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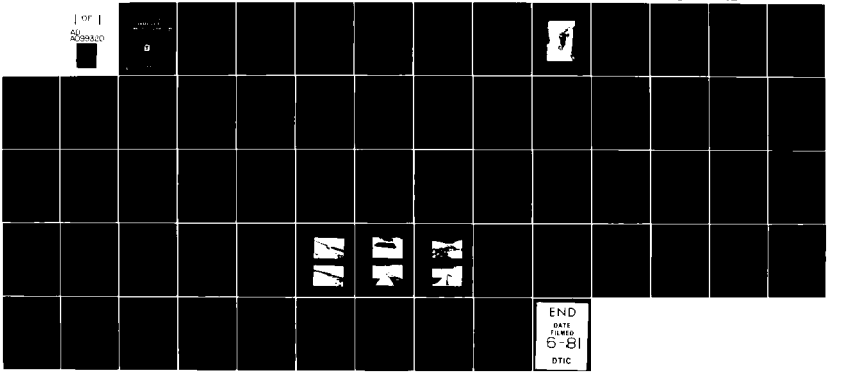

DELAWARE RIVER BASIN,
SWAN CREEK, HUNTERDON COUNTY
NEW JERSEY

LEVEL

LAMBERTVILLE WATER CO. DAM (NJ 00775)

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

DACW61-79-C-0011

Final rept.

DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

Rept. No. DAEN/NAP-53842/NJ00775-81/03

MARCH 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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National Dam Safety Program
Lambertville Water Co. Dam, N.J.
Spillways

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

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

IN REPLY REFER TO
NAPEN-N

15 MAY 1981

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

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lambertville Water Company Dam in Hunterdon 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 in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Lambertville Water Company 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 fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 17 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure 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 within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, the following remedial measures should be initiated:

(1) The makeshift flashboards at the principal spillway should be replaced with permanently affixed and easily operable stop log components.

(2) The vegetation at the principal spillway entrance and the slab, toe, and sides of the principal spillway should be removed.

(3) The eroded area at the toe of the auxiliary spillway slab should be filled with stone.

NAPEN-N
Honorable Brendan T. Byrne

(4) Deteriorated and cracked concrete should be repaired or replaced where necessary. These areas include the cap wall, portions of the auxiliary spillway notch, and those portions of the spillway slab that are cracked or missing.

(5) The seepage at the toe of the spillway slab should be monitored for increases in fine material content, volume, or velocity of the flow and corrective action should be taken if necessary.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan and downstream warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

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 Courter of the Thirteenth District. Under the provision 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 Inspection 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,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

LAMBERTVILLE WATER COMPANY (NJ00775)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 27 August 1980 by Louis Berger and Associates, Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Lambertville Water Company 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 fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to 17 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure 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 within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, the following remedial measures should be initiated:

(1) The makeshift flashboards at the principal spillway should be replaced with permanently affixed and easily operable stop log components.

(2) The vegetation at the principal spillway entrance and the slab, toe, and sides of the principal spillway should be removed.

(3) The eroded area at the toe of the auxiliary spillway slab should be filled with stone.

(4) Deteriorated and cracked concrete should be repaired or replaced where necessary. These areas include the cap wall, portions of the auxiliary spillway notch, and those portions of the spillway slab that are cracked or missing.

(5) The seepage at the toe of the spillway slab should be monitored for increases in fine material content, volume, or velocity of the flow and corrective action should be taken if necessary.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan and downstream warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 14 May 81

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam Lambertville Water Co. Dam Fed ID# NJ 00775
NJ ID # 55

State Located	New Jersey
County Located	Hunterdon
Coordinates	Lat. 4021.7 - Long. 7455.5
Stream	Swan Creek
Date of Inspection	27 August 1980

ASSESSMENT OF GENERAL CONDITIONS

Lambertville Water Co. Dam is assessed to be in a fair overall condition. It is recommended that the hazard classification be changed to significant since a failure would damage a smaller downstream dam owned by the same company. Although the spillways can only accommodate 16% of the design flood, overtopping is not considered a serious problem since the entire dam functions as an overflow weir. However, additional H&H studies should be performed and the feasibility of increasing the normal spillway capacity determined. Remedial actions to be undertaken in the near future include 1) replacement of the temporary flashboards, 2) repair and/or replacement of all deteriorated concrete and eroded surfaces, 3) removal of vegetation from the areas of both spillways, and 4) the placement of additional stone at the toe of the auxiliary spillway slab. In addition, the seepage at the toe of the auxiliary spillway slab should be monitored at regular intervals. It is further recommended that the owner develop an emergency action plan and a downstream warning system.

Abraham Perera P.E.
Project Manager

OVERVIEW OF LAMBERTVILLE WATER CO. DAM

AUGUST, 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines can be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I investigations is to identify expeditiously those dams that may pose hazards to human life or property. The assessment of the general condition of the dam is based on available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In the review of this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway test flood is based on the estimated "probable maximum flood" for the region (greatest reasonable possible storm runoff) or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: Lambertville Water Co. Dam Fed ID# NJ 00775

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Engineer District, Philadelphia, to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Lambertville Water Co. Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION

a. Description of Dam and Appurtenances

Lambertville Water Co. Dam (Middle Reservoir) is a low-lying 770-foot-long earth and stone structure built in 1877. The 12-foot-wide dam crest is paved with asphalt and is utilized as an access road by the water company. The two-zone dam has a 3H:1V sloped, riprapped embankment on the upstream side and 1H:1V sloped stone fill on the downstream half. The zones are separated by a cutoff consisting of two layers of 2-inch-thick timber sheeting. Over the years the stone backslope has been extended and brought up to crest elevation for a distance of 80 to 90 feet from the centerline. A 12-inch-thick concrete wall extends along the upstream edge of the dam crest.

This wall is 2 feet higher than the road and has a 7-inch-deep by 127-foot-long notch located near the center of the dam. The notch functions as an auxiliary overflow weir that discharges across the dam and down a concrete spillway slab. At the left end of the dam, three weirs with a combined clear opening of 12 feet 2 inches by 2 feet 8 inches discharge through the crest wall to a 12 foot by 5 foot 4 inch concrete culvert beneath the crest road. Makeshift flash boards cover the weir openings at present. A wood foot rail extends along the downstream edge of the dam crest at the auxiliary overflow weir. A 16-inch-diameter water main extends from the floor of the reservoir to the downstream water plant.

b. Location

Lambertville Water Co. Dam (Middle Reservoir) is located on Swan Creek about 3,000 feet upstream from the Lambertville boundary line in Hunterdon County, New Jersey. The damsite is approximately 500 feet northwest of County Route 518.

c. Size Classification

The maximum height of the dam is 16.5 feet at the top of the crest wall and the maximum storage is estimated to be 157 acre-feet. Therefore, the dam is placed in the small size category as defined by the Recommended Guidelines for Safety Inspection of Dams (storage less than 1,000 acre-feet and height less than 25 feet).

d. Hazard Classification

The Lambertville Water Co. Lower Reservoir is located about 1,000 feet downstream from the Middle Reservoir Dam. The channel between the two reservoirs and for an additional mile downstream is densely wooded and uninhabited, with moderately steep confining side slopes. While a dam failure at Middle Reservoir may cause significant damage to the Lower Reservoir Dam, it is believed that only minor damage would be experienced in the town of Lambertville about one mile downstream. In order to verify the hazard

classification, a breach analysis was performed assuming a 15-foot-wide break developing within one hour. A maximum flood stage of about 3.6 feet was developed in the steeper reaches of the channel and a maximum flood stage of 4.7 feet above stream bottom was developed in the downstream area of Lambertville. Accordingly, it is recommended that the classification of this dam be downgraded to the significant hazard category.

e. Ownership

This dam is owned by the Lambertville Water Co., Lambertville, New Jersey.

f. Purpose of Dam

The dam impounds a reservoir for water supply.

g. Design and Construction History

The dam was originally constructed around 1877. As constructed it was about 600 feet long, 13 feet high, and had a maximum width of 12 and 60 feet at the crest and base, respectively. In 1912, a 16-inch-diameter blow off pipe and valve was built into the dam. In 1924, the concrete wall and spillway slab were added with the wall extending up onto the abutment areas. At some later date the weir notches and culvert were added at the left abutment of the dam.

h. Normal Operating Procedures

Procedures in effect at the dam consist of those consonant with water supply operations. Flows are varied in accordance with water demands, and during periods of peak inflow, the flashboards at the secondary notch weirs are removed to provide additional discharge capacity. Maintenance is performed at the facility as necessary to provide a consistent uninterrupted supply of water to the downstream users.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area is 1.38 square miles.

b. Discharge at Dam Site

The spillway capacity with the reservoir at the dam crest elevation is calculated to be 201 cfs.

c. Elevation (above M.S.L.)

Top of Dam - 282.1
Normal Pool - 279
Streambed at Centerline of Dam - 265.5

d. Reservoir

Length of Normal Pool - 2,600 feet
Length of Maximum Pool - 3,200 feet

e. Storage

Normal Pool - 98 acre-feet.
Top of Dam - 168 acre-feet.

f. Reservoir Surface

Top of Dam - 26.5 acres
Normal Pool - 18.4 acres

g. Dam

Type - Earth embankment with stone fill and concrete spillway

Length - 770 feet

Height - 16.5 feet

Cutoff - 2 layers of 2 inch-thick timber sheeting to unknown depth.

Top width - 12 feet

Side slopes - 3H:1V upstream; 1H:1V downstream modified and variable

Zoning - Two zone; clayey earth upstream half, stone fill downstream half

h. Diversion and Regulating Tunnel

None

i. Spillway

Principal - Flashboard-controlled weir located near left abutment at crest elevation 279.0. Hydraulic control is 12 foot by 5 foot 4-inch culvert under the road on the crest of the dam.

Auxiliary - 127-foot-long notch weir and spillway slab located near the center of the dam. Crest elevation about 281.5.

j. Regulating Outlets

A 16-inch diameter water main outlet is located on the right side of the auxiliary spillway at approximate invert elevation 261 NGVD.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

There is no detailed information available concerning the design of this dam. A schematic sketch of a typical section through the dam was prepared in August 1912, at which time application was made to install the 16-inch transmission line. The sketch depicts the zoning, cutoff, and approximate dimensions at the dam prior to the 1924 modifications. The latter construction was described in a report on the modification application prepared by the State Water Supply Commission.

2.2 CONSTRUCTION

There is little detailed information available with respect to the dam's original construction or later modifications. However, the inspection indicates the 1924 modifications were built to the approximate dimensions related in the repair application.

2.3 OPERATION

No formal details of operations at the dam were available for review by the inspection team. However, communication with the Lambertville Water Co. produced sufficient information to formulate a clear understanding of procedures employed at the damsite.

2.4 EVALUATION

a. Availability

No hydrologic, hydraulic, or structural design criteria were available for review by the inspection team. Limited information pertaining to the dam's composition and dimensions was available in the microfilm obtained from the N.J.D.E.P.. General information pertaining to the foundation material was obtained from the New Jersey State Geologic Map and the Rutgers Engineering Soil Survey. The latter indicates that the soil cover at the site of the dam and reservoir consists of recent alluvium, deposited by Swan Creek, overlying a thin mantle of residual soil consisting of silt and silty clays. The latter material is derived from the underlying diabase bedrock, which

thin mantle of residual soil consisting of silt and silty clays. The latter material is derived from the underlying diabase bedrock, which was formed in conjunction with the palisades sill. The hard igneous bedrock usually exhibits extensive joint and fracture systems in the upper layers.

b. Adequacy

While little detailed design or construction data were available for review, the descriptions and sketch combined with the field inspection provided sufficient information to perform an evaluation of the hydraulic capacity and stability of the dam as well as a general assessment within the purview of P.L. 92-367.

c. Validity

The available descriptions of the dam were generally confirmed by observations and measurements made in the field. The principal variations observed were the existence of an auxiliary outlet, for which no data were available, and the widening of the dam to a point that obviates the need for stability analysis. See Section 6 for additional comment on the structural stability regarding the width/height ratio.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of Lambertville Water Co. Dam took place on August 27, 1980 with engineering personnel of the water company present to assist the inspection team and answer questions pertaining to the dam. The dam was found to be in a generally fair overall condition although concrete deterioration and excessive growth on the downstream embankment were noted, as detailed below.

b. The horizontal alignment appears quite uniform and satisfactory. However, the dam crest has been widened from 12 feet, as originally constructed, to as much as 90 feet by the addition of earth on the downstream slopes. The crest pavement is in good condition as is the upstream embankment where the original riprap has been covered with a layer of silt and now supports a thick grass cover in many areas. The downstream embankment has extensive areas of very heavy brush and tree growth. The concrete wall on the upstream edge of the dam crest is in fair condition, although areas with excessive surface cracking, scaling, and general deterioration were noted. A failed section of concrete is located in the center of the auxiliary spillway wall where an 8-inch-deep by 2-foot-wide hole has been repaired temporarily with plywood and a 2-inch by 4-inch board nailed to the crest of the wall. Cracking and displacement of a six-inch cap section of the concrete wall was observed at an offset in the wall alignment about 200 feet from the left abutment.

c. Appurtenant Structures

As indicated in Paragraph b above, the crest wall at the auxiliary spillway notch exhibits some serious concrete deterioration. At this location on the dam, the crest width is 12 feet as originally designed because the downstream side of the dam is covered with a 2H:1V sloped, concrete spillway slab. The spillway slab, which overlies stone fill, is cracked and exhibits signs of surface deterioration. Brush is growing through the cracks and some undercutting has

occurred at the toe of the slab where the underlying stone is now exposed. The water level at the toe of the slab was 16.5 feet below crest elevation and is apparently caused by seepage, although it is not possible to determine whether the seepage is coming through the dam or the fractured upper levels of the bedrock. Review of the materials in the dam suggests that the latter area is the most probable source of the seepage because the upstream embankment consists of relatively impermeable silty clay, and the cutoff sheeting, in all probability, penetrated to bedrock, which is found at shallow depths in this area. The water at the toe was about 2 feet deep and clear but did not appear to be moving at the time of the inspection. The principal spillway at the left abutment appeared in good condition although some brush is growing at the weir entrance and the temporary flashboard could be improved to facilitate its operation. The 16-inch-diameter transmission line was not observed, although its gate valve at the dam was just recently operated and is in good functioning condition.

d. Reservoir Area

The reservoir lies in an undeveloped area of West Amwell, which is heavily wooded and surrounded by moderately sloping hills. At the time of the inspection, the water level was about 4 feet below normal and huge stones and boulders were observed along the exposed shore line. The reservoir reportedly has a maximum depth of about 18 feet at the intake to the transmission line, although sedimentation, while not observed near the dam, has probably reduced the usable lake capacity.

e. Downstream Channel

The channel downstream of the dam is heavily wooded and confined by moderately steep, uninhabited side slopes. Another dam and reservoir, owned by the same company, is located about 1,000 feet downstream. Downstream of the lower reservoir, the channel narrows with steeper and more confining side slopes until entering a developed area in the town of Lambertville about a mile downstream of the subject area.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were not observed by the inspection team, although representatives of the Lambertville Water Co. were available for advice during the inspection. Personnel of the water company are on duty all day, seven days a week. Operations at the damsite consist of those procedures consonant with water supply activities, including regulation of the flashboard and 16-inch-diameter gate valve, periodic inspections, patrol of the dam and reservoir, and occasional debris removal.

4.2 MAINTENANCE OF DAM

The dam and reservoir are maintained by personnel of the water company on an "as-needed" basis. While primary objects of concern at the dam are those facilities necessary to assure safe and uninterrupted water supply operations, grounds keeping and general preventive maintenance are performed within the constraining limitations of personnel availability and funding allocations.

4.3 MAINTENANCE OF OPERATING FACILITIES

As indicated above, operating components of the dam are maintained by water company personnel. The flashboards, while unsophisticated, are easily operated, as is the valve to the 16-inch-diameter transmission line. Maintenance of these facilities is performed on an as-needed basis.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

No formal warning system exists at this dam, although it is monitored daily by water company personnel who regulate outflow during peak inflow periods. Although informal, they rely on in-house methods of alerting civil defense and local authorities in Lambertville of impending problems.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

The present operational procedures, although performed in a satisfactory manner, are somewhat limited in scope. The inspection team noted a need for additional grounds keeping and preventive maintenance in the form of brush removal on the downstream slope and concrete patching on several surfaces.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the criteria in the Recommended Guidelines for Safety Inspection of Dams, Lambertville Water Co. Dam is small in size and is placed in the significant hazard category. Accordingly, a 100-year frequency event was selected as the design storm and an inflow hydrograph was calculated using precipitation data from Technical Paper 40 and NOAA Technical Memorandum NWS Hydro-35. Inflow to the reservoir was calculated utilizing the HEC-1 computer program, discharging a peak into the reservoir of 1,292 cfs. Routing this through the reservoir reduced the value slightly to 1,276 cfs. The spillway capacity before overtopping of the dam crest is 201 cfs and is, therefore, able to accommodate only 16% of the design flood.

b. Experience Data

Division of Water Resources records state that the dam was overtopped by about 6 inches on August 28, 1971. Only minor erosion and some undercutting at the foot of the auxiliary spillway slab resulted from the overtopping. There are no reports of any downstream damage resulting from the overtopping.

c. Visual Observations

It does not appear that overtopping is a matter of serious concern because of the asphalt pavement along the crest.

d. Overtopping Potential

The appended hydraulic analysis indicates a potential exists for overtopping due primarily to the limited spillway capacity. The design flood would overtop the dam crest by approximately 6 inches.

e. Drawdown Potential

Utilizing the blowoff pipe located at the treatment plant, it would take approximately twenty-one days to dewater the lake.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Based upon the field inspection and descriptions of the original construction, the Lambertville Water Co. Dam is adjudged to be in good structural condition, although seepage was noted at the toe of the auxiliary spillway. As described in Section 3, the seepage is believed to be emanating from the fractured bedrock or the soil/rock interface rather than through the dam. In any event, the seepage is thought to be of minor concern because there is little indication of fine material movement and the additional embankment material placed on and behind the downstream slope has significantly increased the stability of the rest of the dam structure.

b. Design and Construction Data

While the original design calculations or stability analysis were not available, a sketch of a typical dam section and correspondence describing subsequent modifications provided dam dimensions and descriptions that were confirmed by field observations. The maximum structural height at the center of the dam was 13 feet while the crest and base width were 12 and 60-feet, respectively, indicating a conservative structural design. The bedrock is believed to lie at shallow depths and, although possessing significant fracture permeability in its upper layers, is a very strong and durable foundation material.

c. Operating Records

No records or logs are maintained at this reservoir for operations other than water consumption, water elevations, and other data associated with normal water supply operations.

d. Post Construction Changes

Several modifications have been made at this dam since its original construction. Structurally, the installation of the 16-inch-diameter transmission line and the principal spillway weir and culvert is of little significance. Although raising the dam 2 feet by construction of the crest wall increased the hydrostatic pressure against the face of the dam, the increased load was more than offset by the widening of the dam crest, which, with the exception of the spillway section, is now 70 to 90 feet wide.

e. Seismic Stability

This dam is located in Seismic Zone 1 in which seismic activity is slight, imparting little additional dynamic loads on structures. Experience indicates that earthen dams that are stable under static loads will remain stable when subjected to the slight dynamic loads imposed by seismic action in Zone 1. As indicated in the foregoing paragraphs, this dam is considered structually stable under the existing static loading conditions.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Lambertville Water Co. Dam (Middle Reservoir), which has stood for 103 years, appears in sound structural condition although in need of some superficial remedial work, as indicated in the ensuing paragraphs. Although the dam's spillway capacity can only accommodate a small percentage (16%) of the SDF, the only recorded overtopping occurred on August 28, 1971 at which time 6 inches of water passed over the dam crest. Only minor erosion resulted from this storm event, nor is more serious damage to be anticipated from an SDF because the entire length of the dam crest is paved with asphalt and the crest is now so wide that flows across the crest are no more erosive than normal overland flow. The entire length of the dam functions as a weir due to the concrete crest wall.

b. Adequacy of Information

Although the amount of engineering data available to evaluate the design criteria was limited, the construction descriptions and field observations provided sufficient information on which to base the Phase I assessment.

c. Urgency

The remedial measure delineated hereafter should be undertaken in the near future as part of the regular maintenance program of the Lambertville Water Co.

d. Necessity for Further Studies

Because the dam's spillway capacity can accommodate only a small percentage of the SDF, it is recommended that the additional H&H studies be undertaken. The studies should include an evaluation of methods to increase the drawdown capacity and may be performed by the owner since the Lambertville Water Co. has experienced engineering personnel in-house.

7.2 Recommendations/Remedial Measures

a. Recommendations

Although the spillways can only accommodate 16% of the SDF, the entire dam functions as an overflow weir and overtopping only causes minor erosion damage at the dam. However, some remedial action is required in the area of the spillways and crest wall, as described below.

1. The makeshift flashboards at the principal spillway should be replaced with permanently affixed and easily operable stop log components.

2. The vegetation at the principal spillway entrance and the slab, toe, and sides of the principal spillway should be removed.

3. The eroded area at the toe of the auxiliary spillway slab should be filled with stone.

4. Deteriorated and cracked concrete should be repaired or replaced where necessary. These areas include the cap wall, portions of the auxiliary spillway notch, and those portions of the spillway slab that are cracked or missing.

5. The seepage at the toe of the spillway slab should be monitored for increases in fine material content, volume, or velocity of flow and corrective action should be taken if necessary.

b. O&M Maintenance and Procedures

Although present procedures are being pursued in a competent, workmanlike manner within the limitations of personnel and funding availability, it is suggested that the owner's personnel employed at the reservoir receive additional training in the safety inspection of dams. It is further recommended that the owner promulgate written

Operating procedures and periodic maintenance to ensure the continued safety of the dam. In addition, the owner should develop an emergency action plan and a downstream warning system to minimize the flood hazard potential in that area.

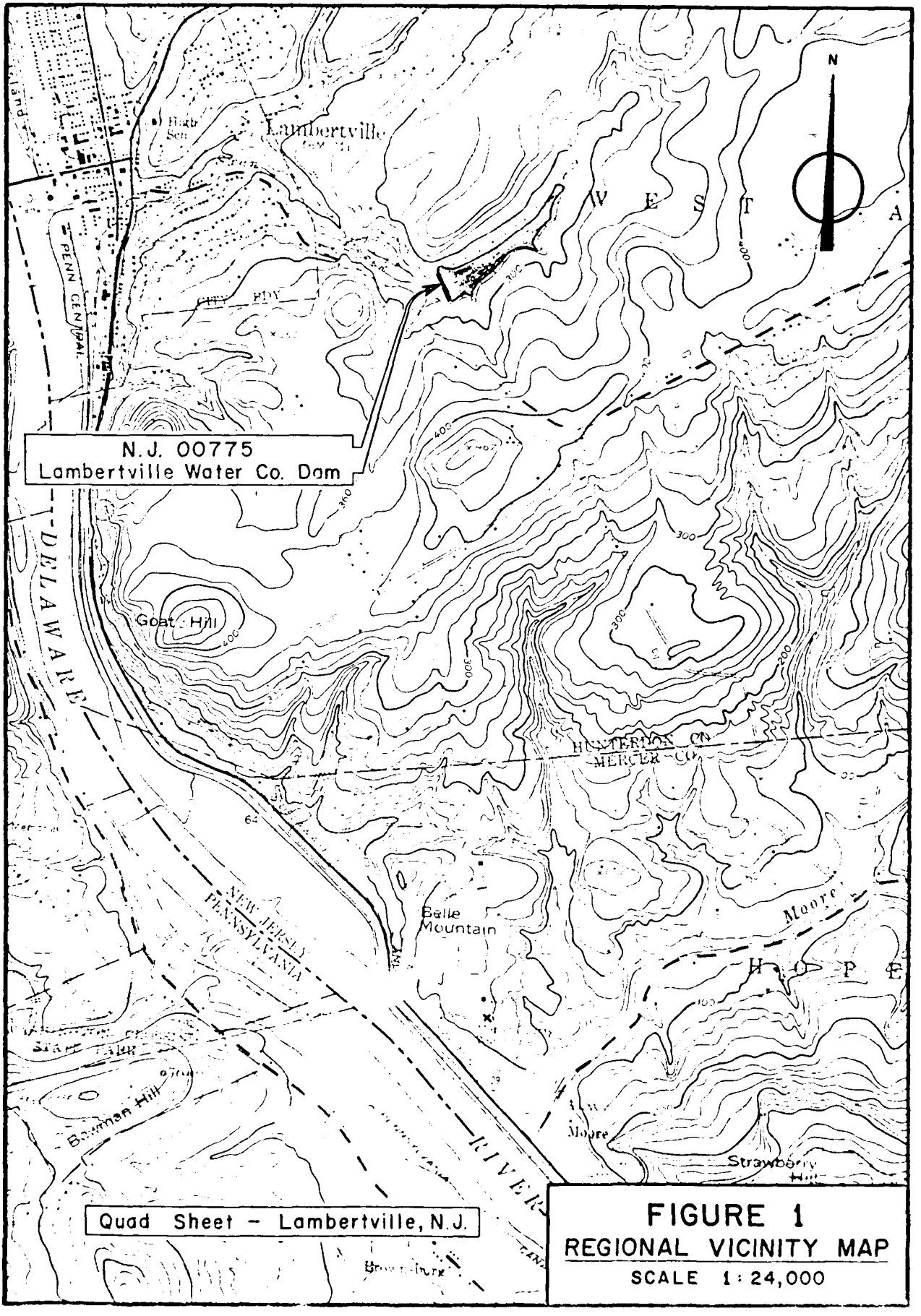
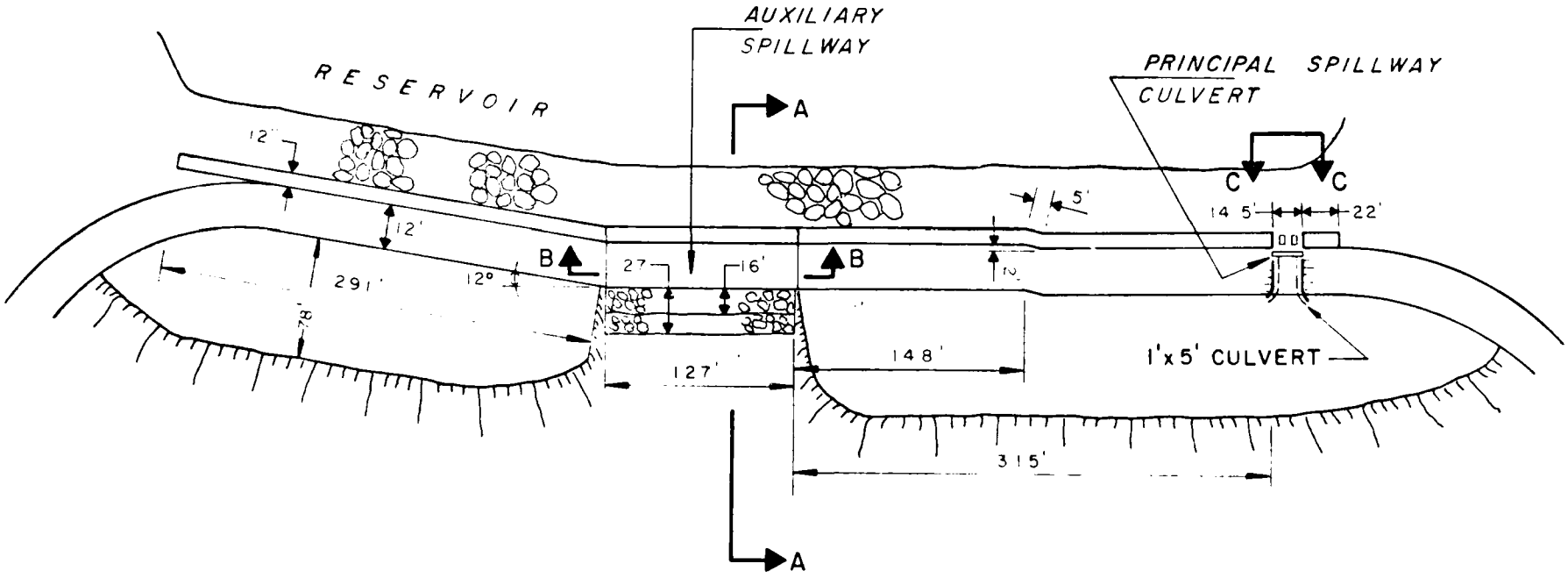


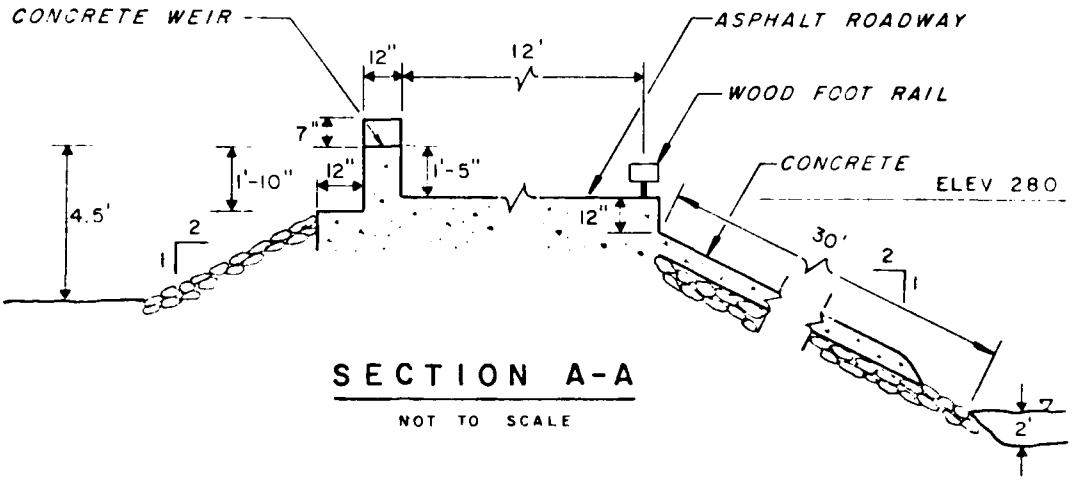
FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24,000



PLAN OF DAM

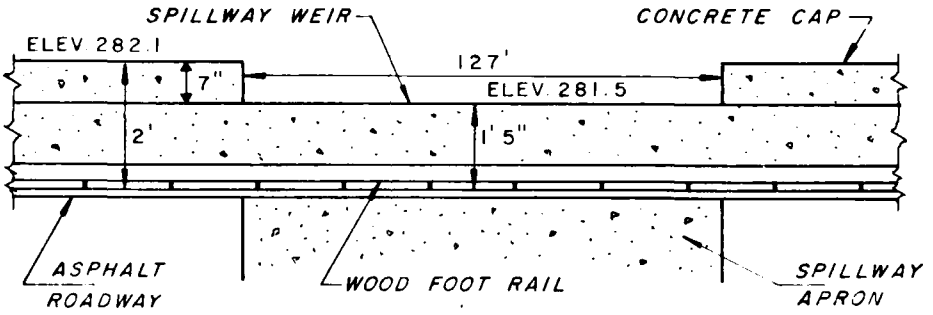
NOT TO SCALE

FIGURE 2



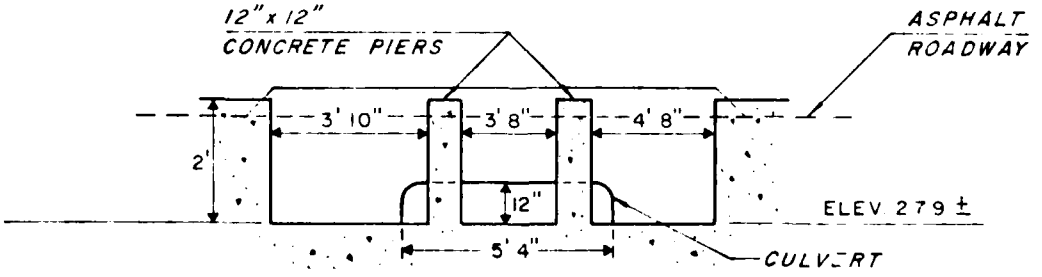
SECTION A-A

NOT TO SCALE



SECTION B-B

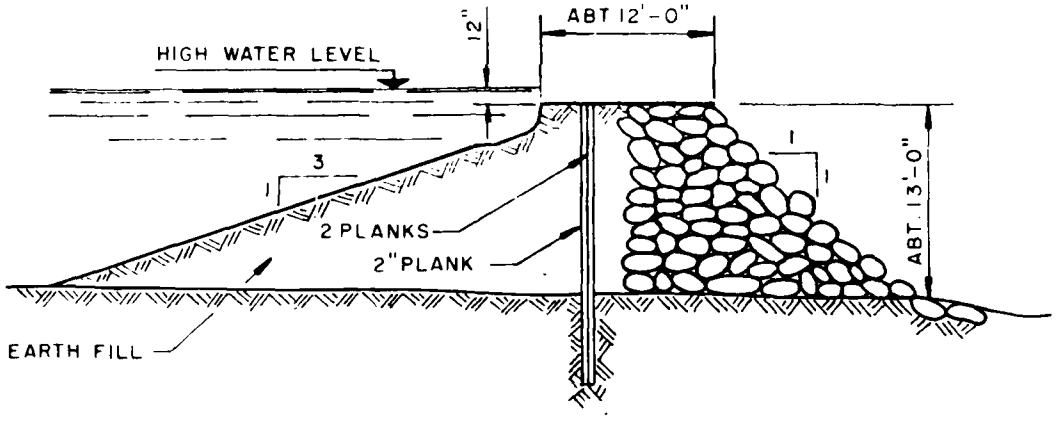
NOT TO SCALE



SECTION C-C

NOT TO SCALE

FIGURE 3



TYPICAL SECTION THROUGH DAM

NOT TO SCALE

FROM: LAMBERTVILLE WATER CO. Sketch dated August, 1912

FIGURE 4

Check List
Visual Inspection
Phase I

Name Dam Lambertville Water Co. Dam County Hunterdon State New Jersey Coordinators N.J.D.E.P.

Date(s) Inspection 8/27/80 Weather Sunny Temperature 95°F

Pool Elevation at Time of Inspection 278 M.S.L. Tailwater at Time of Inspection 266± M.S.L.

Inspection Personnel:

A. Perera T. Chapter

J. Greenstein W. Shirtz (L.W.C.)

R. Lang

T. Chapter Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Observed	Dam crest paved with asphalt. 2-foot high concrete crest wall. Localized concrete deterioration, cracking, and spalling on wall.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	Crest width widened from 12 feet to as much as 90 feet. Downstream embankment now contiguous with surrounding terrain.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Slight erosion of embankment next to spillway slab.	Should be filled and area stablized with stone or vegetation.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Alignment good. Crest wall has offset which appears to have been designed.	Reason for offset unknown.
RIPRAP FAILURES	None Observed	Riprap on upstream face silted in with good grass cover growing on it.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Brush at entrance to auxiliary spillway and growing through cracks in principal spillway slab.	Excessive vegetation should all be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good	Embankment grades smoothly into abutment. No cracking or separation at spillway/embankment junction.
ANY NOTICEABLE SEEPAGE	Seepage at toe of spillway slab. Water depth in channel is about 2 feet.	May be ground water from bedrock or drainage through stone fill of dam's downstream embankment. Should be monitored and corrected if necessary.
STAFF GAGE AND RECORDER	None	None
DRAINS	None	Entire low stream side of dam is large stone and may function as toe drain.

OUTLET WORKS

[illegible] INSPECTION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
[illegible] AND SPALLING OF [illegible] SURFACES IN OUTLET CONDUIT	Not Observed	36-inch-diameter transmission line extends to water plant downstream.
INTAKE STRUCTURE	Not observed	Below lake surface elevation
OUTLET STRUCTURE	Not observed	Located in downstream plant
OUTLET CHANNEL	None	
[illegible] GATE	[illegible]	[illegible] blow off located at [illegible] downstream.

CREST SPILLWAY

	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
[illegible] WEIR	Failure section 8 inch x 2 feet, spalling and cracking noted along weir notch. Hole covered by plywood.	All deteriorated concrete sections should be repaired. Hole should be closed with reinforced concrete.
APPROACH CHANNEL	Not Applicable	
[illegible] CHANNEL	Discharge flows across paved road and down a concrete slab. Slab is cracked with additional deterioration in evidence. Portions of slab missing at toe and stone fill exposed.	Missing portions of slab should be replaced. Cracks should be sealed. Slab should be resurfaced.
[illegible] AND PIERS	None	

GATE SPILLWAY

	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
[illegible] STEEL	4 weir [illegible]es in good condition. Control is at adjoining bridge culvert.	This section appears new.
APPROACH CHANNEL	Brush growing in front of weirs.	Should be removed.
DISCHARGE CHANNEL	Discharges directly under dam crest roadway. Opening clear.	
BRIDGE AND PIERS	1 foot x 5 foot concrete culvert under crest roadway is in good condition.	Controls flow over auxiliary spillway weirs.
GATES AND OPERATING EQUIPMENT	Temporary plywood flashboard	Should be replaced with permanently [illegible] structure.

INSTRUMENTATION

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

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Heavily wooded, moderate slopes surrounding reservoir. Undeveloped area.	Water level down about 4 feet. Large boulders scattered along flat shoreline.
SEDIMENTATION	Silt covering upstream riprap. Exposed area of reservoir bottom appeared quite muddy.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Heavily wooded channel continues directly to lower reservoir about 1000 feet downstream.	
SLOPES	Moderately steep confining side slopes wooded and uninhabited.	
APPROXIMATE NO. OF HOMES AND POPULATION	None until Lambertville about one mile downstream.	Sufficient attenuation to minimize flood damage.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not Available
REGIONAL VICINITY MAP	Available - U.S.G.S. Quadrangle - Lambertville, New Jersey
CONSTRUCTION HISTORY	Not Available
TYPICAL SECTIONS OF DAM	One sketch available - microfilm N.J.D.E.P., Prospect St., Trenton, N.J.
HYDROLOGIC/HYDRAULIC DATA	Not Available
OUTLETS - PLAN	Not Available
- DETAILS	Not Available
- CONSTRAINTS	Not Available
- DISCHARGE RATINGS	Not Available
RAINFALL/RESERVOIR RECORDS	Not Available

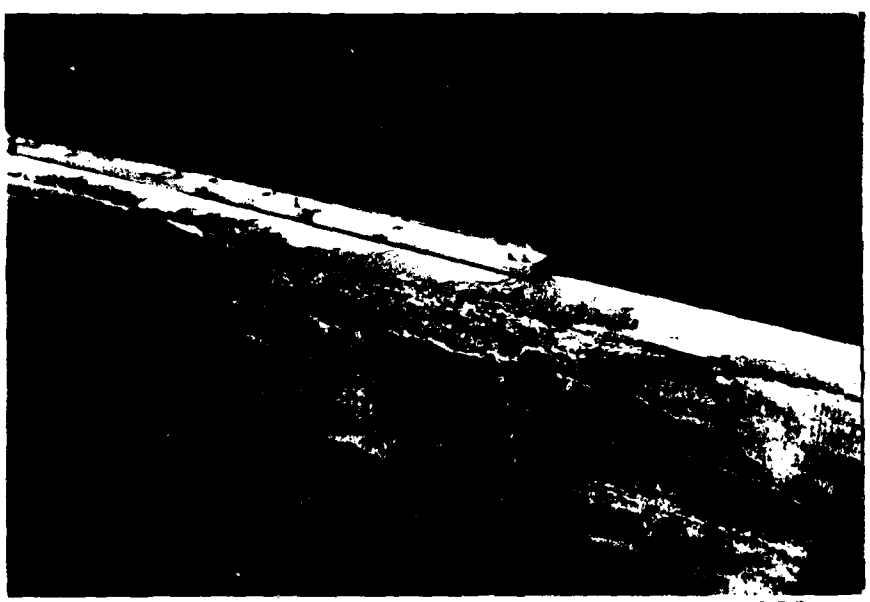
ITEM	REMARKS
SPILLWAY PLAN	Not Available
SECTIONS	Not Available
DETAILS	Not Available
OPERATING EQUIPMENT PLANS & DETAILS	Not Available Not Available

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Available - State Geologic Map, Engineering Soil Survey of New Jersey, Rutgers University, New Brunswick, New Jersey
DESIGN COMPUTATIONS	Not Available
HYDROLOGY & HYDRAULICS	Not Available
DAM STABILITY	Not Available
SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS	Not Available
BORING RECORDS	Not Available
LABORATORY	Not Available
FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	Patrolled by employees
MODIFICATIONS	Available - N.J.D.E.P. microfilm
HIGH POOL RECORDS	No formal records available - hearsay overtopping water levels available from owner's representative.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None Recorded
MAINTENANCE	Informal descriptions available from owner's representative
OPERATION	Informal descriptions available from owner's representative
RECORDS	Not Available

August, 1980

Failure Section in Concrete Wall



August, 1980

Deterioration of Concrete Wall

August, 1980

Culvert at Left Abutment

August, 1980

Spillway Notch

August, 1980

Reservoir

August, 1980

View of Crest Looking South

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.38 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 279 MSL (98 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 282.1 MSL(157 acre-feet)

CREST: Principal spillway/auxiliary spillway weirs

a. Elevation 281.5 MSL / 279 ± MSL
b. Type Narrow crested notched weir
c. Width 12 inch - wide crest wall
d. Length 129-foot-long weir/combined length-12 feet, 2 inches
e. Location Spillover 315 feet. from left abutment/left abutment
f. Number and Type of Gates None/flashboard

OUTLET WORKS:

a. Type 16 inch diameter RCP transmission line
b. Location Right side of principal spillway
c. Entrance inverts Unknown
d. Exit inverts Unknown
e. Emergency draindown facilities 6-inch - diameter blow off

HYDROMETEOROLOGICAL GAGES: NONE

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 201 cfs

BY SCS METHOD (FROM "URBAN HYDROLOGY FOR SMALL WATERSHEDS" TECHNICAL RELEASE NO 55)

ASSUME C_N FOR WATERSHED = 75
SLOPE = 15%
L = 7750'

S = 1000/CN − 10 = 3.33

= .186 HOURS

... = 3.10 HOURS

LAG = ... = 1.74

LOUIS BERGER & ASSOCIATES INC

LOUIS BERGER & ASSOCIATES INC.

BY [illegible] DATE [illegible]
CHKD BY DATE
SUBJECT [illegible]

LOUIS BERGER & ASSOCIATES INC.

[illegible]

SHEET NO. [illegible] OF
PROJECT [illegible]

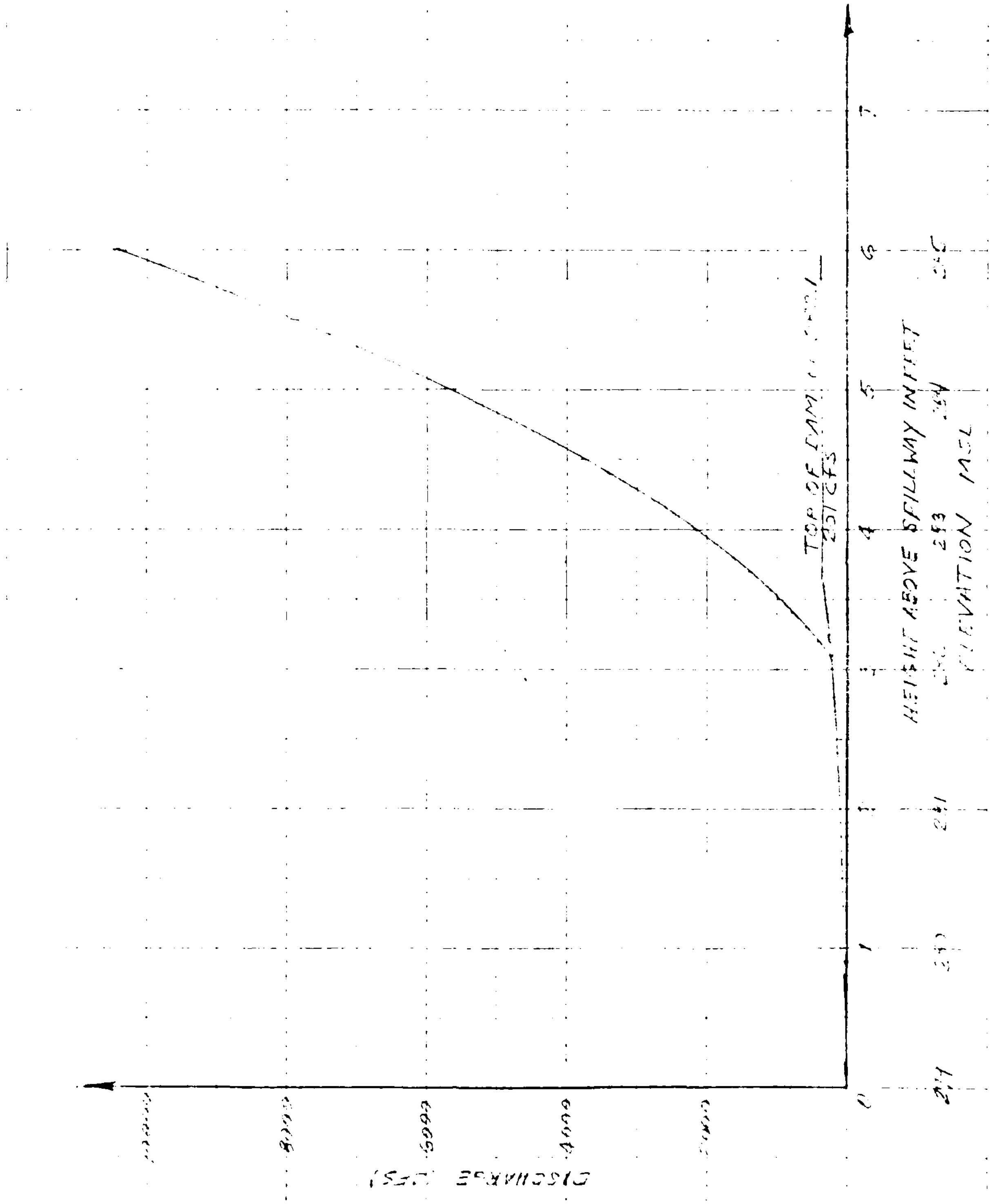
[illegible]

[illegible]

[illegible]

	NATIONAL		PRIMARY CHANNEL			DAM		
	[illegible]		[illegible]			[illegible]		
ELEVATION	H	Q	H	h (FT)	Q	H	Q	
[illegible]	—	—	[illegible]		0	—	—	0
[illegible]	—	—		.5	[illegible]	—	—	[illegible]
2615	0	0	2.5	2.0	31	—	—	31
2621	.6	165	3.1	2.6	36	0	0	201
263	1.5	653	4.0	3.5	42	.9	1314	2059
264	2.5	1406	5.0	4.5	47	1.9	4276	5729
265	3.5	2326	6.0	5.5	52	2.9	9164	10444
266	4.5	3395	7.0	6.5	57	3.9	12576	16026
267	5.5	4567	[illegible]	7.5	61	4.9	17710	
[illegible]	[illegible]	[illegible]	[illegible]	8.5	65	5	[illegible]	

LAMBERTVILLE WATER CO. DAM
SPILLWAY DISCHARGE
CURVE



BY [illegible] DATE [illegible]

CHKD. BY [illegible] DATE [illegible]

SUBJECT [illegible]

LOUIS BERGER & ASSOCIATES INC.

[illegible]

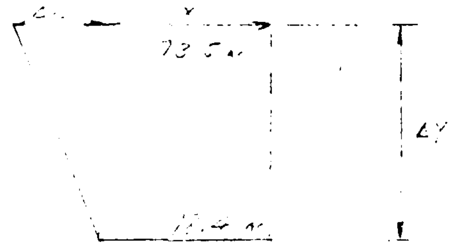
[illegible] STORAGE [illegible]

SHEET NO. A6 OF [illegible]

PROJECT [illegible]

Area of Lake @ Elev 279.0 = 18.4 ac
Area at 300 contour = 73.5 ac

EL. 300

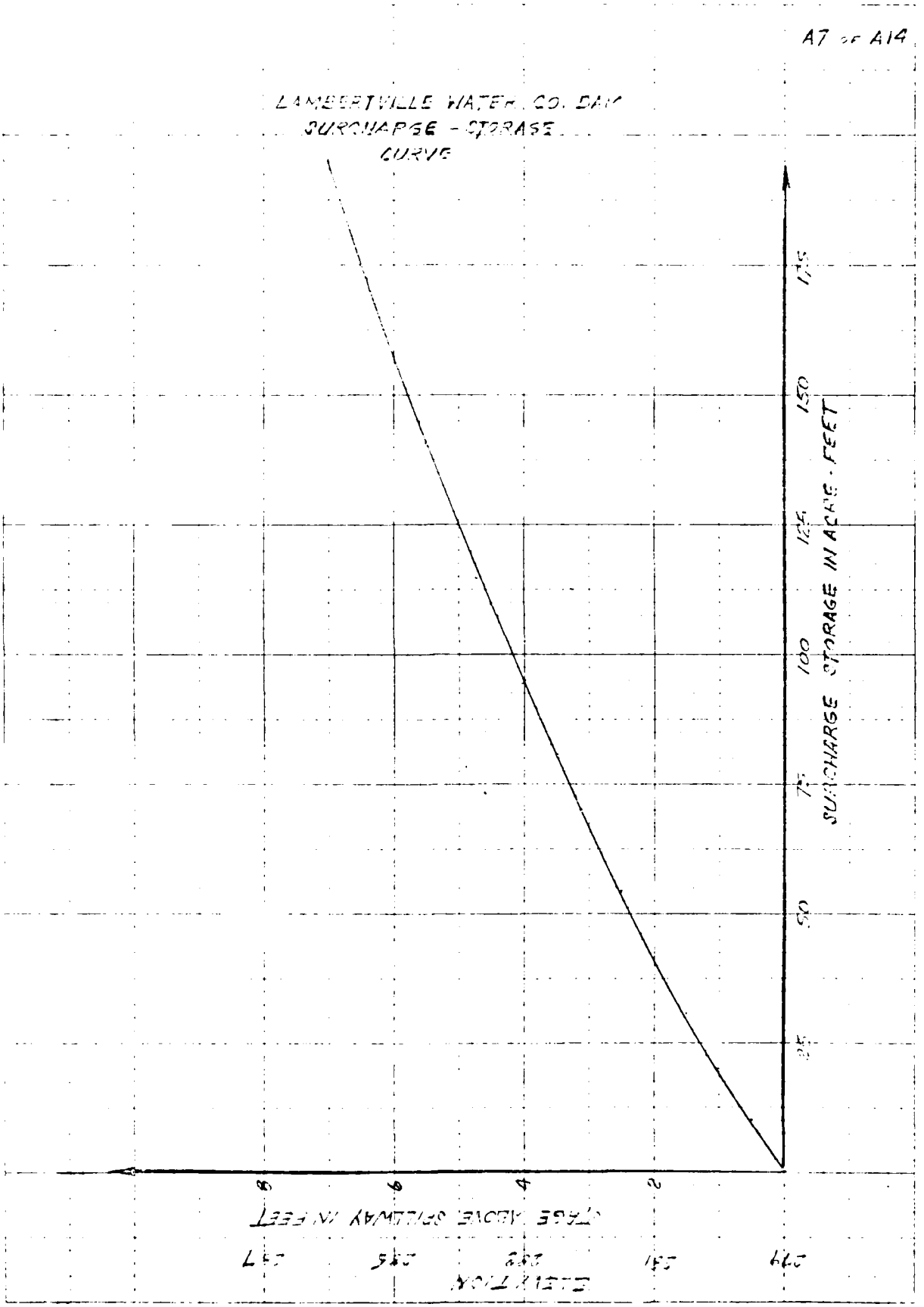


EL. 279.0

[illegible]

EL.	HEIGHT ABOVE SPILLWAY CREST FT	AREA (ACRES)	DISCHARGE STORAGE (ACRE-FT.)
279	0	18.4	0
280	1	21.0	20
281.5	2.5	25.0	54
282.1	3.1	26.5	70
283	4.0	28.[illegible]	95
[illegible]	[illegible]	[illegible]	125
[illegible]	[illegible]	[illegible]	15[illegible]
[illegible]	[illegible]	[illegible]	193

LAMBERTVILLE WATER CO. DAM
SURCHARGE - STORAGE
CURVE



BY [illegible] DATE [illegible]

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 45 OF [illegible]

CHKD. BY ______ DATE ______

[illegible]

PROJECT [illegible]

SUBJECT [illegible] CAPACITY

[illegible] OF POSSIBLE [illegible] 6" [illegible] AND [illegible] DAILY [illegible] OF 25?,000 gal [illegible] VOLUME 6" PIPE APPROX 600' [illegible]

ASSUME [illegible] OVER 24 HOURS

$$[illegible] \frac{GALS}{DAY} \times \frac{1\ DAY}{24\ HRS} \times \frac{1\ HR}{3600\ SEC} \times \frac{0.1337\ FT^3}{1\ GAL}$$

$$= 0.3?\ CFS$$

DISCHARGE CAPACITY OF 6" PIPE

$Q = CA\sqrt{2gh}$ $\qquad C = 0.58$

$A = 0.20\ FT^2$

ASSUME AVG HEAD $= 18/2 = 9'$

$Q_{AVG.} = 0.58 \cdot 0.20\sqrt{64.4 \times 9}$

$\cong 3\ CFS$

ASSUME INFLOW OF 1 CFS

$\therefore Q_{[illegible]} = 3.39 - 1 = 2.39\ CFS$

TOTAL [illegible] $= 31.8 \times 10^6$ GALS.

$= 4{,}251{,}053\ FT^3$

$$TIME = \frac{4{,}251{,}053\ FT^3}{2.39\ FT^3/SEC \times 3600\ SEC/HR}$$

$= 494$ HOURS ≅ 21 DAYS

BY _____ DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO A9 OF A14

CHKD. BY _____ DATE _____ PROJECT _____

SUBJECT _____

ELEV.	HEIGHT ABOVE SPILLWAY CREST (FT)	SURFACE AREA (ACRES)	STORAGE (AC-FT)	DISCHARGE
277	0	16.4	0	0	
280	1	21.0	20	16	
281.5	2.5	23.5	54	31	
282.1	3.1	26.5	70	231	TOP OF DAM
283	4.0	28.7	95	2069	
284	5.0	31.5	125	5729	
285	6.0	34.1	155	10464	
286	7.0	36.5	193	16.25	

DRAINAGE AREA = 1.30 SQ. MI

BY DATE

CHKD. BY DATE

SUBJECT

LOUIS BERGER & ASSOCIATES INC.

SHEET NO OF

PROJECT

BY JLC DATE 4/ / **LOUIS BERGER & ASSOCIATES INC.** SHEET NO A11 OF A17

CHKD. BY ____ DATE ____ PROJECT C262

SUBJECT ____

[illegible]
0 [illegible] RAINFALL
APRIL 9 1981

JOB SPECIFICATION

NW	NMIN	IDAY	IHR	MIN	METRC	IPLT	IPRT	NSTAN
100	0	10	0	0	0	0	0	0

ITAPE	JOPER	KRD	IKOPT	TRACE
	0	0	0	0

[illegible] TYPE 10 RESERVOIR

ISTAO	ICOMP	ICON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IRUNG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	1	1.50	0.000	1.30	0.00	0.000	0	0	0

PRECIP PATTERN

0.05	0.05	0.07	0.06	0.07	0.08	0.09	0.11	0.14	0
0.20	0.20	1.20	0.40	0.30	0.16	0.11	0.07	0.09	
0.07	[illegible]	[illegible]	[illegible]						

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

SUB-AREA RUNOFF COMPUTATION

PRECIP DATA

IPR	STORM	DAD	DAR
21	0.00	0.00	0.00

TSK= 0.00 LAG= 1.74

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH ST END OF PERIOD ORDINATES. TC= 0.00 HRS. LAG= 1.74 VOL= 1.00

19	83	112	150	276	333.	319	255	351	[illegible]
252	197	154	123	99.	81	65	52	42	4
27	[illegible]	17	14	11	9	7	6	5	4
3	3	2	2	1	1	0			

END-OF-PERIOD FLOW

MO DA	HR MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO. DA	HR MN	PERIOD	RAIN	EXCS	LOSS	DPH
1 01	0 15	1	[illegible]	0.00	06	0	1 01	12 45	51	0.00	0.00	[illegible]	
1 01	0 30	2	[illegible]	0.00	05	0	1 01	13 00	52	0.00	0.00	[illegible]	
1 01	0 45	3	0.00	0.00	0.05	0.	1 01	13 15	53	0.00	0.00	[illegible]	
1 01	1 00	4	[illegible]	0.00	06	0	1 01	13 30	54	0.00	0.00	[illegible]	
1 1	1 15	5	[illegible]	0.00	07	0	1 01	13 45	55	0.00	0.00	[illegible]	
1 1	1 30	6	0.00	0.00	0.08	0.	1 01	14 00	56	0.00	0.00	[illegible]	
1 01	1 45	7	[illegible]	0.00	[illegible]	0.	1 01	14 15	57	0.00	0.00	[illegible]	
1 01	2 00	8	0.11	0.07	0.04	1	1 01	14 30	58	0.00	0.00	0.00	
1 01	2 15	9	0.14	0.11	0.03	6.	1 01	14.45	59	0.00	0.00	0.00	
1 01	2 30	10	0.30	0.27	0.03	20	1 01	15 00	60	0.00	0.00	[illegible]	
1 01	2 45	11	[illegible]	0.27	0.03	37	1 01	15 15	61	0.00	0.00	[illegible]	
1 01	3 00	12	0.20	0.17	0.03	101.	1 01	15 30	62	0.00	0.00	0.00	
1 01	3 15	13	1.20	1.17	0.03	310	1 01	15 45	63	0.00	0.00	0.00	
1 01	3 30	14	0.40	0.37	0.03	571	1 01	16 00	64	0.00	0.00	0.00	
1 01	3 45	15	0.30	0.27	0.03	878.	1.01	16 15	65	0.00	0.00	0.00	
1 01	4 00	16	0.16	0.13	0.03	1093	1 01	16 30	66	0.00	0.00	0.00	
1 01	4 15	17	0.11	0.08	0.03	1254	1 01	16 45	67	0.00	0.00	0.00	
1 01	4 30	18	0.07	0.05	0.03	1316.	1.01	17 00	68	0.00	0.00	0.00	
1 01	4 45	19	0.07	0.05	0.03	1321	1 01	17 15	69	0.00	0.00	0.00	
1 01	5 00	20	0.07	0.04	0.02	1292.	1.01	17 30	70	0.00	0.00	0.00	
1 01	5 15	21	0.07	0.04	0.02	1226.	1.01	17.45	71	0.00	0.00	0.00	
1 01	5 30	22	0.06	0.03	0.02	1130	1 01	18 00	72	0.00	0.00	0.00	
1 01	5 45	23	0.06	0.04	0.02	985	1 01	18 15	73	0.00	0.00	0.00	
1 01	6 00	24	0.06	0.04	0.02	819	1 01	18 30	74	0.00	0.00	0.00	

[illegible] PAGE IS BEST QUALITY [illegible]
FROM COPY FURNISHED TO DDC

BY ... DATE ...
CHKD. BY ... DATE ...
SUBJECT ...

LOUIS BERGER & ASSOCIATES INC.

LAMBERTVILLE DAM
HEC-1 OUTPUT

SHEET NO 112 OF 111
PROJECT 6262

BY J.C. DATE 4/?/81 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO A12 OF A19

CHKD. BY ____ DATE ____ Lambertville Dam PROJECT 5202

SUBJECT ____ HEC-1 DB Output

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
279.0	0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
[illegible]	0.0	0.0	0

END OF PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	0.15	1	0.25	0	0	0	279.0
1.01	[illegible]	[illegible]	0.50	0	0	0	279.0
1.01	[illegible]	[illegible]	0.75	[illegible]	0	0	279.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	1.50	0	0	[illegible]	[illegible]
1	[illegible]	[illegible]	1.75	0	0	0	[illegible]
1	[illegible]	[illegible]	2.00	1	0	[illegible]	[illegible]
1	[illegible]	[illegible]	2.25	2	0	[illegible]	[illegible]
1	[illegible]	10	2.50	25	[illegible]	0	[illegible]
1.01	2.45	11	2.75	47	1	1	279.1
1.01	3.00	12	3.00	101	2	3	279.1
1.01	3.15	13	3.25	210	[illegible]	[illegible]	279.3
[illegible]	[illegible]	[illegible]	3.50	[illegible]	10	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	3.75	[illegible]	17	[illegible]	[illegible]
1	4	[illegible]	4.00	[illegible]	[illegible]	[illegible]	[illegible]
1.01	[illegible]	[illegible]	4.25	[illegible]	[illegible]	[illegible]	281.5
1.01	[illegible]	[illegible]	4.50	1216	[illegible]	[illegible]	[illegible]
1.01	[illegible]	[illegible]	4.75	1271	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	5.00	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	21	5.25	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	5.50	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	5.75	965	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	6.00	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	6.25	[illegible]	754	[illegible]	[illegible]
1	[illegible]	[illegible]	6.50	569	[illegible]	[illegible]	[illegible]
1.01	[illegible]	[illegible]	6.75	497.	555.	74.	282.3
1.01	7.00	[illegible]	7.00	420	470	73	282.2
1.01	7.15	[illegible]	7.25	351	395	72	282.2
1	[illegible]	[illegible]	7.50	290	[illegible]	[illegible]	[illegible]
1	7.45	[illegible]	7.75	[illegible]	[illegible]	[illegible]	[illegible]
1.01	8.00	[illegible]	8.00	[illegible]	223	[illegible]	[illegible]
1	8.15	[illegible]	8.25	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	8.50	127	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	8.75	101	[illegible]	67	[illegible]
1.01	[illegible]	[illegible]	9.00	81.	156.	[illegible]	[illegible]
1.01	[illegible]	[illegible]	9.25	66	137	[illegible]	[illegible]
1.01	[illegible]	[illegible]	9.50	[illegible]	123	[illegible]	[illegible]
1.01	[illegible]	[illegible]	9.75	43	107.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	10.00	34	93	[illegible]	281.7
1	10.[illegible]	41	10.25	28	80	[illegible]	281.7
1.01	10.30	[illegible]	10.50	22	69	[illegible]	281.6
1	10.45	43	10.75	18	59	[illegible]	281.6
1	[illegible]	44	11.00	15	50	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	11.25	12	42	[illegible]	[illegible]
1	11	[illegible]	[illegible]	9	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	11.75	6	31	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	4	31	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	3	31	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30	[illegible]	[illegible]
1	[illegible]	[illegible]	12.75	1	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	13.00	1	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	13.25	1	30	[illegible]	[illegible]
1.01	13.[illegible]	[illegible]	[illegible]	0	29	[illegible]	281.3
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	14.00	[illegible]	[illegible]	[illegible]	281.3
1	[illegible]	57	[illegible]	0	[illegible]	[illegible]	281.3
1	[illegible]	[illegible]	14.50	[illegible]	[illegible]	[illegible]	281.2
1	[illegible]	[illegible]	14.75	0	[illegible]	47	281.2
1.01	[illegible]	[illegible]	15.00	0	[illegible]	47	281.2
1	[illegible]	[illegible]	15.25	0	[illegible]	[illegible]	[illegible]
1	15	[illegible]	15.50	0	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	15.75	[illegible]	27	[illegible]	281.1
1	[illegible]	[illegible]	16.00	0	27	44	[illegible]
1.01	[illegible]	[illegible]	16.25	0	27	44	[illegible]
1.01	16.[illegible]	[illegible]	16.50	0	27.	[illegible]	281.1
1	[illegible]	[illegible]	16.75	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BY J.C. DATE 4/-/81

LOUIS BERGER & ASSOCIATES INC.

SHEET NO 114 OF 114

CHKD. BY ____ DATE ____ LAMBERTVILLE DAM PROJECT C262

SUBJECT HEC-1 DB OUTPUT - SUMMARY

1.01	17.[illegible]	70	17.50	0	26	41	281
1.01	17.45	71	17.75	0	25.	41	280
1.01	[illegible]	[illegible]	18.00	0	25	40	280
[illegible]	[illegible]	73	18.25	0	25	[illegible]	[illegible]
1.01	[illegible]	[illegible]	18.50	0	25	[illegible]	280
[illegible]	[illegible]	[illegible]	18.75	0	25.	[illegible]	[illegible]
1.01	[illegible]	[illegible]	19.00	0	24	[illegible]	[illegible]
1.01	[illegible]	[illegible]	19.25	0	24	37	280
1.01	[illegible]	78	19.50	0.	24.	37.	280.
1.01	[illegible]	79	19.75	0	24	[illegible]	280
1.01	[illegible]	[illegible]	20.00	0	24	35	280
1.01	20.15	81	20.25	0	23.	[illegible]	280
1.01	[illegible]	[illegible]	20.50	0	23	35	280
1.01	[illegible]	[illegible]	20.75	0	23.	[illegible]	280
1.01	21.00	[illegible]	21.00	0.	23.	34.	280
1.01	[illegible]	[illegible]	21.25	0	22	34	280
1.01	[illegible]	[illegible]	21.50	0	22.	33	280
1.01	21.45	87	21.75	0.	22.	33.	280
1.01	[illegible]	[illegible]	22.00	0	22	32	280
1.01	[illegible]	89	22.25	0	22	32	280
1.01	22.30	90	22.50	0.	21.	31	280.
1.01	[illegible]	91	22.75	0	21	31	280
1.01	[illegible]	[illegible]	23.00	0	21	[illegible]	[illegible]
1.01	23.15	[illegible]	23.25	0.	21.	[illegible]	[illegible]
1.01	23.30	94	23.50	0.	21	30	280
1.01	23.45	[illegible]	23.75	0	20	[illegible]	280
1.02	[illegible].00	[illegible]	24.00	0.	20	29.	280.
1.02	0.15	97	24.25	0	20.	28	280
1.02	0.[illegible]	98	24.50	0	20	28	280
1.02	0.45	99	24.75	0.	20.	28.	280
1.02	1.00	100	25.00	0.	20.	[illegible]	280

PEAK OUTFLOW IS 1276. AT TIME 5.00 HOURS

CFS	1276	510	145.	140	13457
CMS	36	14	4	4	[illegible]
INCHES		3.44	3.92	3.92	3.92
MM		87.[illegible]	99.57	99.57	99.57
AC-FT		252	288.	288.	288
THOUS CU M		312	356.	356.	356

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

HYDROGRAPH AT	1	1272	615	159	152	1.38
		36.57)(	17.41)(	4.49)(	4.31)(	3.57)
ROUTED TO	2	1276	510	145	140	1.38
		36.15)(	14.45)(	4.12)(	3.95)(	3.57)

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	279.00	279.00	282.10
STORAGE	0	0	63
OUTFLOW	0.	0.	201.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	282.61	0.51	83.	1276.	3.75	5.00	0.00

END

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