the left side of the 36 inch square sluice gate that is spalled on the front face and on the area adjacent to the sluice gate.

On the upstream side of the concrete masonry section of the dam there is a five inch tree (9) growing in a separation a maximum of three inches wide (10) between the concrete slab and stone wall which appears to have settled. A portion of the top of the stone wall 20 inches wide and 12 inches high has been washed out (11).

Adjacent to the 36 inch square sluice gate (12), there is some minor spalling of concrete.

Below the sluice gate, there had been constructed a concrete apron (13) which has been mostly washed away. Considerable rubble now occupies the original apron area.

Adjacent to the originally constructed apron along the right bank of the stream channel from the right abutment extending 30 feet downstream exists a concrete wall (14). This wall was observed to be undermined by scour over a distance of more than 15 feet. The undermining extends back under the retaining wall a distance of up to 54 inches at one point. The retaining wall is functioning, in essence, as a cantilevered section and may collapse at any time. A 16 inch diameter outlet pipe (15) was observed below the 36 inch square sluice gate near the right abutment. The pipe had previously been used to draw water from Yantacaw Pond and from an adjacent pond located to the west (see Plate 2); which is now reportedly being filled in for land development according to Mr. Valenstein of Chase Manhattan Bank. At the time of the inspection, the pipe outlet was not functional.

A 14 inch diameter pipe (16) is located just above the 16 inch outlet pipe. The pipe flows from the pond to the recently demolished pump house (17), also shown on Plate 1. When the pump house was demolished, the basement was filled with rubble, cracking a valve housing on the pipe causing leakage. The leakage, estimated at 20 g.p.m., flows through the rubble and fill material, and then over and through weep holes of the undermined concrete wall described as item (14) above.

No seepage from the regraded nearly flat earth embankment section nor any evidence of slumps or sloughage was observed during the visual inspection.

The surface of the earth embankment adjacent to the right abutment shown on Plate 3 was observed to be a few inches lower than the adjacent stone wall. This area of the embankment is probably low due to settlement; or, more likely, erosion from overtopping of the dam 8 November 1977. The sandy soils forming the embankment at this location are considered to be highly erodible.

c. Reservoir Area - Evidence of heavy siltation is present in Yantacaw Pond. Sedimentation islands and water vegetation are scattered throughout the pond. Soundings made by Federick Wm. Engle, Professional Engineer and Land Surveyor, in March 1964 indicate large quantities of sediment have been deposited. The condition has not been corrected since that time, and the amount of sediment present has no doubt increased. Behind the spillway, the water depth was only 2.5 feet.

Some evidence of minor bank erosion is present; located near the left abutment area approximately 50 feet upstream from the overflow spillway.

d. Downstream Channel - The downstream channel in the area adjacent to the toe of the dam has a serious scour problem near the left end of the spillway. Soundings made in this area revealed almost seven feet of scour. The scour at the right end of the spillway was approximately two and one-half to three feet. No soundings could be made at midpoint of the spillway; however, adjacent conditions indicate that scour in this area has probably also occurred.

In general, the appurtenant structures downstream of the dam are seriously undermined by scour.

Located approximately 100 feet downstream from the dam is River Road Bridge, owned by Passaic County, which spans the stream channel. The vertical channel clearance is approximately eight feet high to the bottom flanges of the roadway stringers. A monolithic concrete pier, located at midstream, has cracks present at its midpoint on both sides which may be due to settlement. However, no major scour conditions were observed at the bridge pier or abutments. Debris from previous high water is entangled among the roadway stringers. Some obstruction of the stream channel was observed against the east bridge abutment where previous flood flows have piled up boulders and cobbles to a height of approximately five feet.

The right stream bank has experienced substantial bank erosion downstream from the bridge. The left stream bank has a riprap lining which is intact. Beyond the riprap, a short concrete wall (six feet high) had been build immediately adjacent to the stream to retain a parking area. At the time of inspection, the wall was noted to be undermined, severely leaning and in danger of collapse. It was reported that the wall was undermined by scour during the last major flood on 8 November 1977.

3.2 EVALUATION

a. Dam - Based on the visual inspection of 20 June 1978, the condition of the Waldrich Bleachery Dam can best be described as poor. Serious scour conditions exist at the downstream toe which could have a detrimental affect on the ability of the dam to resist sliding and/or overturning.

The structural integrity of the dam spillway is also believed to be weakened due to the missing courses of stone block from the front face of the spillway. Since the identity of the other materials which constitute the remainder of the spillway is unknown, it is necessary to conclude that the missing courses of stone block may seriously affect the structural integrity of the dam.

b. Appurtenant Structures - The appurtenant structures, which include the left and right retaining walls, are assessed to be in poor condition, and some appurtenances are inoperative. The most significant problem is the undermined condition of the concrete structures.

c. Reservior - The sediment deposits described in paragraph 3.1.c. are believed to have substantially reduced the reservoir storage capacity. In addition, the deposits may possibly exert excessive siltation pressures against the back face of the stone masonry and timber spillway, and on the adjacent concrete and masonry section of the dam.

d. Downstream Channel - As discussed in paragraph 3.2.a., the scour of the downstream channel adjacent to the dam and under the adjacent retaining walls is considered a serious problem which requires action.

A slight restriction in this downstream channel was observed under River Road Bridge where an accumulation of boulders and cobble are present against the east abutment. The restriction has the effect of increasing the elevation of the tailwater below the dam. The higher tailwater could have the effect of decreasing the spillway capacity below the dam, with the result of more water overtopping the dam and River Road.

The other problems noted downstream from River Road Bridge in paragraph 3.1.d. are not considered to endanger or affect the performance of the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no normal procedures to operate the dam, or to regulate the pond level or discharges. No formal written procedures for emergency downstream evacuation in the event of an impending catastrophe have been developed.

Rapid emergency drawdown of the pond is not possible due to the small size and inoperable condition of the sluice gates and outlet pipe. However, a slow drawdown may be possible (depending on stream flow conditions) by removing the flashboards from the 36 inch square sluice gate near the right abutment of the dam.

Formal emergency procedures should be immediately developed and implemented. The formal emergency procedures that are recommended are provided in Section 7 of this report. In addition, the owner should assist public officials in initiating an emergency evacuation plan for areas which will be affected in the event of imminent dam failure or overtopping flood flows. There should also be constant monitoring of the dam when heavy rains are forecast.

4.2 MAINTENANCE OF DAM

No regular maintenance of the dam is performed.

4.3 MAINTENANCE OF OPERATING FACILITIES

No maintenance of the operating facilities is performed.

4.4 WARNING SYSTEMS

None

4.5 EVALUATION

The degree of maintenance performed is considered inadequate.

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SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data - There were no design data available for review and evaluation.

b. Experience Data - There were no experience data available for review and evaluation. Comments received from a representative of the owner of the old bleachery buildings stated that there was major overtopping of the dam in a flood that occurred on 8 November 1977. The flood waters reportedly flowed from the overtopped dam across River Road and into the lower level of the old bleachery buildings causing considerable drainage.

c. Visual Observations - The spillway appeared to be functioning in a normal manner. However, the mechanically operated sluice gates located in the left abutment were not functional and their condition is unknown.

d. Opertopping Potential - The Waldrich Bleachery Dam is classified as a "Significant" hazard-"Small" size dam requiring evaluation for a Spillway Design Flood (S.D.F.) equal to the 100 year frequency flood flow to one-half Probable Maximum Flood (P.M.F.).

The spillway is a free overfall weir, constructed of stone and timber, 60.2 feet wide and approximately seven feet in breadth. The lowest top of dam is 2.65 above the weir. A spillway discharge rating curve was developed by using coefficients from the Handbook of Hydraulics by King and Brater. The maximum spillway capacity without overtopping, at lowest top of dam level, is about 817 c.f.s. The spillway dimensions used for computations were determined by field measurement.

The hydrologic analysis of Waldrich Bleachery Dam was completed by the use of the Flood Hydrograph Computer Package HEC-1 developed by the U.S. Army Corps of Engineers and by procedures outlined in Design of Small Dams, a U.S. Bureau of Reclamation publication, and EM-1110-2-163 by the U.S. Army Corps of Engineers. The flood hydrograph peak was developed using a 100 year frequency rainfall and, therefore, will not necessarily yield a 100 year frequency discharge. In an attempt to more accurately define the 100 year discharge peak, the publication "Magnitude and Frequency of Floods in New Jersey,

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Special Report No. 38 by the U.S. Geological Survey was examined. The 100 year rainfall hydrograph peak discharge was determined to be 2372 c.f.s., which is 82 percent of the U.S.G.S. calculated peak of 2900 c.f.s. The 100 year rainfall hydrograph was then used for further computations.

The 100 year rainfall hydrograph with a peak discharge of 2372 c.f.s. was routed through the Waldrich Bleachery Dam using the HEC-1 program. The routing indicated that the dam had very little affect on the peak flood discharge, causing less than a one percent reduction, and that the dam would be overtopped by the 100 year storm. The spillway, based on this preliminary analysis and the criteria in "Recommended Guidelines for Safety Inspection of Dams," is considered to be inadequate.

It should be indicated that these conclusions pertain to present day conditions and that the effects of future development on the hydrology has not been considered.

e. Emergency Drawdown - The sluice gates through the left abutment were a probable means of drawdown capabilities; but they apparently have not been in operation for several years, and their condition is unknown. Near the right abutment, removal of the flashboards in a 36 inch by 36 inch sluice gate through a concrete portion of the dam could be used to partially drawdown the pond during periods of low stream flow. Additionally, the 16 inch diameter outlet pipe which is located below the 36 inch by 36 inch sluice gate may be capable of assisting an emergency drawdown, provided the nonoperable closed valve is removed and the pipe is not clogged.

None of the existing appurtenant structures are capable of an effective rapid emergency drawdown during periods of high stream flows.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - During the field inspection, structural inadequacies of the masonry and timber spillway, adjacent concrete and masonry dam section, and appurtenant structures were found to exist. The inadequacies included stone block courses missing from the front face of the dam, undermined retaining walls, serious scour problems, and increasing sediment pressures against the back face of the dam due to continued siltation of the pond. Because of these deficiencies, the stability of the spillway and left abutment downstream retaining wall is considered questionable, and the failure of the right abutment downstream retaining wall is imminent.

Because of the low height of the earth fill section of the dam, its substantial width, the nearly flat slopes formed by filling and regrading, and the absence of any evidence of seepage through the earth embankment, it is inferred that the dam could be shown to meet the stability requirements of the "Recommended Guidelines for Safety Inspections of Dams." The slightly low area of the embankment near the right abutment might be due to settlement, but if so, it is not considered sufficient to cause an unstable condition.

b. Design and Construction Data - The structural stability of the spillway, concrete and masonry section of the dam, and the left abutment retaining wall cannot be analyzed due to the lack of design and construction data. But as mentioned above, their stability is questionable because of present conditions.

c. Operating Records - No operating records are available.

d. Post-Construction Changes - The left concrete retaining wall which is located just downstream of the spillway has been constructed recently, but prior to 1977. This information was obtained through a conversation with a Mr. Leon Urdang of E.U.C. Realty, Inc., owner of the old bleachery buildings, and was verified by a visual inspection of the wall. The retaining wall was apparently constructed to buttress an older stone wall since

the top of the stone wall is exposed behind the concrete wall.

As discussed in paragraph 1.2.a., the earth embankment section of the dam is a recently filled in and regraded area. This change from the suspected original embankment configuration should enhance embankment stability.

e. Seismic Stability - The Waldrich Bleachery Dam is located in Seismic Zone I, a zone where only minor earthquake damage can normally be expected. The effects that an earthquake would have on the Waldrich Bleachery Dam in its present condition are not known, but could be evaluated more thoroughly if the nature of the foundation and "as built" conditions were known.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety - The Waldrich Bleachery Dam is evaluated as being a "Significant" hazard-"Small" size dam in accordance with the "Recommended Guidelines for Safety Inspection of Dams" and should have a spillway capacity equal to the 100 year frequency flood flow to one-half P.M.F. As presented in Section 5, however, the spillway was determined in this investigation to have a capacity much smaller than the 100 year frequency flood flow. Based on this investigation, the spillway capacity is, therefore, assessed as being inadequate.

   Other deficiencies in the dam are of a serious nature. The undermining by scour of the left and right abutment downstream retaining walls, the deep scour adjacent to the spillway, and the sections of missing stone masonry on the downstream face of the spillway adversely affect the stability of the dam and appurtenances.

b. Adequacy of Information - The information obtained in this Phase I investigation is not adequate to assess the stability of the masonry and timber spillway, adjacent concrete and masonry section, and the retaining wall adjacent to the left abutment in their present condition with respect to overturning and sliding. Additional investigation would be needed to do these analyses.

c. Urgency - There is no need for emergency repair work at this time, but the additional investigations recommended below must begin immediately.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

As a result of the Phase I investigation, it is believed that there are two basic, reasonable approaches available to remedy the existing condition of the Waldrich Bleachery Dam. These approaches are:

1) It is recommended that the owner engage, immediately, a qualified engineer experienced in the structural, hydrological and geotechnical aspects of dams to determine in detail the existing conditions and stability of the dam; and to develop plans and specification for

its repair and renovation, including modifications to the spillway to carry large flood flows. The additional investigation should include a more accurate determination of peak flows using more sophisticated methods and procedures than those discussed in paragraph 5.1.d. It is believed, however, that very extensive modifications would be necessary for the spillway to carry a 100 year frequency flood flow.

2) Alternately, it is recommended that the owner should engage, immediately, an engineer who is experienced in dams to develop plans for draining the pond, and for demolition and removal of appropriate portions of the dam. The engineer should proceed soon with the task of obtaining the required permits from the appropriate regulatory agencies for these actions.

3) After the engineering work in Recommendations 1) or 2) is complete, and the necessary permits obtained; the owner should proceed with the repair and modification work, or the demolition work immediately.

4) It is also recommended that the owner immediately implement formal emergency procedures including:

   a) How to operate the dam during an emergency.

   b) Methods of draining the reservoir under emergency conditions.

   c) Who to notify, including public officials, in case evacuation from downstream areas is necessary.

   d) Constant monitoring of the dam when heavy rain is forecast.

In addition, an emergency evacuation plan should be initiated immediately to evacuate those areas which will be affected in the event of imminent dam failure or when overtopping flood flows occur.

5) It is further recommended that periodic inspections be conducted during the period that the above recommended engineering studies are being made, as well as afterwards in the event the dam is repaired and renovated.

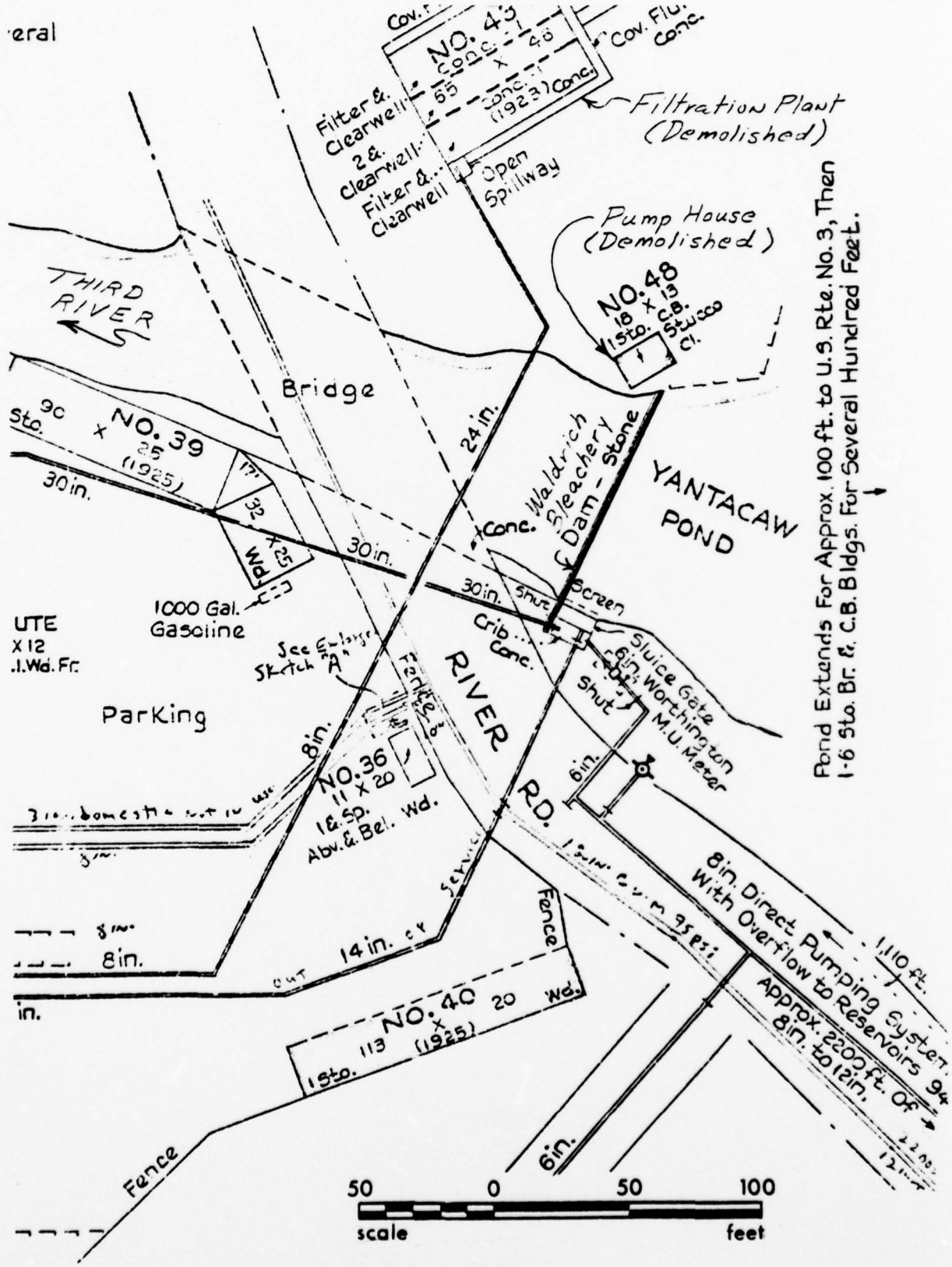
Additional recommendations, which deal with obstructions in the downstream channel, are presented below. However the removal of these obstructions is not the responsibility of the dam owner.

1) The deposit of boulders and cobbles against the east abutment of River Road Bridge should be removed since this deposit will slightly restrict flood flows.

2) The severely leaning retaining wall constructed in the stream channel south of River Road Bridge should be removed since it also will restrict flood flows.

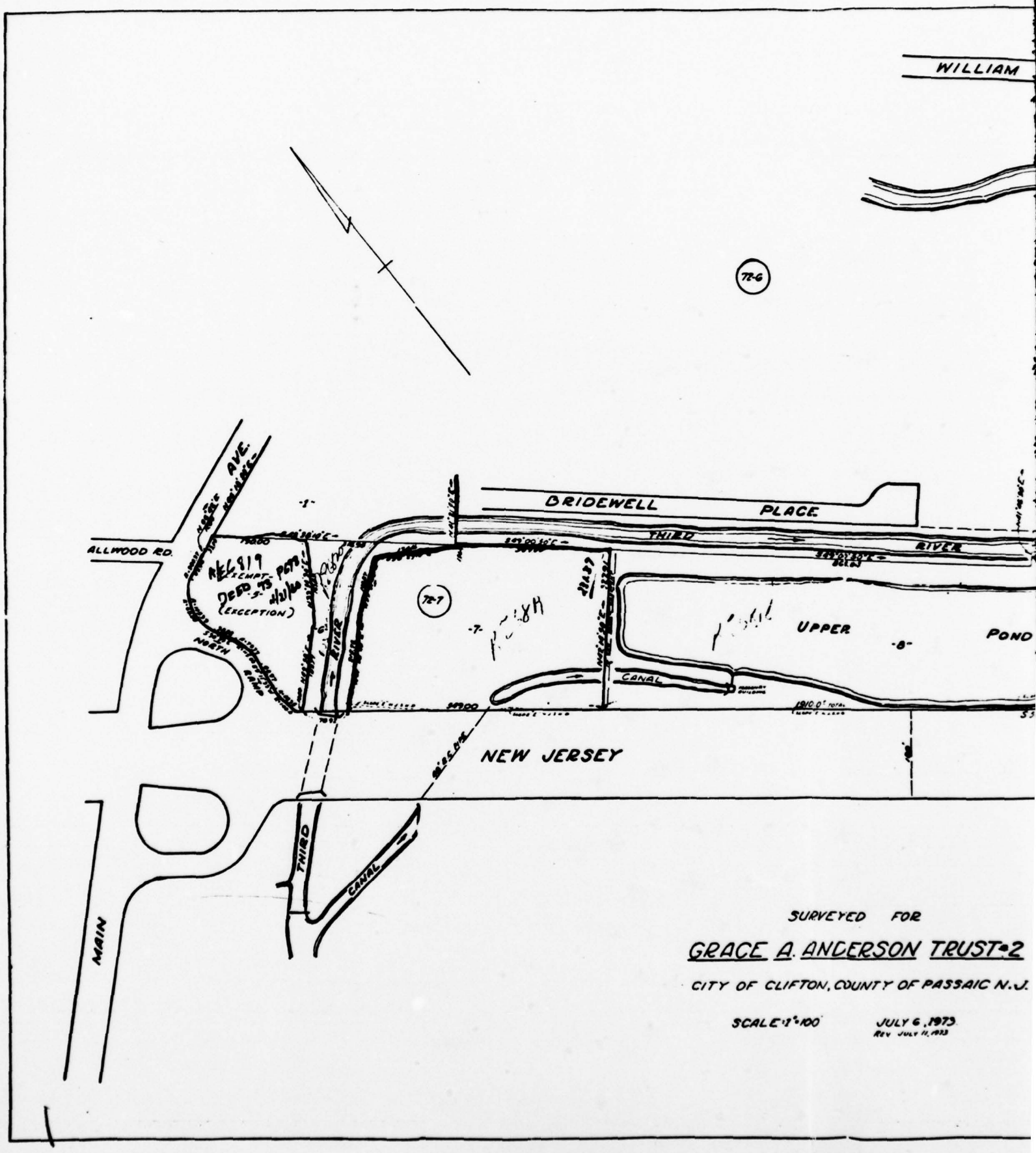
PLATES

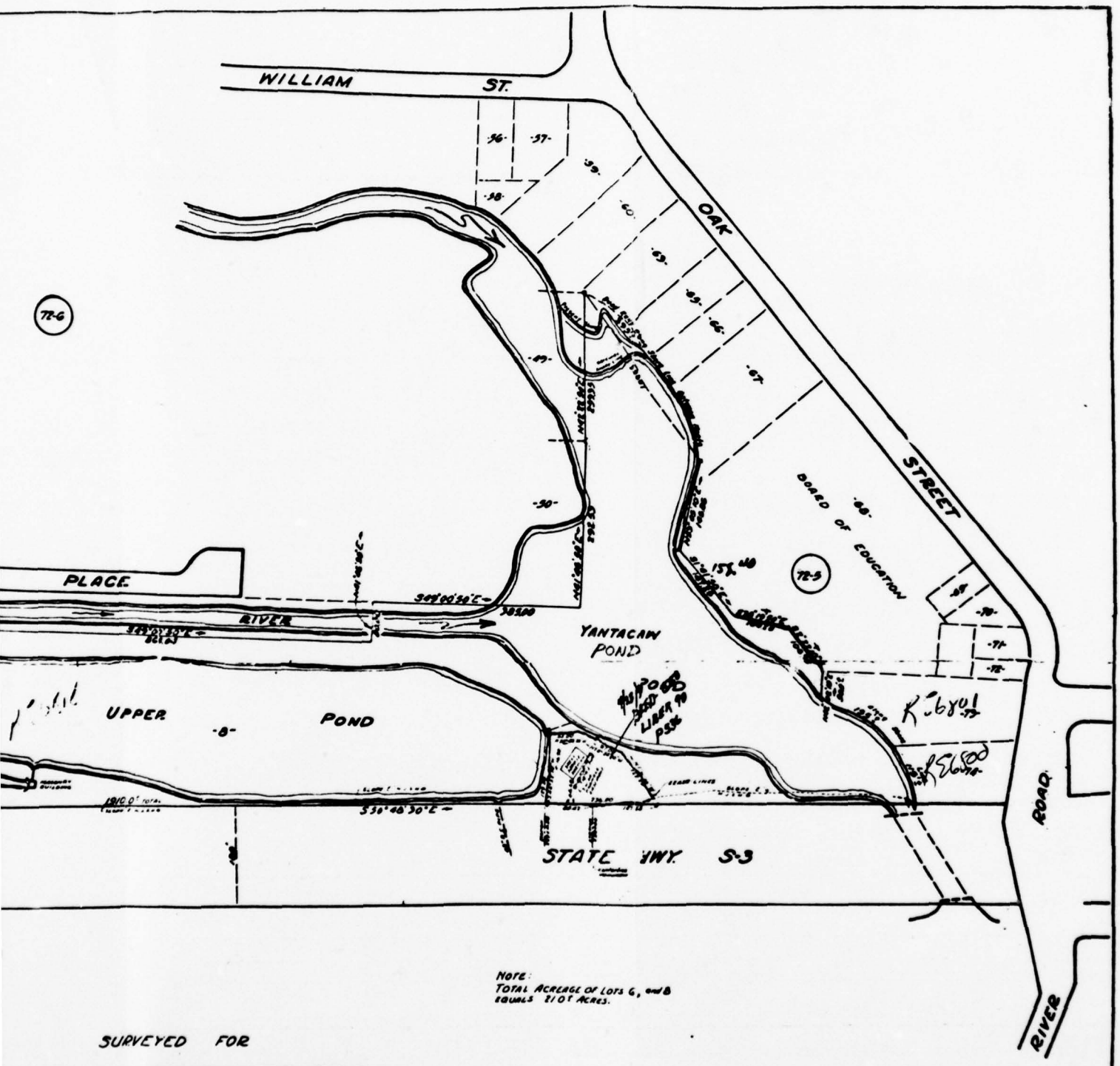
NOTE: NO DESIGN OR "AS BUILT" DRAWINGS COULD BE LOCATED FOR THE PHASE I INSPECTION REPORT OF THE WALDRICH BLEACHERY DAM.



WALDRICH BLEACHERY DAM

PLATE 1


WILLIAM
72-6
BRIDEWELL PLACE
THIRD
RIVER
ALLWOOD RD.
AVE.
-1-
72-7
-7-
UPPER
-8-
POND
CANAL
NORTH
RIVER
NEW JERSEY
THIRD
CANAL
MAIN
SURVEYED FOR
GRACE A. ANDERSON TRUST #2
CITY OF CLIFTON, COUNTY OF PASSAIC N.J.
SCALE 1" = 100'
JULY 6, 1973
REV JULY 11, 1973



Note:
Total Acreage of Lots 6, and 8 equals 21.07 Acres.

SURVEYED FOR

GRACE A. ANDERSON TRUST #2

CITY OF CLIFTON, COUNTY OF PASSAIC N.J.

SCALE 1" = 100'

JULY 6, 1973
REV JULY 11, 1973

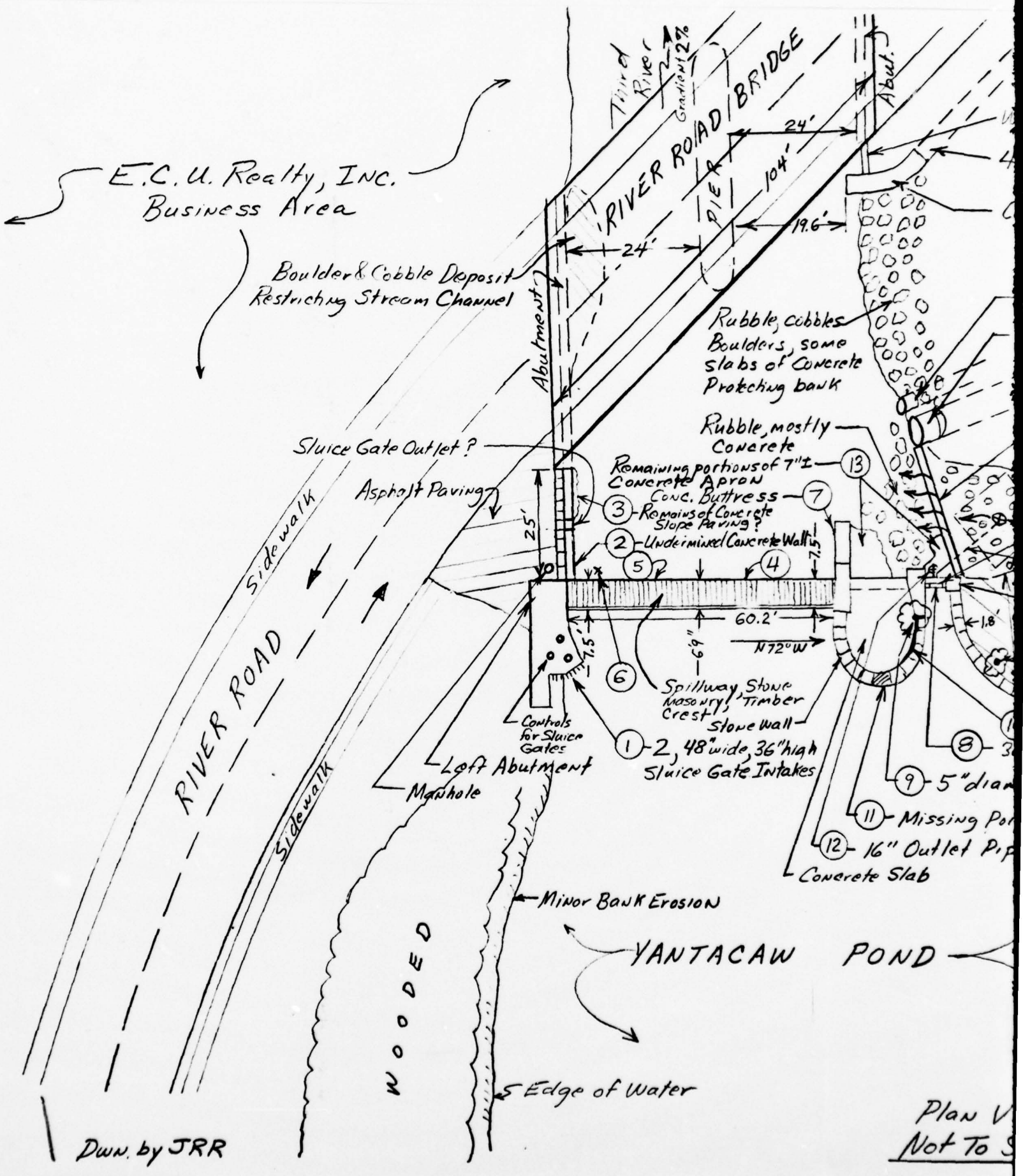
THIS SURVEY IS CERTIFIED TO:
GRACE A. ANDERSON, TRUST #2,
THE CHASE MANHATTAN BANK AS TRUSTEE and
ALL OTHER PARTIES IN CURRENT INTEREST.

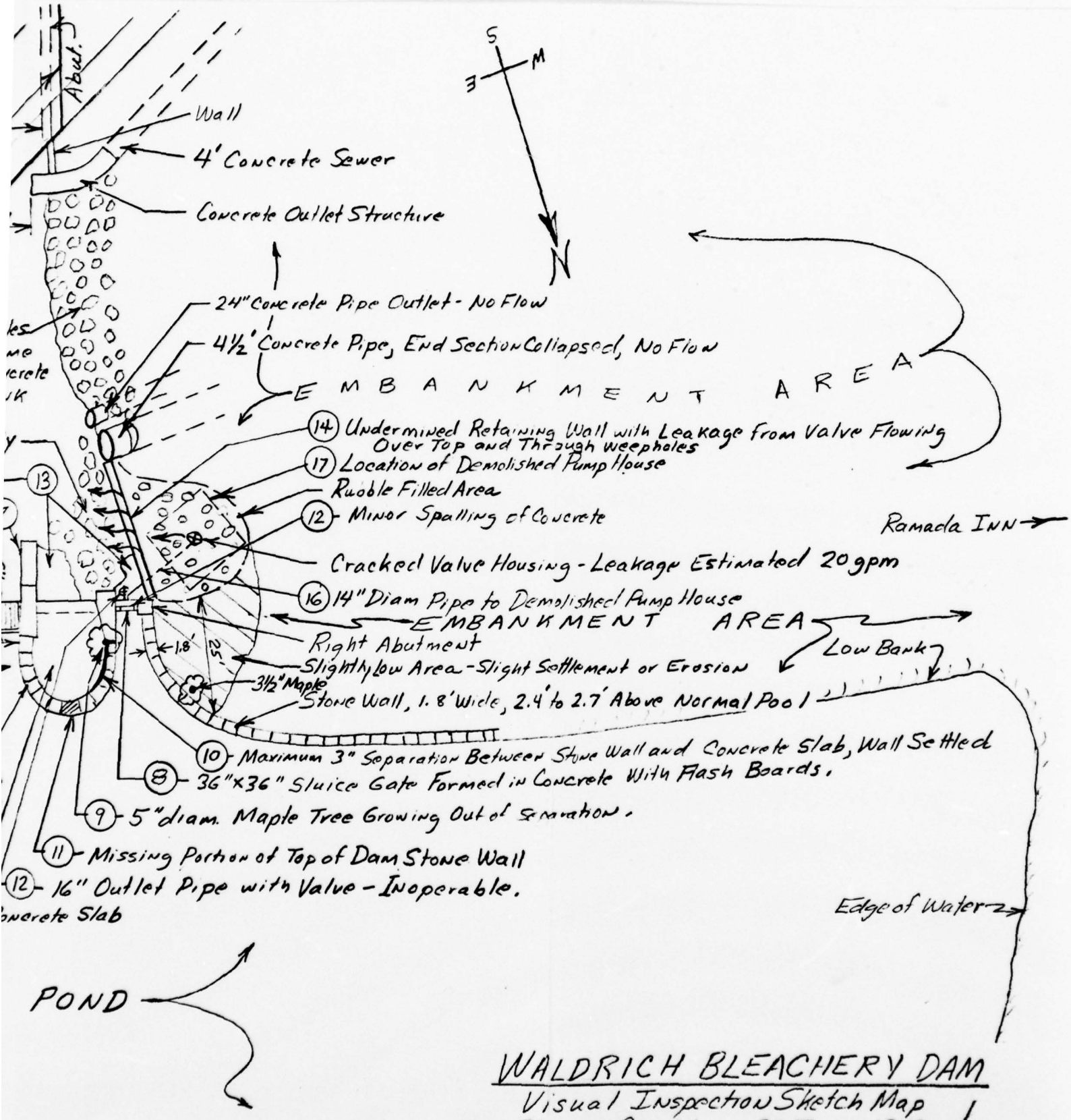
2

PLATE 2

JOHN A. DOOLITTLE & CO.
ENGINEERS (EST. 1890) SURVEYORS
1120 CLIFTON AVE., CLIFTON, N.J.
BY Robert W. Doolittle, Jr. P.L.S.
NEW JERSEY STATE LICENSE NO. 4133

LITHO - 779


E.C.U. Realty, Inc.
Business Area
Boulder & Cobble Deposit
Restricting Stream Channel
Third River
Gradient 2%
RIVER ROAD BRIDGE
PIER
24'
104'
19.6'
24'
Abut.
Abutment
Rubble, cobbles
Boulders, some
slabs of Concrete
Protecting bank
Rubble, mostly
Concrete
Sluice Gate Outlet ?
Asphalt Paving
Remaining portions of 7" I
Concrete Apron
Conc. Buttress
3 - Remains of Concrete
Slope Paving ?
2 - Undermined Concrete Wall
25'
7.5'
60.2'
N72°W
6.9"
7.5'
1.8'
Spillway, Stone
Masonry, Timber
Crest
Stone wall
Controls
for Sluice
Gates
1 - 2, 48" wide, 36" high
Sluice Gate Intakes
Left Abutment
Manhole
Sidewalk
RIVER ROAD
Sidewalk
8 - 3
9 - 5" diam
11 - Missing Por
12 - 16" Outlet Pip
Concrete Slab
Minor Bank Erosion
YANTACAW POND
WOODED
Edge of Water
Dwn. by JRR
Plan V
Not To S



WALDRICH BLEACHERY DAM

Visual Inspection Sketch Map
Showing Conditions 20 June 1978
Drawn by JRR - Michael Baker Jr. Inc.

Plan View
Not To Scale

2

PLATE 3

PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam - Picture Looking East Toward Masonry Spillway and Concrete Abutments (Height of Dam Is Approximately 12 Feet).

Photo 1 - View Toward Left Abutment and River Road Bridge (Note Undermining of Abutment Wall) - 20 June 1978.

Photo 2 - View Toward Right Abutment Showing Rubble Fill Behind Retaining Wall - 20 June 1978.

Photo 3 - Right Abutment Area (Picture Shows Rubble Fill in Foreground, Trees Growing in Cracks in Concrete and Rectangular Gate With Water Seeping Through Flashboard.) - 20 June 1978.

Photo 4 - Picture of Undermined Retaining Wall, Rubble Fill and Collapsed Storm Sewer Outlet (Concrete Apron, Originally Constructed at Base of Retaining Wall, Has Been Almost Completely Washed Away.) - 20 June 1978.

Photo 5 - Fourteen Inch Pipe Located Below Rectangular Gate Shown in Photo 3 (Pipe Flows Toward Pump House, Which Was Demolished and Filled in With Rubble, Shown in Center of Photo 4.) - 20 June 1978.

Photo 6 - Top of Valve on 14 Inch Pipe in Pump House (Area Is Shown in Right Side of Picture Under Threaded Rod. Dumping of Rubble Cracked Valve Housing Causing Leakage Which Flows Through Rubble and Then Over and Through Weep Holes of Undermined Retaining Wall in Photo 4) - 20 June 1978.

Photo 7 - Close-Up of Leakage From Pipe Valve Flowing Over Retaining Wall - 20 June 1978.

Photo 8 - View of River Road Bridge and Storm Sewer Concrete Outlet at Right of Photo (Flood Conditions on 8 November 1977 Overtopped Bridge Deck) - 20 June 1978.

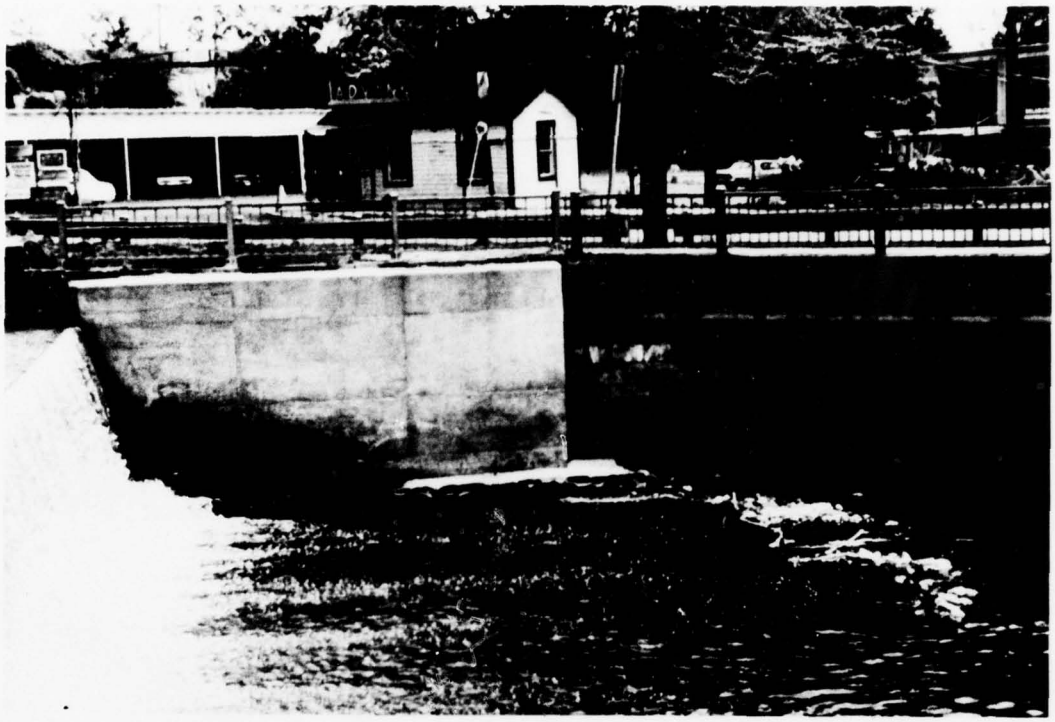


PHOTO 1

PHOTO 2

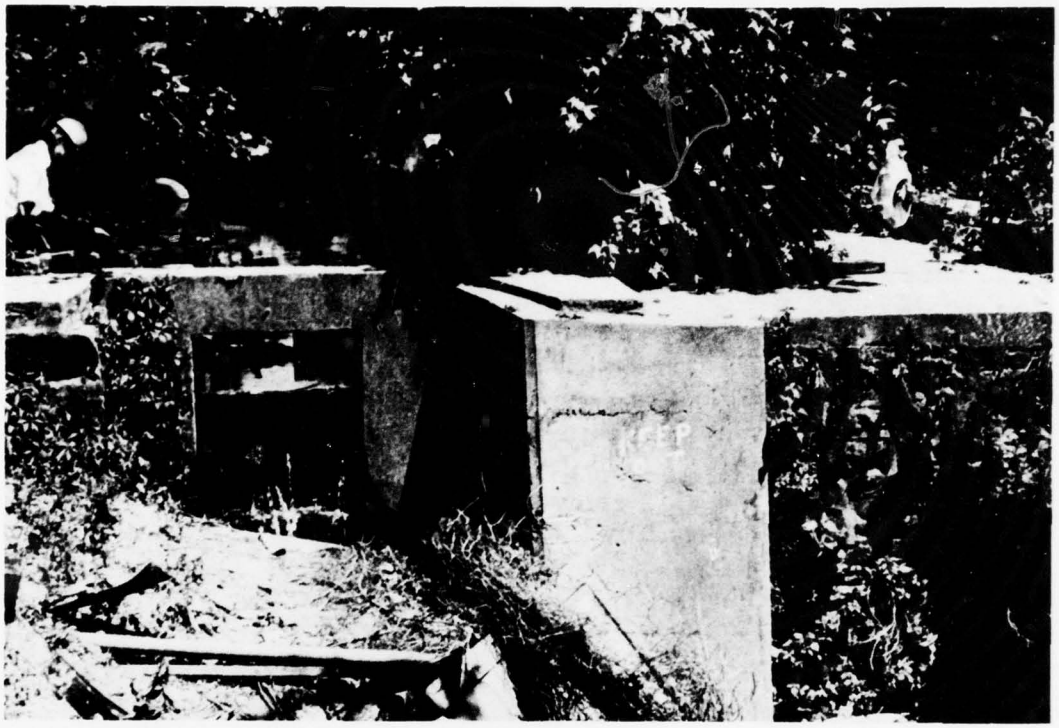


PHOTO 3

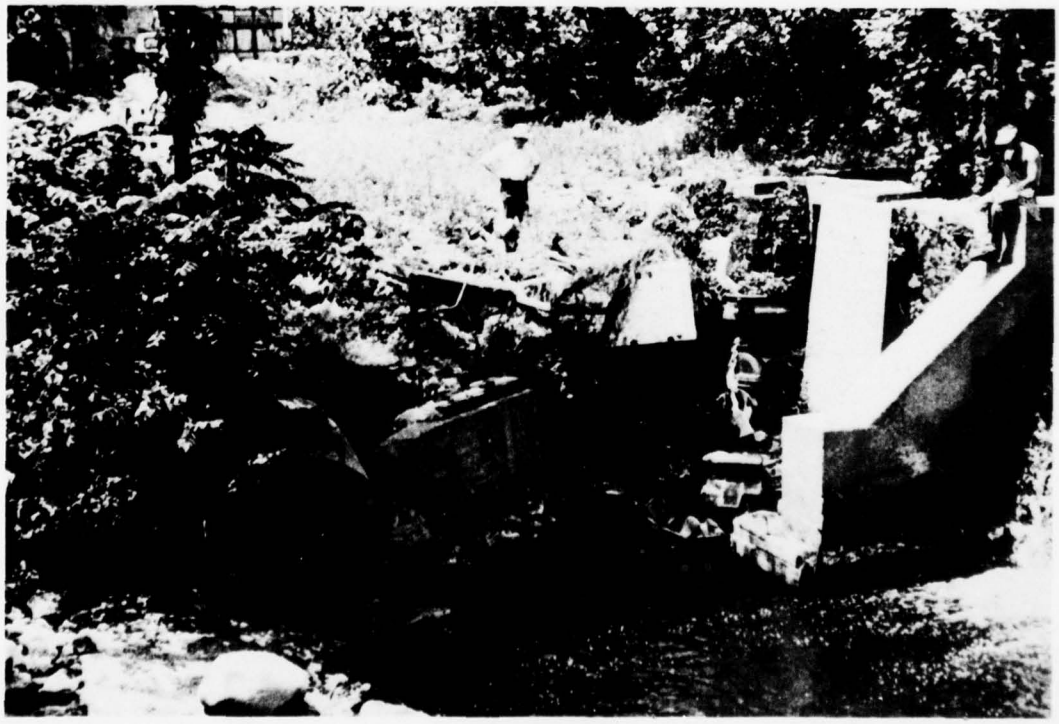


PHOTO 4

PHOTO 5

PHOTO 6

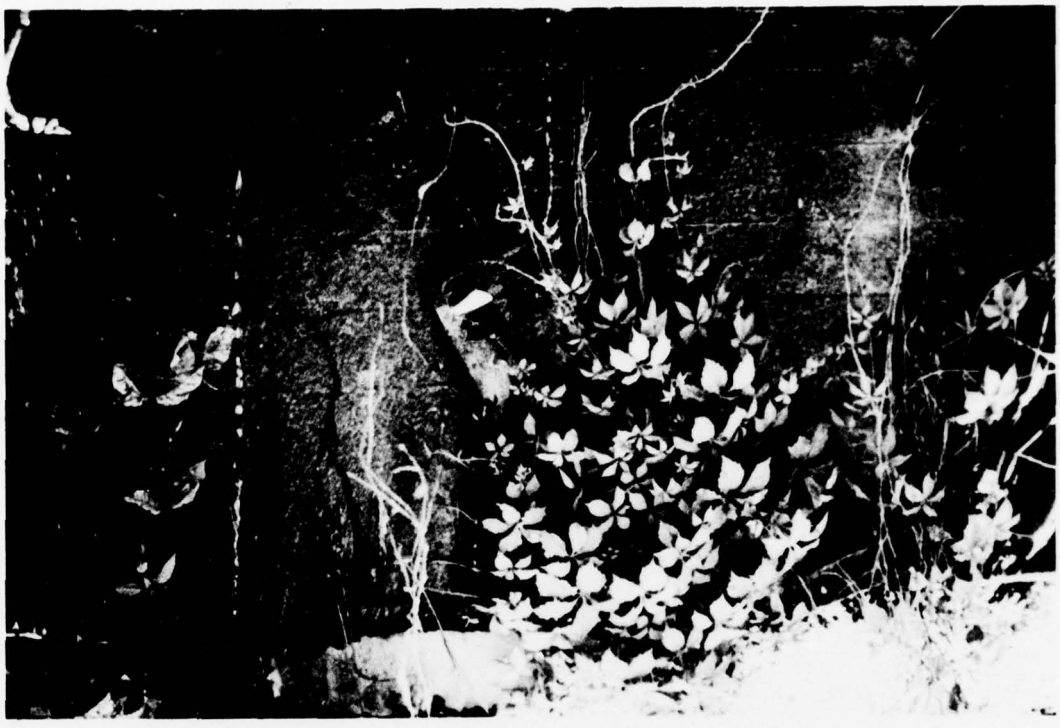


PHOTO 7

PHOTO 8

APPENDIX A

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name Dam Waldrich Bleachery Dam (Yantacaw Pond) County Passaic State New Jersey Coordinates Lat. 40°49.5'N Long. 74°08.0'W

Date Inspection 20 June 1978 Weather hot, sunny Temperature 85°± F.

All of the following elevations are based on an estimated elevation of 16.6 feet for the top of the dam.

Pool Elevation at Time of Inspection 14.2 M.S.L. Tailwater at Time of Inspection 4.35 M.S.L.

Inspection Personnel:

MICHAEL BAKER, JR., INC.:

E. U. Gingrich
T. J. Dougan
J. R. Rapp

J. R. Rapp Recorder

CONCRETE/MASONRY DAMS

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	For cracks, see "STRUCTURAL CRACKING". Minor spalling of concrete surfaces is present at the concrete section of the dam adjacent to the right abutment and on the concrete buttress at the right end of the spillway.	Additional investigation of the dam is recommended.
STRUCTURAL CRACKING	The concrete buttress (see Plate 3) has a crack 1/16 to 1/8 of an inch wide across the top which may be due to undermining of the buttress by scour followed by differential settlement. This crack continues across the adjacent concrete slab. The buttress appears to be in good condition otherwise.	Additional investigation of the dam is recommended.
VERTICAL AND HORIZONTAL ALIGNMENT	No misalignments of the stone masonry and timber spillway, or adjacent concrete and stone masonry dam section were noted.	
MONOLITH JOINTS	No problems were noted.	
CONSTRUCTION JOINTS	A maximum 3 inch wide separation between the stone wall and concrete slab (Item 10 on Plate 3) was observed. The stone wall appears to have rotated and settled. A 5 inch diameter maple tree grows out of the separation at one end (see Plate 3).	Additional investigation of the dam is recommended.
OTHER	Slope paving appears to have been originally present at the toe of the right abutment downstream retaining wall but only 1.5 to 2.0 feet of this "paving" remains. The rest has apparently washed away (see Plate 3).	Additional investigation of the dam is recommended.

CONCRETE/MASONRY DAMS

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE	No seepage was visible at the left abutment area. Near the right abutment, an estimated leakage of 20 g.p.m. occurs through a broken valve connected to a 14 inch diameter iron or steel pipe in the area of the demolished pump house (see sketch--Plate 3). No other areas of seepage or leakage were observed.	Additional investigation of the dam is recommended.
STRUCTURE TO ABUTMENT/ EMBANKMENT JUNCTIONS	No problems were observed.	
DRAINS	None were observed.	
WATER PASSAGES	Two sluice gate intakes, measuring 48 inches wide by 36 inches high, located at the left abutment are inoperable. A sluice gate, 36 inches square, formed in concrete is also located near the right abutment. Baffle boards were stacked to 26 inches high to elevation 14.25 feet. Some flow was occurring between, but not over, the boards.	Additional investigation of the dam is recommended.
FOUNDATION	The left abutment downstream retaining wall is undermined by up to 44 inches of scour. The stream channel is scoured out to a depth of seven feet at the left end of the spillway. The spillway may be undermined. The buttress at the right end of the spillway is undermined, as well as the remains of the adjacent 7± inch thick concrete apron. The right abutment downstream retaining wall is undermined for a length greater than 15 feet and as far under as 54 inches. This wall could collapse at any time.	Additional investigation of the dam is recommended.

EMBANKMENT

Waldrich Bleachery Dam

NOTE: The embankment now consists of a filled and regraded area approximately 200 feet long and a minimum 100 feet wide which is nearly level and is intended to become a parking lot for a nearby Ramada Inn.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None were observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No movement or cracking at toe along the Third River downstream from the dam was observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The surface at the embankment adjacent to the right abutment (see Plate 3) was observed to be a few inches lower than the top of the adjacent stone wall, probably due to settlement or erosion from overtopping of the dam.	Additional investigation of the dam is recommended.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No problems noted except for low area adjacent to right abutment noted above.	Additional investigation of the dam is recommended.
RIPRAP FAILURES	None were observed.	

EMBANKMENT

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems were noted except for the area of slight settlement or erosion from overtopping adjacent to the right abutment.	Additional investigation of the dam is recommended.
ANY NOTICEABLE SEEPAGE	None was observed, except for the estimated 20 g.p.m. leakage from the broken valve housing in the area at the demolished pump house. If there is any seepage under the spillway it could not be observed.	Additional investigation of the dam is recommended.
STAFF GAGE AND RECORDER	There are none.	
DRAINS	The only drains observed were the two apparently abandoned storm sewers, which are located 30 feet downstream from the spillway, with diameters of 24 inches and 4.5 feet. Both had no flow. The end section of the 4.5 feet sewer has collapsed due to undermining from scour.	
OTHER	Soil exposed near the right abutment consists of light brown medium sand with a little to trace amount of medium size gravel and a trace of silt. Behind the stone wall near the right abutment at the 3.5 inch maple tree (Plate 3), the embankment consists of brown fine sand and silt with traces of charcoal. These soils may be considered as being highly erodible.	

OUTLET WORKS

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The outlet for the sluice gates may be the 30 inch wide by 16 inch opening near the base of the left abutment downstream retaining wall. The interior of this conduit could not be observed during the visual inspection.	Additional investigation of the dam is recommended.
INTAKE STRUCTURE	The sluice gate intake trash racks were partially blocked with debris.	Additional investigation of the dam is recommended.
NOTE:	Two 48 inch wide, 36 inch high sluice gate intakes are located in left abutment. The sluice gates are inoperable.	
OUTLET STRUCTURE	The outlet may be the 30 inch wide by 16 inch high opening formed in concrete near the bottom of the right abutment downstream retaining wall. No problems at this outlet were noted.	
OUTLET CHANNEL	There is none.	
EMERGENCY GATE	There is none.	

UNGATED SPILLWAY

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
STONE MASONRY WEIR WITH TIMBER CREST	A portion of a course of stone blocks 1.5 feet high and 8.66 feet in length was observed to be missing at tailwater elevation 40 feet from the left abutment. The stone above the missing course appeared to be working loose. At 20 feet from the left abutment, additional stone facing was missing at tailwater elevation in an area 1.5 feet high and 2.5 feet long. Evidence of mortar deterioration is present in areas where the stone facing blocks are missing.	Additional investigation of the dam is recommended.
APPROACH CHANNEL	There is none. (NOTE: The reservoir behind the spillway is heavily silted causing additional lateral pressure on this portion of the dam).	Additional investigation of the dam is recommended.
DISCHARGE CHANNEL	The bottom of the discharge channel below the sluice gate with flashboards was observed to be covered with concrete and rubble debris. Part of the discharge channel bottom was lined with a concrete apron which has since been undermined by scour and almost completely washed away (see Plate 3).	Additional investigation of the dam is recommended.
BRIDGE AND PIERS	There are none. However, River Road Bridge, a skewed bridge, with bottom of girders 8.0 feet above streambed, is located 25 to 100 feet downstream from the dam. The bridge has a total length of 104 feet, and the substructure consists of two abutments and one center pier, with the stream channels being 24 feet wide between the pier and each abutment. Evidence was observed indicating that flood flows have occurred over the bridge deck, reportedly due to the Election Day Flood, 8 November 1977.	

GATED SPILLWAY

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not Applicable	
APPROACH CHANNEL	Not Applicable	
DISCHARGE CHANNEL	Not Applicable	
BRIDGE AND PIERS	Not Applicable	
GATES AND OPERATION EQUIPMENT	Not Applicable	

INSTRUMENTATION

Waldrich Bleachery Dam

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	There are none.	
OBSERVATION WELLS	There are none.	
WEIRS	There are none.	
PIEZOMETERS	There are none.	
OTHER	There are none.	

RESERVOIR

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Natural reservoir side slopes are nearly flat to gently sloping. In general, the slopes are covered with brush, grasses, weeds and light forest cover including some large trees. Much of the land surrounding the pond away from the banks is light industrial or commercial. The graded fill west of the right abutment is proposed to become a Ramada Inn parking lot. Minor bank erosion was noted approximately 50 feet south of the left abutment.	
SEDIMENTATION	The reservoir is heavily silted with silt deposits exposed above water level at several locations.	Additional investigation of the dam is recommended.

DOWNSTREAM CHANNEL

Waldrich Bleachery Dam

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel below the dam is the natural stream channel of the Third River. The streambed, and locally the banks, are covered with rock fragments, cobbles and small to medium size boulders. A considerable mound of cobbles and boulders five feet high has been deposited against the downstream portion of the east abutment of River Road Bridge which will restrict flood flows (see Plate 3).	The boulder and cobble obstruction against the abutment should be removed.
SLOPES	The channel downstream from River Road Bridge shows some evidence of bank erosion including the undermining by scour of a six feet high retaining wall which is located about 200 feet downstream. The wall is leaning severely. No slumps or landslides were observed. Most of the slope areas are covered with a vegetative growth consisting of brush, weeds and hardwood trees.	The retaining wall which encroaches on the stream should be removed.
APPROXIMATE NO. OF HOMES AND POPULATION	Several businesses, a few homes and a sewage treatment plant are located downstream along the Third River between the dam and the Passaic River.	
OTHER	The downstream channel gradient at the bridge was measured to be approximately two percent. A small bedrock outcrop was observed in the streambed downstream from River Road Bridge consisting of a medium hard, fine grained reddish brown sandstone, striking roughly N.40°E., about 5° dip toward the east.	

APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Waldrich Bleachery Dam

ITEM	REMARKS
PLAN OF DAM	There are none per say; however, available maps include: 1) Survey blueprint of Yantacaw Pond and surrounding properties labeled "Map Showing Locations and Properties of WORTHEN & ALDRICH CO. and WHITE SPRING PAPER CO. and Vicinity, DELAWANNA, N.J." scale 1 Inch=200 Feet, by Wise and Watson, Engineers, Passaic, New Jersey. The map is not dated. 2) Map of Yantacaw Pond (Waldrich Lower Pond) entitled "Map Prepared for Indian Head Mills, Inc., Clifton Plant, Clifton, N.J., Hydrographic Map of Waldrich Lower Pond". Map shows the configuration of pond and depth soundings taken 7 March 1964 and was prepared by Federick Wm. Engle, Professional Engineer and Land Surveyor, licence no. 3301. 3) Plan of "Advance Piece Dye Works, Inc., Et. Al., Clifton (Delawanna), N.J." Surveyed by R.M. Edman on 27 March 1973. The plan includes dam alignment, some water line locations, [pump house (No. 48) and filtration plant (No. 43)--both now demolished], roads, Third River and part of Yantacaw Pond. 4) Property plat of Yantacaw Pond area north of State Highway S-3 surveyed for Grace A. Anderson Trust #2 by John A. Doolittle & Co., 6 July 1973. Revised 11 July 1973.
REGIONAL VICINITY MAP	A U.S.G.S. 7.5 Minute Topographic Quadrangle, Orange, New Jersey, was used to prepare the vicinity map which is attached as the Location Plan.
CONSTRUCTION HISTORY	Not available, except that the dam was verbally reported to be constructed in 1922.
TYPICAL SECTIONS OF DAM	None are available.
HYDROLOGIC/HYDRAULIC DATA	None are available.
OUTLETS (PLAN, DETAILS, CONSTRAINTS, DISCHARGE RATINGS)	None are available.
RAINFALL/RESERVOIR RECORDS	Rainfall and stream flow records for the gaging station upstream from Yantacaw Pond are available from the U.S.G.S. in Trenton, New Jersey since May 1977.

Waldrich Bleachery Dam

ITEM	REMARKS
DESIGN REPORTS	None are available.
GEOLOGY REPORTS	None are available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None are available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None are available.
POST-CONSTRUCTION SURVEYS OF DAM	Not available, except for a hydrographic survey to determine pond depths made 7 March 1964.
BORROW SOURCES	Information on borrow sources is not available.

Waldrich Bleachery Dam

ITEM	REMARKS
MONITORING SYSTEMS	There are none.
MODIFICATIONS	Modifications to the dam are a recently constructed retaining wall built between the left abutment and the abutment of River Road Bridge and the filling and regrading of the earth embankment area west of the right abutment.
HIGH POOL RECORDS	There are none.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	There are none.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	There were none reported.
MAINTENANCE OPERATION RECORDS	There are none.

Waldrich Bleachery Dam

ITEM	REMARKS
SPILLWAY PLAN	None are available.
SECTIONS	None are available.
DETAILS	None are available.
OPERATING EQUIPMENT PLANS & DETAILS	None are available.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 12.5 square miles of primarily urbanized land.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY AT NORMAL POOL): 14.2 feet (41 acre-feet, based on hydrographic survey of March 1964)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not Applicable

ELEVATION MAXIMUM DESIGN POOL: Not Applicable

ELEVATION TOP DAM: 16.6 feet

CREST:

a. Elevation 13.95 feet
b. Type Wood timbers covering stone masonry
c. Width 60.2 feet
d. Length 6.75 to 7.5 feet
e. Location Spillover Left abutment
f. Number and Type of Gates Two (2) 36 by 48 inch gates not operational, type unknown.

OUTLET WORKS:

a. Type Above mentioned gates and 36 inch square opening with flashboards.
b. Location Gates at left of spillway; square opening at right of spillway.
c. Entrance inverts Gates unknown; square opening--elevation 12.0 feet.
d. Exit inverts Gates
e. Emergency draindown facilities None operable

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE This is not available.

However, the 8 and 9 November 1977 storm that produced a maximum flow of record at the New Milford Gage which is located on the Hackensack River, also produced a discharge of 1950 c.f.s. at the gage which is located on the Third River just upstream of Yantacaw Pond. This flow overtopped the Waldrich Bleachery Dam on 8 November 1977 and caused about 1.5 feet of flooding in the old Bleachery buildings.

NAME OF DAM: WALDRICH BLEACHERY DAM

APPENDIX C

HYDRAULIC/HYDROLOGIC CALCULATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject WALDRICH BLEACHERY DAM S.O. No. _____
APPENDIX - H&H Comp. Sheet No. ____ of ____
Drawing No. _____
Computed by _____ Checked by _____ Date _____

APPENDIX

	Pages
Snyder Method	1
100 YEAR Rainfall	2-3
Spillway Rating	4-5
Elev. vs. Discharge Curve	6
Elev., Discharge, Storage Table	7
Elev. vs. Storage	8
Elev. vs. Storage Curve	9
Storage vs. Discharge Curve	10
ELEV., STORAGE, OUTFLOW USED IN HEC-1	11
HEC-1	12-18

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject WALDRICH BLEACHERY S.O. No.
Snyder Method Sheet No. 1 of 18
Drawing No.
Computed by JRM Checked by RCH Date 8-25-78

From C.O.E., Philadelphia District
$C_t = 2.0$ $640\ C_p = 400$

$L = 65{,}400' = 12.39\ mi$
$L_{CA} = 40{,}800' = 7.73\ mi$

t_l (lag time) $= 2.0 \cdot [(12.39)(7.73)]^{0.3} = 7.86\ hrs \approx 8.0\ hrs$

$t_r = \frac{7.86}{5} = 1.43\ hrs \approx 1.5\ hrs$

$t_p = 8.0 + 1.5/2 = 8.75\ hrs$

$Q_p = 640\ C_p\ A / T_l = 400\ (12.4) / 7.86 = 631$

REF. "INTRODUCTION TO HYDROLOGY", WARREN VIESSMAN JR. ET. AL., INTEXT EDUCATIONAL PUBLISHERS, NEW YORK, 1972 PG. 88-90

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
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Subject N.J. DAM INSPECTION S.O. No. _____
WALDRICH BLEACHERY Sheet No. 2 of 18
DEPTH VS. DURATION COMPS Drawing No. _____
Computed by RCH Checked by _____ Date 8/23/78

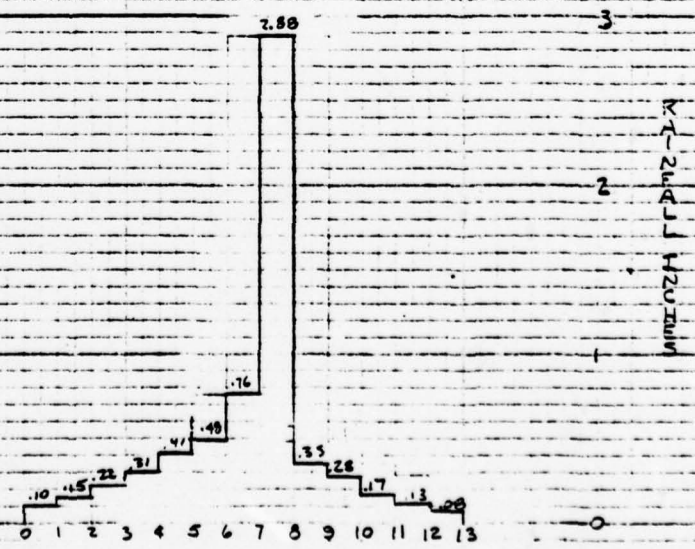
100 YEAR FREQUENCY EVENT

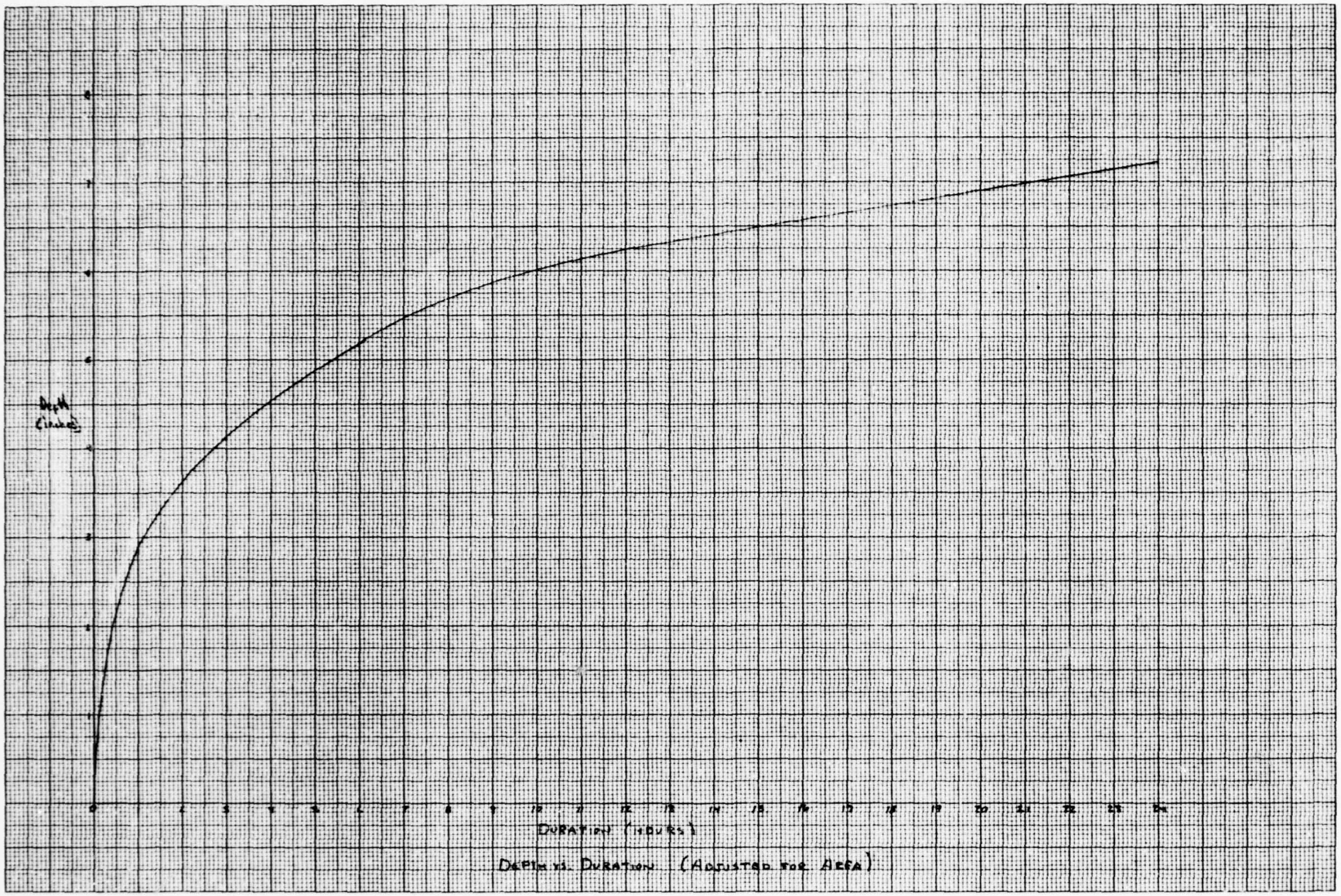
D.A. = 12.4 mi²

T.C = 9.5 HR

DURATION	POINT DEPTH	ADJUSTMENT FACTOR	AVG DEPTH
5 MIN	.88		
10 MIN	1.36		
15 MIN	1.71		
30 MIN	2.38	.895	2.13
1 HR	3.08	.935	2.88
2 HR	3.79	.960	3.64
3 HR	4.25	.970	4.12
6 HR	5.32	.975	5.19
12 HR	6.37	.980	6.24
24 HR	7.35	.982	7.22

DURATION	AVG RAINFALL
1	2.88
2	.76
3	.48
4	.41
5	.35
6	.31
7	.28
8	.22
9	.17
10	.15
11	.13
12	.10
13	.08



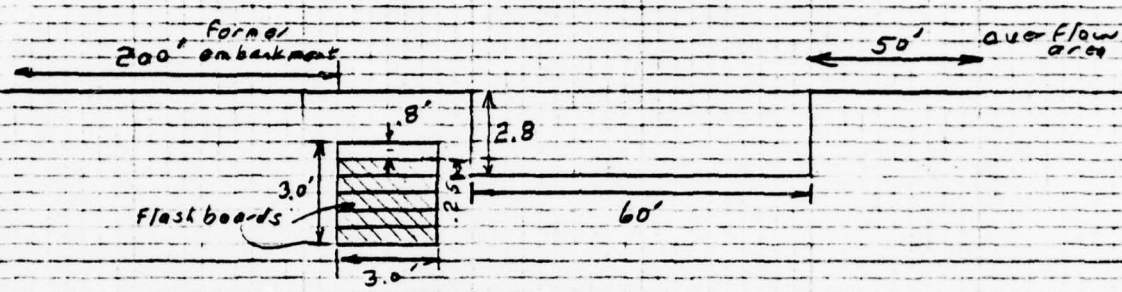


DEPTH VS. DURATION (ADJUSTED FOR AREA)

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject WALDRICH BLEACHERY S.O. No.
SPILLWAY RATING Sheet No. 4 of 18
Drawing No.
Computed by JRM Checked by RCH Date 8-25-78



Broad Crested Weir with inclination $\frac{2.5'}{7.5'} = 0.022$ (used 0.026)
Table 5-5 Handbook of Hydraulics King & Brater 1963

H	$H^{3/2}$	L	C	Q (cfs)
0.5	.354	60	3.07	65
1.0	1.00		3.02	181
1.5	1.84		2.97	328
2.0	2.83		2.92	496
2.2	3.26		2.90	567
2.4	3.72		2.88	643
2.6	4.19		2.86	719
2.8	4.69		2.84	799
3.0	5.20		2.82	880
3.5	6.55		2.80	1100
4.0	8.00		2.80	1344
4.5	9.55		2.80	1604
5.0	11.18		2.80	1878

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Box 280
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Subject: WALDRICH BLEACHERY
SPILLWAY RATING

S.O. No.
Sheet No. 5 of 18
Drawing No.
Computed by: JRM Checked by: RCH Date: 8-25-78

BROAD CRESTED WEIR - for over flow areas
Total length of over flow area = 250'

$Q = CLH^{3/2}$
breadth = 7 ft

"C" coefficients
King's Handbook

H above spillway	H (ft) above top of dam	L	C	Q (CFS)
3.0	0.2	250	2.41	54.
3.5	0.7		2.69	394.
4.0	1.2		2.69	884.
4.5	1.7		2.65	1468.
5.0	2.2		2.65	2162.

ORIFICE FLOW - with Flashboard

$Q_o = CA\sqrt{2gH_o}$

Head above top of spillway H (ft)	H_o (ft)	C	A (ft^2)	Q_o (cfs)
0.5	0.	.62	2.40	0.
1.0	0.35			7.
1.5	0.85			11.
2.0	1.35			14.
2.2	1.55			15.
2.4	1.75			16.
2.6	1.95			17.
2.8	2.15			18.
3.0	2.35			18.
3.5	2.85			20.
4.0	3.35			22.
4.5	3.85			23.
5.0	4.35			25.

Weir flow over orifice has negligible effect.

Weir flow over 3' sect of dam (orifice area)
breadth = 7' Table 5-3
$Q = CLH^{3/2}$ King's Handbook

H over top of dam	C	L (ft)	Q
0.2	2.41	3	1.
0.7	2.69		5.
1.2	2.69		11.
1.7	2.65		18.
2.2	2.65		26.

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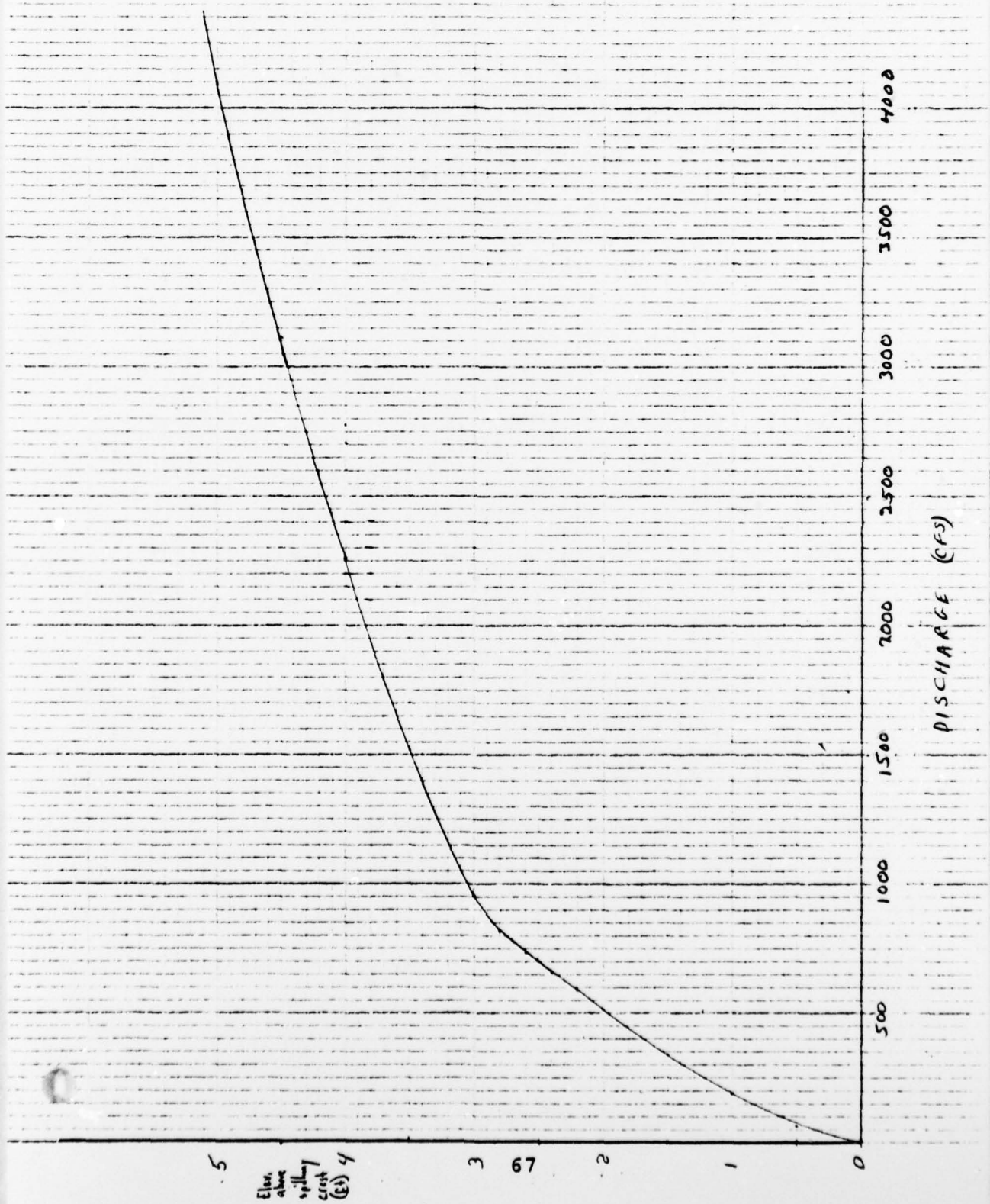
Subject WALDRICH BLEACHERY
RATING CURVE
ABOVE SPILLWAY

S.O. No.
Sheet No. 6 of 18
Drawing No.
Computed by JRM Checked by Date 8-25-78



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Box 280
Beaver, Pa. 15009

Subject: WALDRICH BLEACHERY
TABLE OF SPILLWAY DISCHARGES

S.O. No.
Sheet No. 7 of 18
Drawing No.
Computed by JRM Checked by RCH Date 8-25-78

	ELEV. Ft. above Top of Spillway	DISCHARGE (CFS) Broad-Crested W. with inclin.	ORIFICE FLOW	Weir Flow over orifice area	Broad-C. Weir Overflow	Discharge Total (CFS)	Storage (Ac-Ft)
	0.	0.	0.			0.	0 *.
	0.5	65	0.			65.	4.1
	1.0.	181.	7.			188.	8.3
	1.5	328.	11.			339.	12.3
	2.0	496.	14.			510.	16.4
	2.2	567.	15.			582.	18.0
	2.4	643.	16.			659.	19.6
	2.6	719.	17.			736.	21.3
Top of Dam →	2.8	799.	18.	—	—	817.	23.0
	3.0	880.	18.	1.	54.	953.	24.5
	3.5	1100.	20.	5.	394.	1519.	28.6
	4.0	1344.	22.	11.	884.	2261.	32.7
	4.5	1604.	23.	18.	1468.	3113.	36.7
	5.0	1878.	25.	26.	2161.	4090.	40.7

*Zero Storage started at spillway crest

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Subject WALDRICH BLEACHERY
ELEV. VS. STORAGE

S.O. No.
Sheet No. 8 of 18
Drawing No.
Computed by JRM Checked by Date 8-25-78

Top of Spillway 7.298 Acres = 7.3 acres
Top of Dam 9.12 Acres

	ELEV.	AREA (AC)	Avg. Area (Ac)	Incr. St. (Ac-Ft)	Cum. St. (Ac-Ft)
Top of Spillway	0	7.30			0
			7.43	2.97	
	0.4	7.56			2.97
			7.69	3.08	
	0.8	7.82			6.05
			7.95	3.18	
	1.2	8.08			9.23
			8.21	3.28	
	1.6	8.34			12.51
			8.47	3.39	
	2.0	8.60			15.90
			8.73	3.49	
	2.4	8.86			19.39
			8.99	3.60	
	2.8	9.12			22.99

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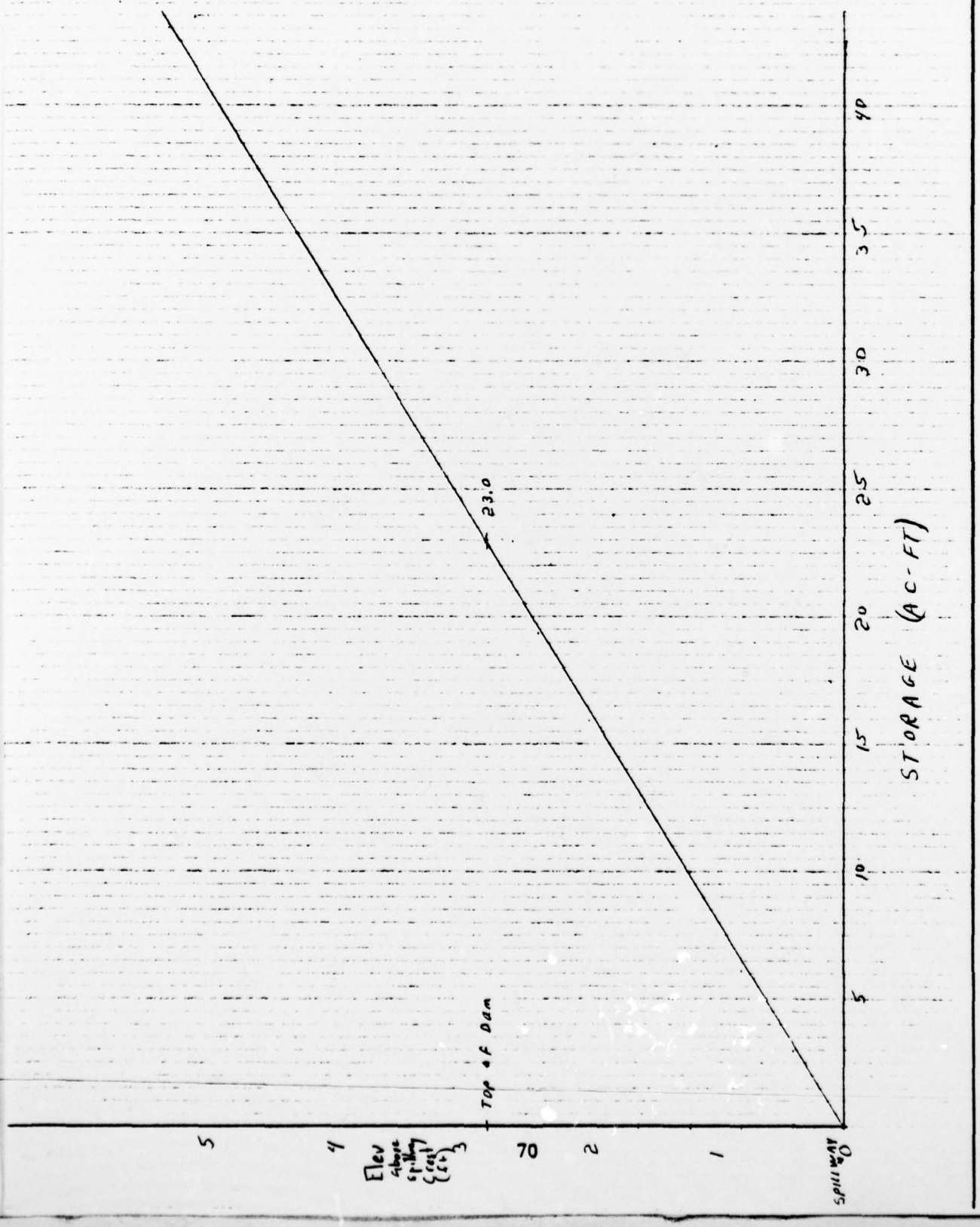
Subject WALDRICH BLEACHERY
ELEV. VS. STORAGE CURVE

S.O. No.
Sheet No. 9 of 18
Drawing No.
Computed by JRM Checked by Date 8-25-78



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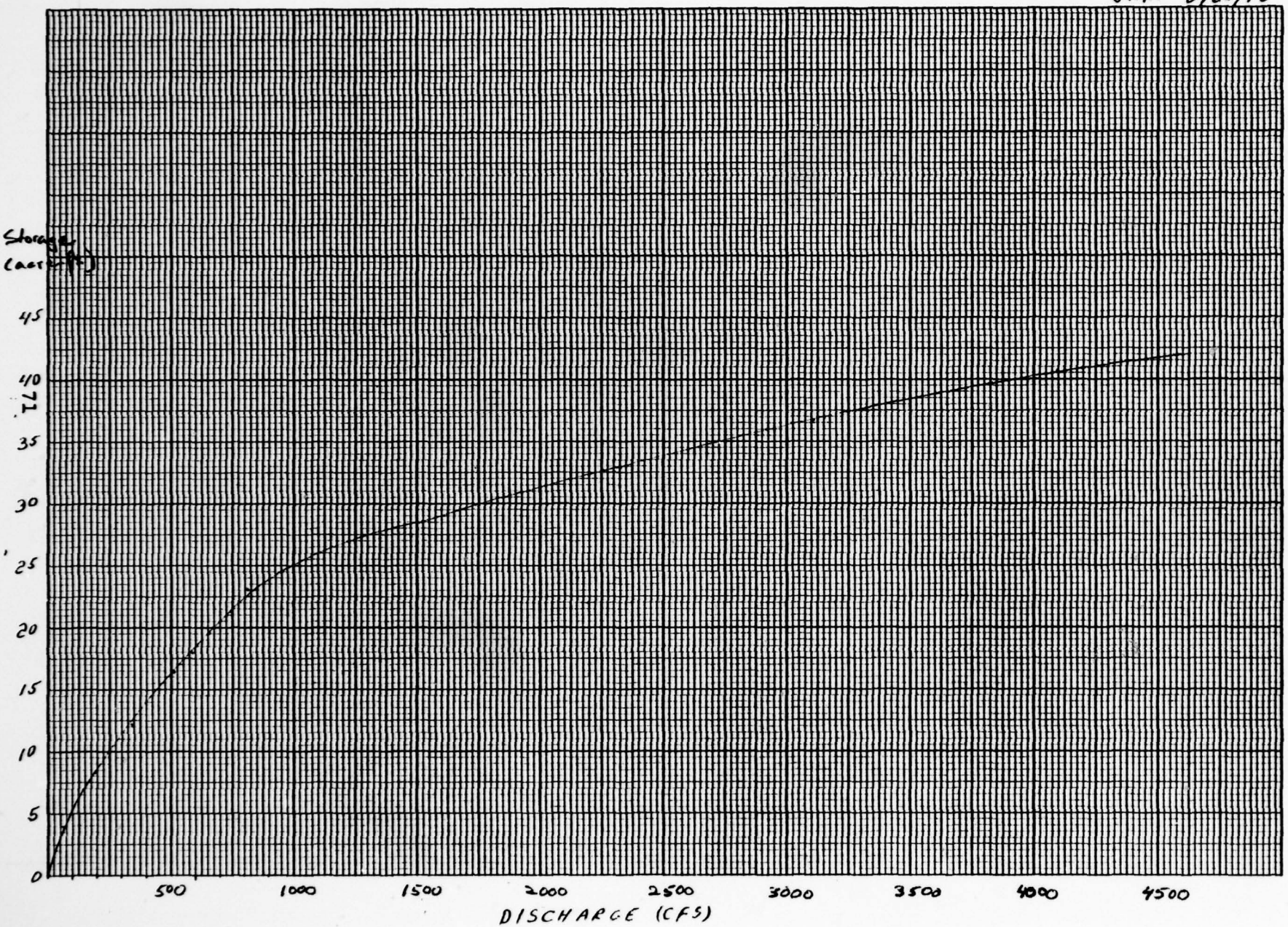
WALDRICH BLEACHERY
JRM 8/25/78



9/01

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject: WALDRICH BLEACHERY S.O. No.
ELEV, DISCHARGE, STORAGE Sheet No. 11 of 18
USED IN HEC-1 Drawing No.
Computed by: JRM Checked by: Date: 8-30-73

	ELEV. ABOVE SPILL. CREST	STORAGE* (AC-FT)	OUTFLOW* (CFS)
	0	0	0
	0.5	4	65
	1.0	8	200
	2.4	20	675
	2.6	21	725
Top of Dam	2.8	23	830
	3.0	25	1000
	4.0	33	2325
	4.5	37	3150
	5.0	41	4225

*VALUES OBTAINED FROM GRAPHICAL PLOT

12/18

```
A                    NEW JERSEY DAM INSPECTIONS
A                     WALDRICH BLEACHERY DAM
A          SNYDER'S HYDROGRAPH METHOD - 100 YEAR FREQUENCY STORM
B    100       1
1      3
K      0       1                         2       1       1
1          THIS IS HYDROGRAPH FOR WALDRICH BLEACHERY WATERSHED
M              1   12.39
O     13
1    .10     .15     .22     .31     .41     .48     .76    2.88     .35     .28
1    .17     .13     .08
T                     0                         0       1     .15
W   8.58    .625
Y                     1
K      1       2                         2       1       1
1          THIS IS ROUTED HYDROGRAPH FOR WALDRICH BLEACHERY WATERSHED
Y                             1
1      1
2      0       4       8      20      21      23      25      33      37      41
3      0      65     200     675     725     830    1000    2325    3150    4225
K     99
A
```

13/18

Final 100 YR

```
****************************
HEC-1 VERSION DATED JAN 1973

****************************
                                   NEW JERSEY DAM INSPECTIONS
                                   WALDRICH BLEACHERY DAM
                         SNYDER'S HYDROGRAPH METHOD - 100 YEAR FREQUENCY STORM

                                        JOB SPECIFICATION
                          NQ   NHR  NMIN  IDAY   IHR  IMIN METRC  IPLT  IPRT NSTAN
                         100     1     0     0     0     0     0     0     0     0
                                              JUPER   NWT
                                                  3     0


          **********          **********          **********          **********          **********

                                     SUB-AREA RUNOFF COMPUTATION

                         THIS IS HYDROGRAPH FOR WALDRICH BLEACHERY WATERSHED

                              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME
                                  1       0       0       0       2       1       1

                                        HYDROGRAPH DATA
                    IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                        0      1   12.39     0.0     0.0     0.0     0.0       0       0       0

                                         PRECIP DATA
                                     NP   STORM     DAJ     DAK
                                     13     0.0     0.0     0.0
                                         PRECIP PATTERN
          0.10    0.15    0.22    0.31    0.41    0.48    0.76    2.88    0.35    0.28
          0.17    0.13    0.08

                                         LOSS DATA
                   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                     0.0     0.0    1.00     0.0     0.0    1.00    1.00    0.15     0.0     0.0

                                     UNIT HYDROGRAPH DATA
                                TP=  8.58    CP=0.63    NTA=  0

                                         RECESSION DATA
                            STRTQ=    0.0     QRCSN=    0.0     RTIOR= 1.00
CLARK DID NOT CONVERGE TO GIVEN SNYDER COEFFICIENTS
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 8.49 AND R= 8.83 INTERVALS

              UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG=   9.14 HOURS, CP= 0.66  VOL= 1.00
          23.     87.    175.    277.    384.    479.    547.    585.    587.    546.
         485.    430.    382.    339.    300.    267.    237.    210.    186.    165.
         147.    130.    116.    103.     91.     81.     72.     64.     56.     50.
          44.     39.     35.     31.     28.     24.     22.     19.     17.     15.
          13.     12.     11.      9.      8.      7.      7.      6.      5.      5.

                                     END-OF-PERIOD FLOW
                                TIME   RAIN   EXCS   COMP Q
                                   1   0.10   0.00       0.
                                   2   0.15   0.00       0.
                                   3   0.22   0.00       0.
```

14/18

4	0.31	0.00	0.
5	0.41	0.12	3.
6	0.48	0.33	18.
7	0.76	0.61	64.
8	2.88	2.73	208.
9	0.35	0.20	486.
10	0.28	0.13	852.
11	0.17	0.02	1260.
12	0.13	0.00	1670.
13	0.08	0.00	2021.
14	0.0	0.0	2260.
15	0.0	0.0	2372.
16	0.0	0.0	2345.
17	0.0	0.0	2178.
18	0.0	0.0	1949.
19	0.0	0.0	1734.
20	0.0	0.0	1539.
21	0.0	0.0	1366.
22	0.0	0.0	1212.
23	0.0	0.0	1076.
24	0.0	0.0	955.
25	0.0	0.0	847.
26	0.0	0.0	752.
27	0.0	0.0	667.
28	0.0	0.0	592.
29	0.0	0.0	525.
30	0.0	0.0	466.
31	0.0	0.0	414.
32	0.0	0.0	367.
33	0.0	0.0	326.
34	0.0	0.0	289.
35	0.0	0.0	256.
36	0.0	0.0	228.
37	0.0	0.0	202.
38	0.0	0.0	179.
39	0.0	0.0	159.
40	0.0	0.0	141.
41	0.0	0.0	125.
42	0.0	0.0	111.
43	0.0	0.0	99.
44	0.0	0.0	87.
45	0.0	0.0	78.
46	0.0	0.0	69.
47	0.0	0.0	61.
48	0.0	0.0	54.
49	0.0	0.0	48.
50	0.0	0.0	43.
51	0.0	0.0	38.
52	0.0	0.0	34.
53	0.0	0.0	30.
54	0.0	0.0	26.
55	0.0	0.0	23.
56	0.0	0.0	19.
57	0.0	0.0	14.
58	0.0	0.0	2.
59	0.0	0.0	1.
60	0.0	0.0	0.
61	0.0	0.0	0.
62	0.0	0.0	0.
63	0.0	0.0	0.
64	0.0	0.0	0.
65	0.0	0.0	0.
66	0.0	0.0	0.
67	0.0	0.0	0.
68	0.0	0.0	0.
69	0.0	0.0	0.

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70	0.0	0.0	0.
71	0.0	0.0	0.
72	0.0	0.0	0.
73	0.0	0.0	0.
74	0.0	0.0	0.
75	0.0	0.0	0.
76	0.0	0.0	0.
77	0.0	0.0	0.
78	0.0	0.0	0.
79	0.0	0.0	0.
80	0.0	0.0	0.
81	0.0	0.0	0.
82	0.0	0.0	0.
83	0.0	0.0	0.
84	0.0	0.0	0.
85	0.0	0.0	0.
86	0.0	0.0	0.
87	0.0	0.0	0.
88	0.0	0.0	0.
89	0.0	0.0	0.
90	0.0	0.0	0.
91	0.0	0.0	0.
92	0.0	0.0	0.
93	0.0	0.0	0.
94	0.0	0.0	0.
95	0.0	0.0	0.
96	0.0	0.0	0.
97	0.0	0.0	0.
98	0.0	0.0	0.
99	0.0	0.0	0.
100	0.0	0.0	0.
SUM	6.32	4.14	32940.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2372.	2187.	1246.	457.	32939.
INCHES		1.64	3.74	4.12	4.12
AC-FT		1085.	2473.	2724.	2724.

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OVN

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

THIS IS ROUTED HYDROGRAPH FOR WALDRICH BLEACHERY WATERSHED

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	1	0	0	2	1	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE=	0.	4.	8.	20.	21.	23.	25.	33.	37.	41.
OUTFLOW=	0.	65.	200.	675.	725.	830.	1000.	2325.	3150.	4225.

TIME	EOP STOR	AVG IN	EOP OUT
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	1.	1.
6	1.	11.	9.
7	2.	41.	35.
8	6.	136.	139.
9	13.	397.	393.
10	21.	669.	741.
11	26.	1056.	1245.
12	29.	1465.	1628.
13	31.	1845.	2007.
14	32.	2141.	2240.
15	33.	2316.	2374.
16	33.	2358.	2346.
17	32.	2261.	2198.
18	31.	2064.	1963.
19	30.	1842.	1751.
20	28.	1637.	1552.
21	27.	1453.	1379.
22	26.	1289.	1222.
23	26.	1144.	1086.
24	25.	1015.	967.
25	23.	901.	864.
26	22.	799.	771.
27	20.	709.	687.
28	18.	629.	615.
29	17.	559.	545.
30	15.	496.	484.
31	14.	440.	429.
32	13.	390.	381.
33	11.	346.	338.
34	11.	307.	300.
35	10.	273.	266.
36	9.	242.	236.
37	8.	215.	210.
38	8.	191.	187.

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40	6.	150.	147.
41	6.	133.	131.
42	6.	118.	116.
43	5.	105.	103.
44	5.	93.	91.
45	4.	83.	81.
46	4.	73.	72.
47	4.	65.	64.
48	4.	58.	59.
49	3.	51.	53.
50	3.	45.	47.
51	3.	40.	42.
52	2.	36.	37.
53	2.	32.	33.
54	2.	28.	29.
55	2.	25.	26.
56	1.	21.	22.
57	1.	17.	18.
58	1.	8.	10.
59	0.	1.	3.
60	0.	0.	1.
61	0.	0.	0.
62	0.	0.	0.
63	0.	0.	0.
64	0.	0.	0.
65	0.	0.	0.
66	0.	0.	0.
67	0.	0.	0.
68	0.	0.	0.
69	0.	0.	0.
70	0.	0.	0.
71	0.	0.	0.
72	0.	0.	0.
73	0.	0.	0.
74	0.	0.	0.
75	0.	0.	0.
76	0.	0.	0.
77	0.	0.	0.
78	0.	0.	0.
79	0.	0.	0.
80	0.	0.	0.
81	0.	0.	0.
82	0.	0.	0.
83	0.	0.	0.
84	0.	0.	0.
85	0.	0.	0.
86	0.	0.	0.
87	0.	0.	0.
88	0.	0.	0.
89	0.	0.	0.
90	0.	0.	0.
91	0.	0.	0.
92	0.	0.	0.
93	0.	0.	0.
94	0.	0.	0.
95	0.	0.	0.
96	0.	0.	0.
97	0.	0.	0.
98	0.	0.	0.
99	0.	0.	0.
100	0.	0.	0.
SUM			32939.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2374.	2188.	1245.	457.	32939.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	2372.	2187.	1246.	457.	12.39
ROUTED TO	2	2374.	2188.	1245.	457.	12.39

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This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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