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NATIONAL DAM SAFETY PROGRAM. SYLVAN LAKE DAM (NJ-00151), DELAWA--ETC(U)
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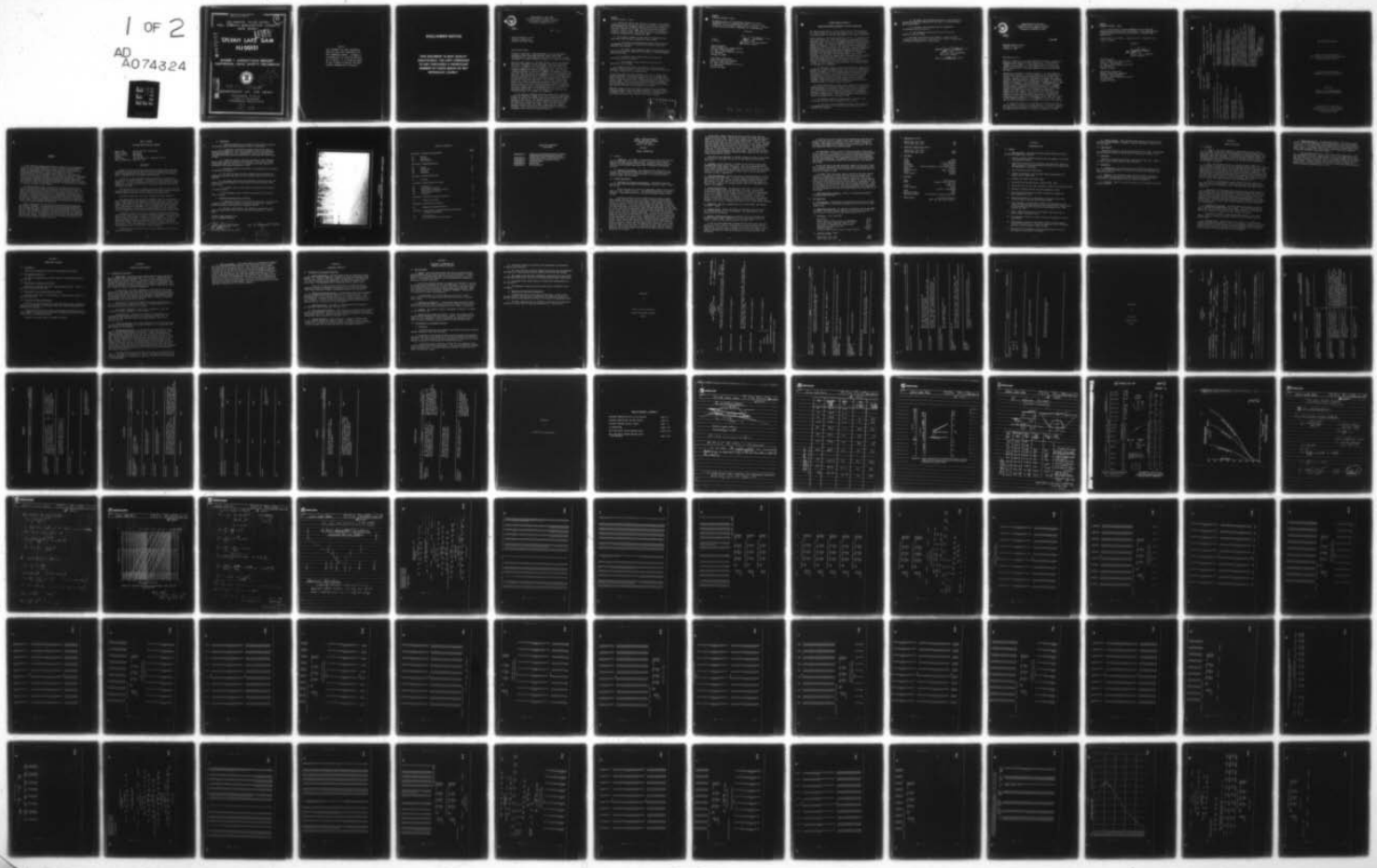

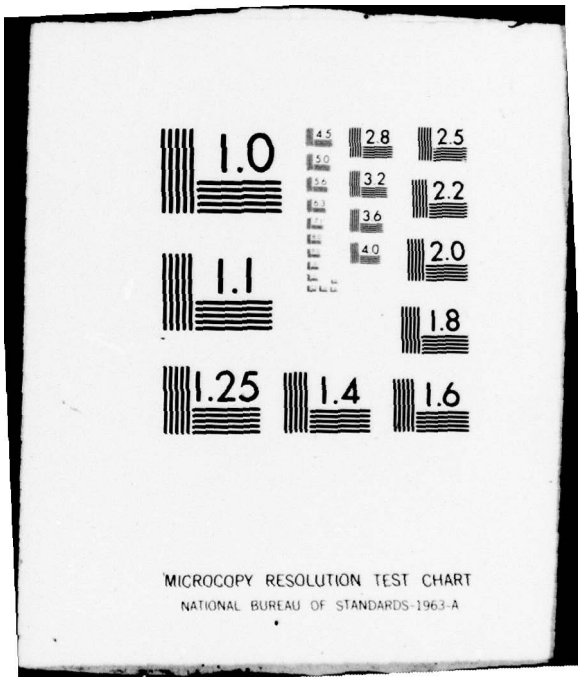
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DELAWARE RIVER BASIN
MILL STREAM, BURLINGTON COUNTY
NEW JERSEY

LEVEL II

SYLVAN LAKE DAM
NJ 00151

AD A074324

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DDC
SEP 26 1979
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DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

May 1979

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NOTICE

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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-D

17 SEP 1979

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

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Sylvan Lake Dam in Burlington 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, Sylvan Lake Dam, a high hazard potential structure, is judged to be in poor overall condition. Also, the spillway is considered seriously inadequate since 13 percent of the Probable Maximum Flood (PMF) would overtop the dam. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from 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 within three 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 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within three months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1980.

c. The following remedial actions should be completed within three months from the date of approval of this report:

1. All trees and brush should be removed from the dam and the embankment area where the trees have been removed should be backfilled and regraded.

2. The swampy region beginning immediately downstream of the dam should be monitored regularly for any signs of increased seepage and/or turbid water.

3. A reservoir drain system should be designed and incorporated into the structure.

4. The embankment slopes should be protected with a vegetative cover or riprap.

d. The Owner should develop and implement a maintenance and inspection checklist similar to the one in this report, to insure that all items are maintained on a regular basis.

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 Thomas B. Evans of the Fourth 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.

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NAPEN-D
Honorable Brendan T. Byrne

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,

JAMES G. TON
Colonel, Corps of Engineers
for District Engineer

1 Incl
As stated

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

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

79 09 24 030

SYLVAN LAKE DAM (NJ00151)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 13 April 1979 by O'Brien & Gere Engineers Inc. under contract to the U.S. Army Engineer District, Philadelphia, in accordance with the National Dam Inspection Act, Public Law 92-367.

Sylvan Lake Dam, a high hazard potential structure, is judged to be in poor overall condition. Also, the spillway is considered seriously inadequate since 13 percent of the Probable Maximum Flood (PMF) would overtop the dam. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from 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 within three 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 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within three months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1980.

c. The following remedial actions should be completed within three months from the date of approval of this report:

1. All trees and brush should be removed from the dam and the embankment area where the trees have been removed should be backfilled and regraded.

2. The swampy region beginning immediately downstream of the dam should be monitored regularly for any signs of increased seepage and/or turbid water.

3. A reservoir drain system should be designed and incorporated into the structure.

4. The embankment slopes should be protected with a vegetative cover or riprap.

d. The Owner should develop and implement a maintenance and inspection checklist similar to the one in this report, to insure that all items are maintained on a regular basis.

APPROVED: Joel Kallstrom LTC
JAMES G. TON
Colonel, Corps of Engineers
for District Engineer

DATE: 13 September 1979

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

IN REPLY REFER TO
NAPEN-D

7 SEP 1979

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

Dear Governor Byrne:

This is in reference to our ongoing National Program for Inspection of Non-Federal Dams within the State of New Jersey. Sylvan Lake Dam (Federal I.D. No. NJ00151), a high hazard potential structure has recently been inspected. The dam is owned by the City of Burlington and is located on Mill Stream approximately two miles upstream from Burlington.

Using Corps of Engineers screening criteria, it has been determined that the dam's spillway is seriously inadequate since approximately 13 percent of the Probable Maximum Flood would overtop the dam. The seriously inadequate spillway is assessed as an UNSAFE, non-emergency condition, until more detailed studies prove otherwise, or corrective measures are completed. The classification of UNSAFE applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with an UNSAFE unclassification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard potential to loss of life downstream from the dam. As a result of this UNSAFE determination, it is recommended that the dam's owner take the following measures within 30 days of the date of this letter:

a. Engage the services of a qualified professional consultant to more accurately determine the spillway adequacy by using more detailed and sophisticated hydrologic and hydraulic analyses, and to recommend any remedial measures required to prevent overtopping of the dam.

b. In the interim, a detailed emergency operation plan and downstream warning system should be developed. Also, round-the-clock surveillance should be provided during periods of unusally heavy precipitation.

A final report on this Phase I Inspection will be forwarded to you within two months.

Sincerely,

for Roy A. Mirutano
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

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

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

UNSAFE DAM
NATIONAL PROGRAM OF INSPECTION OF DAMS

a. NAME: Sylvan Lake Dam

b. ID NO.: NJ00151

c. LOCATION State: New Jersey County: Burlington
River or Stream: Mill Stream.
Nearest D/S City or Town: Burlington

d. HEIGHT: 18 feet.

e. MAXIMUM IMPOUNDMENT CAPACITY: 150 ac ft.

f. TYPE: Earthfill with timber core wall.

g. OWNER: City of Burlington.

h. DATE GOVERNOR NOTIFIED OF UNSAFE CONDITIONS: 7 Sep 79.

i. CONDITION OF DAM RESULTING IN UNSAFE ASSESSMENT Preliminary report calculations indicate 13% of PMF would overtop the dam.

l. URGENCY CATEGORY: UNSAFE, Non-Emergency.

m. EMERGENCY ACTIONS TAKEN:
Gov. notified of this condition by District Engineer's letter of 7 Sep 79.

j. DESCRIPTION OF DANGER INVOLVED:
Overtopping and failure of the dam would significantly increase hazard potential to loss of life and property downstream of dam.

h. REMEDIAL ACTIONS TAKEN:
N.J.D.E.P. will notify dam's owner upon receipt of our letter.

k. RECOMMENDATIONS GIVEN TO GOVERNOR:
Within 30 days of date of District Engineer letter the owner to do the following:
a. Engage the services of a qualified professional consultant to more accurately determine the spillway adequacy by using more detailed and sophisticated hydrologic and hydraulic analyses, and to recommend any remedial measures required to prevent overtoppoing of the dam.
b.In the interim, a detailed emergency operation plan and downstream warning sustem should be developed. Also, around-the-clock surveillance should be provided during periods of unusually heavy precipitation.

o. REMARKS: Final report, to be issued within six weeks, will have WHITE cover.

W. H. ZINK, Coordinator
Dam Inspection Program
U.S.A.E.D., Philadelphia

DELAWARE RIVER BASIN

Name of Dam: Sylvan Lake Dam
County & State: Burlington County, New Jersey
Inventory Number: NJ 00151

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared by:

O'BRIEN & GERE ENGINEERS, INC
JUSTIN & COURTNEY DIVISION

For

DEPARTMENT OF THE ARMY
Philadelphia District, Corps of Engineers
Custom House-2nd & Chestnut Streets
Philadelphia, PA 19106

PREFACE

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. 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 1 REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Sylvan Lake Dam ID #NJ 00151
State Located:	New Jersey
County Located:	Burlington
Stream:	Mill Stream
Coordinates:	Latitude 40° 03.3', Longitude 74° 51.5'
Date of Inspection:	April 13, 1979

ASSESSMENT

Based on visual observations made during the date of the inspection, information made available by New Jersey DEP, and conversations with the Owner's representative Sylvan Lake Dam (owned by the City of Burlington, N.J.) is considered to be in overall poor condition.

The dam is an earth embankment approximately 940 feet long and 18 feet high at its maximum section. It appears to be an irregularly placed dumped fill. The entire embankment has no form of slope protection either vegetative or riprap. There are large trees growing on both the upstream and downstream slopes.

The spillway consists of a channel averaging 5 feet in width with side slopes of about 2H:1V which extends from the left side of the dam a distance of approximately 5,100 feet to its confluence with Tanner Brook.

The 20 acre reservoir is used for recreation by local residents.

Just downstream of the toe of the embankment there is a wet region which extends downstream for hundreds of yards in the floor of Mill Stream Valley. The ground in this region is very soft with pools of murky, rust colored water 6 to 8 inches deep. There is evidence of seepage along the face of the downstream embankment 3 to 4 feet above the toe. There are rust colored stains on old tires and assorted debris in the valley 6 to 12 inches higher than the existing surface of the murky rust colored water.

Examination of the results of the hydrologic and hydraulic analyses indicate that the spillway is capable of passing 12 percent of the Probable Maximum Flood (PMF) without overtopping of the embankment. The PMF is the Spillway Design Flood (SDF). Failure of the dam would cause extensive additional property damage and probable loss of life downstream in the City of Burlington. The capacity of the spillway system is therefore classified as "Seriously Inadequate." The dam is considered to be "Unsafe (non-emergency)" and is in the "High" hazard category.

Recommendations and remedial measures which should be initiated very soon are as follows:

a. Facilities.

1. A detailed hydrologic and hydraulic study should be made and the need and type of mitigating measures should be determined.

2. A subsurface investigation program should be initiated to determine the composition and in situ properties of the earth embankment and foundation materials. The investigations should be supervised by a licensed professional engineer experienced in the design and construction of dams.

3. A stability analysis should be performed for the embankment based on the results of the field investigations. This analysis should be performed under the direction of a licensed professional engineer experienced in the design and analysis of dams.

4. Piezometers should be installed in the embankment and foundation to measure pore pressures.

5. All trees and brush should be removed from the dam and the embankment area where the trees have been removed should be backfilled and regraded.

6. The swampy region beginning immediately downstream of the dam should be monitored regularly for any signs of increased seepage and/or turbid water.

7. A reservoir drain system should be designed and incorporated into the structure.

8. The embankment slopes should be protected with a vegetative cover or riprap.

b. Operation and Maintenance Procedures.

1. A downstream warning system should be developed. During periods of heavy rainfall, the dam should be monitored and downstream residents should be alerted in the event of an impending failure.

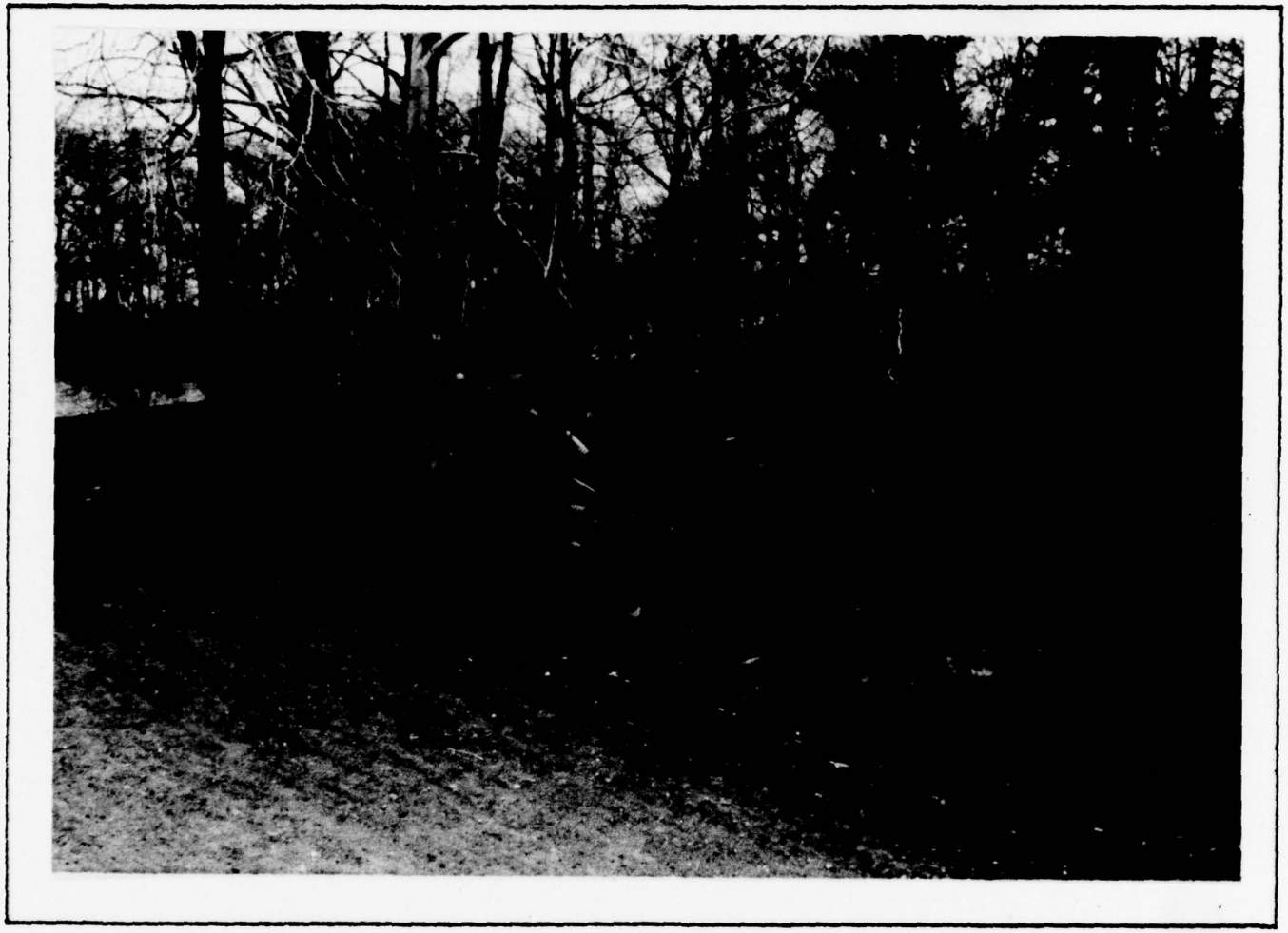
2. The Owner should develop and implement a maintenance and inspection checklist to insure that all items are maintained on a regular basis.

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

John J. Williams

Date: 3 August 1979

John J. Williams, P.E.
Vice President
New Jersey Registration No. 24916



OVERVIEW
SYLVAN LAKE DAM, BURLINGTON COUNTY, NEW JERSEY

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PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SYLVAN LAKE DAM
NDI I.D. NO. NJ-00151

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 #DACW 61-78-C-0052 between O'Brien & Gere Engineers, Justin & Courtney Division and the United States Army Corps of Engineers, Philadelphia District.

b. Purpose of Inspection. The purpose of this inspection is to evaluate the structural and hydraulic condition of the Sylvan Lake Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life or property.

1.2 Project Description

a. Description of Dam and Appurtenances. (Information obtained from the New Jersey Department of Environmental Protection (DEP), Trenton, New Jersey).

Sylvan Lake Dam is an earth fill embankment composed of fine sand, some clay, and a timber core wall. The embankment which has a horseshoe alignment is approximately 940 feet long with a maximum height of about 18 feet.

A channel averaging 5 feet in width with side slopes of about 2H:1V extends from the left side of the dam a distance of approximately 5,100 feet to its confluence with Tanner Brook. This channel is the only spillway or outlet facility for releasing flow from the reservoir without overtopping the dam. The channel flows through a 25 foot long, 6 foot wide by 3 foot high semi-circular culvert about 340 feet downstream from the lake. At a point about 440 feet downstream from the lake, the channel is constricted to less than 3 feet by a vertical timber wall on the right side and heavy brush on the left side (looking downstream). For the next approximately 3,500 feet the banks are overgrown with trees and brush as the channel flows through an area known as Town Estates. Approximately 3,900 feet downstream of the impoundment, the channel passes through two 48-inch corrugated metal, 25-foot long culverts under Salem Road. 600 feet further downstream the channel passes through twin 25-foot long, 4-foot wide by 2-foot high semi-circular culverts. About 1,000 feet downstream of Salem Road, the channel passes through twin 10-foot long, 4-foot wide by 2 foot high semi-circular culverts. One of these culverts is partially crushed. 200-feet further downstream the channel empties into Tanner Brook (Approximately 5,100 feet downstream of the lake).

An auxiliary channel branches off the main outlet about 180 feet downstream from the lake. The auxiliary channel is aligned approximately normal to the main outlet channel; has a bottom width of about 6 feet, side slopes averaging 1:1, and a crushed stone invert. About 20 feet from the main channel there are twin, 30-inch culverts, 20 feet long. Sandbags have been placed around the culverts in both faces of the embankment and there is about one foot of earth over the culverts. The channel continues for 75 feet beyond the twin culverts before passing over a concrete drop structure between 2 and 3 feet high. From the drop structure, the auxiliary channel meanders downstream before emptying into low lying swamps downstream of the dam.

According to the agreement of 10/10/47 between the State of New Jersey and the City of Burlington the top of the dam should be maintained at Elev. 39.5

b. Location. Sylvan Lake Dam is located on Mill Stream in Burlington Township, Burlington County, New Jersey. The site is approximately 1/2 mile upstream of Burlington, a community with a 1970 population of 11,991 and is shown on USGS Quadrangle entitled, "Bristol, NJ & PA" at coordinates N 40° 3.3', W 74° 51.5'. A regional location map of Sylvan Lake Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. Sylvan Lake Dam has a maximum height of 18 feet which places it in the "Small" size dam category for height because it is less than 40 feet high. It has a maximum storage volume of 150 Ac. Ft. which places it in the "Small" size dam category for storage because it has less than 1,000 Ac. Ft. maximum storage. The dam is therefore in the "Small" size category.

d. Hazard Classification. The populated hazard area in Mill Stream valley begins about 1,000 feet downstream of the dam. Approximately one half mile downstream of the dam, discharge in the Mill Stream channel is directed through a 3-foot diameter pipe for a distance of about 0.75 miles in the southern portion of the City of Burlington. Failure of Sylvan Lake Dam would result in flooding of a large area of the southern portion of the City of Burlington causing extensive property damage and probable loss of lives. Therefore, the dam is in the "High" hazard category.

e. Ownership. The dam is owned by the City of Burlington, New Jersey, City Hall, 08016.

f. Purpose of Dam. Sylvan Lake Dam was constructed to divert flow in Mill Stream around the City of Burlington. The impoundment is used extensively for recreation.

g. Design & Construction History. The dam was originally constructed sometime prior to 1885. Right-of-way for the main outlet channel was obtain in 1885, but the channel was not built until 1894.

In 1903 the earth embankment breached draining both Sylvan Lake and Lesser Lake which is 400 feet upstream and connected to Sylvan Lake at that time by a 12-inch pipe. The lakes were drained resulting in serious flooding and extensive property damage in the City of Burlington. The damaged embankment was repaired by throwing tree stumps and sand into the breach.

In 1933 the main outlet channel levee breached about 950 feet downstream of Sylvan Lake in a region of the outlet channel which passes through a swale known as Black Water Lake. As a result, portions of the City of Burlington were flooded to a depth of two feet. The dike was immediately rebuilt with sand and gravel.

The embankment failed on June 27, 1938 as the result of the heavy rains of June 26-27. Flooding with associated extensive property damage in the low-lying southern portion of the City of Burlington resulted. The dam failed due to saturation and slumping of the earth embankment and not from overtopping. The embankment was repaired and some grading and cleaning of the outlet channel were accomplished in late 1939 and early 1940.

No work was done on the dam and outlet channel for the next 7 years. After extensive controversy and litigation, the outlet channel and dam were accepted by State of New Jersey authorities as being satisfactorily repaired in October of 1947.

In November 1947, Burlington Township offered to take over responsibility for maintenance of both lakes and the outlet channel upon completion of modifications then pending for the Lesser Lake if the City of Burlington would provide financial support for the maintenances. Both parties were advised that they should come to an agreement for the performance of the then proposed work and for future maintenance. There is no evidence in the DEP files that such an agreement was ever reached. As interpreted by DEP, since no such agreement exists, full responsibility for maintenance of the dams and outlet channel rests with the City of Burlington.

h. Normal Operating Procedures. There are no operating procedures associated with this site.

1.3 Pertinent Data

a. Drainage Area. The drainage area upstream of the dam is 0.9 square miles, as taken from information provided by DEP and verified on topographic maps.

b. Discharge at Dam Site. No high pool or discharge records were made available. The outlet channel capacity with the reservoir surface at the low point of the top of the dam (Elev. 38.6) is 187 cfs.

c. Elevation. (Feet above MSL)

Normal Pool	36.0±
Outlet channel (initial invert at impoundment)	36.0±
Top of Dam (State requested, refer to 1.3.b)	39.5
Top of Dam (as determined by field survey)	38.6
Streambed at Centerline of Dam	21.0±
Maximum Tailwater	Unknown
Invert of semi-circular culvert in Outlet Channel	35.3

d. Reservoir Length. (Feet)

Normal Pool, Elev. 36.0	1,800
Top of Dam, Elev. 38.6	2,200

e. Storage.(Acre-Feet)

Normal Pool, Elev. 36.0	99
Top of Dam, Elev. 38.6	162

f. Reservoir Surface Area.(Acres)

Normal Pool, Elev. 36.0	20.0
Top of Dam, Elev. 38.6	28.0

g. Dam Data.

Type	Earth
Length	940 feet
Height	18 feet (Maximum)
Top Width	20 feet (Ave.)
Side Slopes	1.5H:1V (upstream); 1.7H:1V (downstream)
Zoning	Unknown
Impervious core	Timber core wall
Cutoff	Unknown
Grout Curtain	Unknown

h. Spillway.

Type	Earth channel
Width	Average 5 feet with side slopes 2:1
Length	5,100 feet
Crest Elevation	36.0+ at edge of impoundment
Gates	None
Upstream channel	None
Downstream channel	Full Length of channel 5,100 feet.

i. Outlet Works. No outlet facilities other than the outlet channel.

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. The engineering data made available by the New Jersey DEP includes the following:

1. History of events concerning Sylvan Lake with emphasis on failures and subsequent repairs.

2. Application, report on the application, and permit for repairs on Sylvan Lake Dam in 1939 necessitated by failure of the Sylvan Lake Dam embankment in June 1938.

3. Specifications for the 1939 repairs.

4. Hydraulics, hydrology, and structural design computations for repairs (1934, 1939, 1947).

5. Drawings for repair work (1939, 1947).

6. Construction and design progress reports (1939, 1947).

7. Photographs through the years beginning in 1938 of the dam and spillway.

8. Newspaper clippings through the years beginning in 1938.

9. Dam Inspection Reports by the State of New Jersey through the years beginning in 1938.

10. Resolution opposed to any application to raise the water level in Sylvan Lake by the City of Burlington (1945).

11. Legal documents, correspondence, minutes of State hearings, and results of hearings concerning the City of Burlington's responsibility for maintenance of Sylvan Lake Dam and appurtenances (Nov. 1946 through Feb. 1947).

12. Deed of 1884 giving the City of Burlington right-of-way for an outlet channel from Sylvan Lake.

13. Correspondence relative to public recreation development at Sylvan Lake (1947).

14. Correspondence relative to Burlington Township assuming responsibility for maintenance of Sylvan Lake with the City of Burlington providing financial support (1947 and 1962).

15. Miscellaneous correspondence majority being between the City of Burlington and the State of New Jersey.

b. Design Features. The principal design features for the structure are shown on the drawings in Appendix E and are discussed in Section 1.2.a of this report.

2.2 Construction

The dam was originally constructed sometime prior to 1885. Construction necessitated by failures of the structure is discussed in Section 1.2.g.

2.3 Operation

There are no operational features associated with this dam. There is no known reservoir drain system in this structure.

2.4 Evaluation

a. Availability. All information made available was obtained from DEP. Very limited information is available concerning the embankment and foundation materials.

b. Adequacy. The information made available by DEP, converstions with the Owners representative and observations made during the field investigation provided adequate data for a Phase 1 evaluation.

c. Validity. There is no reason to question the validity of the data obtained from DEP.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Sylvan Lake Dam took place on April 13, 1979. At the time of the inspection, the reservoir water surface was a few inches above the invert of the entrance to the outlet channel. No underwater areas were inspected. The observations and comments of the field inspection team are in the checklist which is Appendix B of this report. The appearance of the facility indicates that the dam and its appurtenances are marginally maintained.

b. Dam. The dam appears to be an irregularly placed, dumped fill. It has an extremely irregular top width which averages about 20 feet, very irregular side slopes which average about 1.7H:1V downstream and 1.5H:1V upstream and a very irregular top of dam profile which varies over 2 feet in elevation. The embankment has no slope protection on either the upstream or downstream slopes. Trees growing on the upstream slope have trunks up to 12 inches in diameter and are over 30 feet tall while trees growing on the downstream slope are up to 50 feet tall with trunks as much as 3 feet in diameter. Waste asphalt, concrete, and tree stumps were found protruding from the embankment fill.

The dam is approximately horseshoe shaped and concave downstream. The right side of the embankment is about 370 feet long, the central part is about 230 feet long, and the left side is about 340 feet long (Refer to SH.2 Appendix E).

Beginning a few feet downstream of the toe of the central portion of the embankment there is a wet region which extends downstream for hundreds of yards in the floor of Mill Stream valley. The ground in this region is very soft with pools of murky, rust colored water 6 to 8 inches deep. There is evidence of seepage along the face of the downstream embankment 3 to 4 feet above the toe. There are rust colored stains on old tires and assorted debris in the valley 6 to 12 inches higher than the existing surface of the murky, rust colored water.

c. Appurtenant Structures. The outlet channel (described in Section 1.2.a) has trees and brush growing on its banks. It is constricted to less than 3 feet in one location with vertical timber sidewalls. At various locations the channel is clogged with brush, sediment and debris.

The auxiliary channel aligned approximately normal to the outlet channel 180 feet downstream from the reservoir is clear of debris for its entire length.

d. Reservoir Area. The perimeter of the reservoir is completely developed in residential properties. There is no evidence of excessive siltation, slope instability, or other features that would adversely affect the storage capacity of the reservoir. The slopes along the perimeter of the reservoir are for the most part vegetated and on gentle gradients.

e. Downstream Channel. The downstream channel is the outlet channel until it joins the Tanner Brook channel approximately 5,100 feet downstream of the dam. For a description of the channel for its entire length refer to Section 1.2.a. The channel gradient varies between 0.1 percent and 0.6 percent. There are about three dozen homes in Town Estates which would be affected by flooding of the outlet channel.

The populated hazard area in Mill Stream valley begins about 1,000 feet downstream of the dam. Approximately one half mile downstream of the dam, discharge in the Mill Stream channel is directed through a 3-foot diameter pipe for a distance of about 0.75 miles in the southern portion of the City of Burlington. Failure of Sylvan Lake Dam would result in flooding of a large area of the southern portion of the City of Burlington causing extensive property damage and probable loss of lives.

SECTION 4

OPERATIONAL FEATURES

4.1 Procedures

There are no operational procedures associated with this dam.

4.2 Maintenance of the Dam

The Owner's representative said that there is no maintenance program for the dam.

4.3 Maintenance of Operating Facilities

There are no operating facilities associated with the dam. There is no reservoir drain for this dam.

4.4 Description of any Warning System in Effect

According to the Owner's representative, no flood warning system is in effect at this site.

4.5 Evaluation of Operation Adequacy

There are no operating facilities associated with the dam. Maintenance appears to be marginal. A maintenance check list should be developed and implemented by the Owner.

A downstream warning system should be developed and during periods of heavy rainfall, the dam should be monitored and downstream residents alerted in the event of an impending failure.

The dam is accessible under all weather conditions.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. The drainage area contributing to Sylvan Lake Dam is about 0.7 miles long and averages about 1.3 miles wide. Ground elevations range from 92 to 36 feet above MSL. The slopes of the drainage basin are for the most part gentle. The drainage basin is made up of relatively equal portions of woodland, pastures, orchards, and residential development. The runoff characteristics of the drainage basin may undergo change in the future as a result of further residential development.

As specified by the State (agreement of 10/10/47) the top of dam should be 3.5 feet above the normal pool level of Elev. 36.0. As revealed by the inspection field survey, the entire portion of the embankment parallel to the outlet channel and a portion of the embankment approximately 60 feet long adjacent to the right abutment have less than a 3.5-feet of freeboard between normal pool and the top of the dam.

The spillway is the outlet channel (discussed in Sections 1.2.a and 3.1.c) which has a maximum design capacity of approximately 190 cfs. to the surveyed low point of the top of the dam.

For further information, refer to the computations, data, and printouts included in Appendix C of this report.

b. Experience Data. According to the Owner's representative, no discharge or reservoir stage records are maintained for this site. He did note that the reservoir stage varies approximately a foot in the course of a year.

c. Visual Observation. The outlet channel which is the only route for discharge from the impoundment is in poor condition. It is overgrown, sediment choked, and constricted.

d. Overtopping Potential. The Spillway Design Flood (SDF) for this small size, high hazard structure is given as a range from one-half of the Probable Maximum Flood (PMF) to the full PMF. Based on the distance of 1,000 feet to the populated hazard area, the SDF selected for use is the PMF. The PMF hydrograph was routed through the reservoir with the starting water surface elevation at the invert of the semi-circular culvert in the outlet channel, Elev. 35.3 . The maximum water surface elevation in the reservoir resulting from the PMF routing would be 5.4 feet above the invert of the semi-circular culvert in the outlet channel and 2.1 feet above the lowest point of the top of the dam. The low point of the crest was determined by a field survey of the dam crest profile during the field investigations (See Sheet 3, Appendix E).

The peak inflow and outflow rates for the SDF were determined to be 3601 cfs. and 3604 cfs. respectively. Based on the hydrologic analyses, the spillway is capable of discharging 12 percent of the PMF without overtopping of the embankment.

e. Spillway Adequacy. A dam break analysis was performed to evaluate the "hazard to loss of life downstream from the dam from that which would exist just before overtopping failure" (ETL 1110-2-234, 10 May, 1978). For 50 percent of the PMF just before failure with the depth of flow about 1.5 feet over the low point of the top of the dam the discharge would be 1,780 cfs and the depth of flow would be 5.3 feet in the Mill stream valley at the investigated hazard area 1,000 feet downstream of the dam. With failure of the dam the discharge would be 3,910 cfs. and the depth of flow would be 7.5 feet at the hazard area. Failure of the dam is considered to significantly increase the hazard to loss of life and would probable cause apprecible additional property damage. Therefore, the spillway of the Sylvan Lake Dam is classified as "Seriously Inadequate".

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation. The dam appears to be an irregularly placed, dumped fill. It has an extremely irregular top width which averages about 20 feet, very irregular side slopes which average about 1.7H:1V downstream and 1.5H:1V upstream, and an undulating top of dam profile which varies over 2 feet. The embankment has no slope protection on either slope.

The roots of trees growing on the dam may increase the seepage potential through the embankment and uprooting of the trees by high winds could cause substantial volumes of embankment material to be displaced.

b. Design and Construction Data. The embankment cross-section geometry does not conform with the design drawing cross-section which has a 3H:1V downstream slope, 2H:1V upstream slope and a top width of 12 feet. There is no information available on stability analyses, seepage computations, or soil properties. Further information concerning design and construction is found in Sections 1.2.g and 2.1.a of this report.

c. Operating Records. The Owner's representative was not aware of any operating records associated with this site.

d. Post Construction Changes. Since there are no records of the original design and construction, there is no way of knowing exactly what constituted the original structure. Construction necessitated by failures of the structure through the years is discussed in Section 1.2.g.

e. Seismic Stability. Sylvan Lake Dam is located is Seismic Zone 1 of the "Seismic Zone Map of Contiguous States." Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected Zone 1 earthquake conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety. The visual observations and review of available information indicate that the Sylvan Lake Dam is in poor condition. The many deficiencies and problem areas noted in Sections 1.2.g and 3.1.b, 3.1.c, and 6.1.a are evidence of a general lack of maintenance and potentially hazardous structural conditions.

The spillway (outlet channel) is capable of discharging 12 percent of the PMF without overtopping of the earth embankment. Failure of the dam by overtopping would increase the hazard to loss of life and would result in an extensive increase in property losses downstream of the dam. Therefore, the spillway is classified as "Seriously Inadequate", and the dam is classified as "Unsafe (non-emergency)."

The impoundment can be drawn down below the outlet channel invert elevation only by pumping since the dam does not have a reservoir drain system.

b. Adequacy of Information. The information made available by DEP, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase 1 evaluation.

c. Urgency. The remedial measures recommended in Section 7.2 should be initiated very soon.

d. Necessity for Further Evaluation. Further investigation should be performed to determine the source of the seepage, and to determine the stability of the embankment. Detailed hydrologic and hydraulic studies should be made to determine measures required to pass the PMF safely.

7.2 Recommendations and Remedial Measures

a. Facilities

1. A detailed hydrologic and hydraulic study should be made to determine measures required to pass the PMF safely.

2. A subsurface investigation program should be initiated to determine the composition and in situ properties of the earth embankment and foundation materials. The investigations should be supervised by a licensed professional engineer experienced in the design and construction of dams.

3. A stability analysis should be performed for this embankment based on the results of the field investigations. This analysis should be performed under the direction of a licensed professional engineer experienced in the design and analysis of dams.

4. Piezometers should be installed in the embankment and foundation to measure pore pressures.

5. All trees and brush should be removed from the dam and the embankment area where the trees have been removed should be backfilled and regraded.

6. The swampy region beginning immediately downstream of the dam should be monitored regularly for any signs of increased seepage and/or turbid water.

7. A reservoir drain system should be designed and incorporated into the structure.

8. The embankment slopes should be protected with a vegetative cover or riprap.

b. Operation and Maintenance Procedures.

1. A downstream warning system should be developed. During periods of heavy rainfall, the dam should be monitored and downstream residents in the Mill Stream valley should be alerted in the event of an impending failure.

2. The Owner should develop and implement a maintenance and inspection checklist to insure that all items are maintained on a regular basis.

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Sylvan Lake Dam

ID # NJ-00151

ITEM	REMARKS
AS-BUILT DRAWINGS	There are no "As-Built" drawing for the original structure. The drawings in the DEP files are for the repairs partially completed in 1939, 1940 and 1947.
REGIONAL VICINITY MAP	Refer to sheets 1,4,&5 of Appendix E
CONSTRUCTION HISTORY	The original dam was built sometime prior to 1885. The outlet channel was originally built in 1894. Repair construction was necessary following the failure of 1903, 1933, & 1938.
TYPICAL SECTIONS OF DAM	Refer to sheets 5 & 6 of Appendix E
OUTLETS - PLAN	Refer to sheets 7 & 8 of Appendix E.
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	Refer to Appendix C
RAINFALL/RESERVOIR RECORDS	Not recorded

ITEM	REMARKS
DESIGN REPORTS	Design material is available for repair work required following dam failures of 1933 & 1938. (DEP)
GEOLOGY REPORTS	None provided in DEP files. Refer to Appendix F of this report.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS	Available for designs required following 1933 & 1938 failures (DEP)
DAM STABILITY SEEPAGE STUDIES	No data available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No information available
POST-CONSTRUCTION SURVEYS OF DAM	Following failure of 1938 plan and profile information available from DEP for the dam & spillway (outlet channel).
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	After 1894, when the outlet channel was built, construction associated with the structure was limited to repairs necessitated following the failures of 1903, 1933 & 1938.
HIGH POOL RECORDS	No official pool records are maintained by the City of Burlington. The city's representative said the pool level fluctuates about one foot during the course of a year.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Only as necessitated by failures of the dam (1903, 1933, & 1938)
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	The structure has had 3 failures (1903, 1933, & 1938). Refer to section 1.2.g of this report. Reports available from DEP on all three failures with extensive reports covering the 1938 failure.
MAINTENANCE OPERATION RECORDS	Correspondence through the years (from DEP files) gives information about sporadic maintenance work that was done on the structure.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Refer to Appendix E for details
OPERATING EQUIPMENT PLANS & DETAILS	There is no operating procedure associated with this site.
MISCELLANEOUS	Engineering data available from the DEP files is listed in Section 2.1.a of this report.

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Sylvan Lake Dam County Burlington State New Jersey National ID # NJ-00151

Type of Dam Dumped Earth Fill Hazard Category High

Date(s) Inspection 4/13/79 Weather cloudy Temperature 40°-50° F

Pool Elevation at Time of Inspection 36± M.S.L. Tailwater at Time of Inspection 18± M.S.L.
Old stream valley floor downstream of dam

Inspection Personnel:

Lee DeHeer Leonard R. Beck David Campbell

Leonard R. Beck Recorder

Remarks:

Mr. Bernie Wojtkowiac, P.E., the City of Burlington's representative accompanied us during the inspection.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	Essentially a fine sand embankment which does not tend to crack
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	The embankment is so irregularly placed it is difficult to tell if there has been any movement.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The embankment is so irregularly placed it is difficult to tell if there has been any sloughing or erosion; there is sloughing of the embankment slopes when they are walked on.	There is no vegetative or riprap protection on the entire embankment. A boring program should be initiated to determine the composition and *in situ* properties of the embankment and foundation materials and to determine the stability of the dam. Piezometers should be installed in the bore holes to evaluate poor pressure development throughout the embankment. Riprap would be helpful on the upstream slope for wave protection.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The embankment is so irregularly placed it is difficult to discern the vertical and horizontal alignment.	
RIPRAP FAILURES	There is no riprap on the entire structure.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	It is difficult to tell where the junction of the embankment and abutment is located. The junction of the spillway (outlet channel) and dam has no vegetative or riprap protection.	Refer to the remarks on sheet 2/7. A means of positive cutoff and/or internal drainage system must be considered.
ANY NOTICEABLE SEEPAGE	There is seepage along the downstream toe and along the face of the downstream embankment 3 to 4 feet above the toe.	
STAFF GAGE AND RECORDER	None	None
DRAINS	None	And internal drainage system should be considered for the dam.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No concrete involved in the outlet channel (spillway)	None
INTAKE STRUCTURE	There is no intake structure; see outlet channel below	None
OUTLET STRUCTURE	There is no outlet structure ; see outlet channel below	None
OUTLET CHANNEL	The outlet works (spillway) consists of a channel averaging 5 feet in width with side slopes of about 2:1 which extends from the left side of the dam to an outlet in Tanners Brook 5,100 feet downstream	The outlet channel has trees and brush growing on its banks. It's constricted to less than 3 feet in one location. At many points it is clogged with brush, debris, & sediment.
EMERGENCY GATE	None applicable	None

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	None
OBSERVATION WELLS	None	None
WEIRS	None	None
PIEZOMETERS	None	Refer to remarks on sheet 2/7
OTHER	None	None

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes along the perimeter of the reservoir are for the most part vegetated and on gentle gradients.	None
SEDIMENTATION	The perimeter of the reservior is completely developed in residential properties. There is no evidence of excessive siltation, slope instability, or other features that would adversely affect the storage capacity of the reservoir.	None

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The first 1/2 mile downstream from the dam the stream bed passes through a heavily wooded region. The last 2 miles to the Delaware River is through the heavily urbanized City of Burlington.	Discharge from the Sylvan Lake does not flow through the Mill Stream drainage basin, but instead is rerouted through the outlet channel discussed on sheet 4/7 of the Visual Inspection check list.
SLOPES	The channel gradient averages about 0.2% for the entire 2.5 miles from Sylvan Lake Dam to the confluence of Mill Stream with the Delaware River	None
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately ½ mile downstream is the City of Burlington (population ≈ 12,000)	A formal warning system should be developed and implemented. Procedures for evacuating people within the potential flood area should be implemented.

APPENDIX

C

Hydrologic & Hydraulic Data

TABLE OF CONTENTS - APPENDIX C

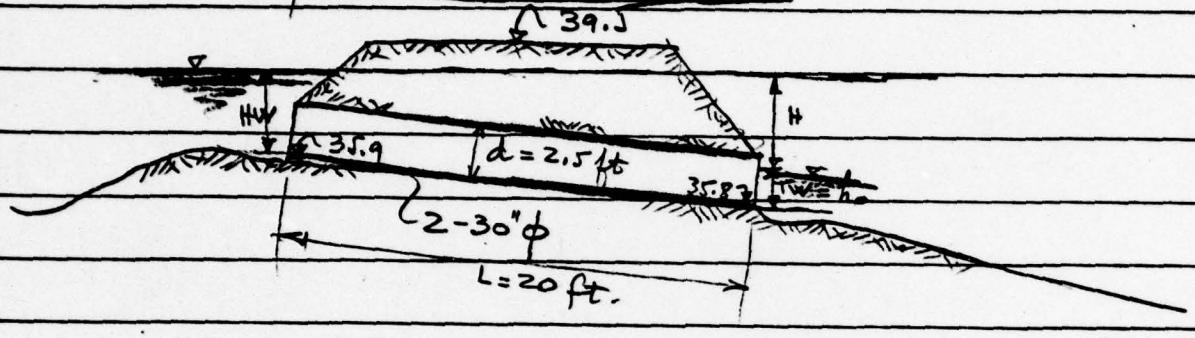
DISCHARGE COMPUTATIONS FOR 2,30" ø CULVERTS	SHEET 1-3
DISHCARGE COMPUTATIONS FOR ARCH CULVERT	SHEET 4-5
SPILLWAY DISHCARGE CAPACITY CURVES	SHEET 6
T_ℓ COMPUTATIONS	SHEET 7-10
HEC-I DAM SAFETY VERSION COMPUTER OUTPUT	SHEET 12-36
HEC-I DAM SAFETY VERSION COMPUTER OUTPUT WITH DAM BREAK	SHEET 37-51

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
SYLVAN LAKE DAM	1	SHA	5/2/79	1800-005-114

5/16/79

I) 2-30" ϕ CULVERTS



Square-edged entrance

Unsubmerged outlet

$H^* = 1.5\,d = 1.5 \times 2.5 = 3.75$ ft =

for $HW \leq H^*$ the entrance is not submerged.

In our case, the inlet controls* and consequently the discharge is dependent only on the HW above the invert at the entrance.

* short culverts with relatively low tailwater elevations almost always operate under inlet control

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Sylvan Lake Dam	2	SM	5/2/79	1800-005-114

5/16/79

	#W	Headwater Level (ft)	$\frac{\#W}{D}$	Q (cfs)	2Q (cfs)
	6"	36.4	0.2		
	12"	36.9	0.4		
	18"	37.4	0.6	10	20
	~~24~~ 24"	37.9	0.8	17	34
	30"	38.4	1.0	23	46
	36"	38.9	1.2	29	58
	42	39.4	1.4	34	68
Assume high flow overtops dam	48	39.9	1.6	38	76
	54	40.4	1.8	41	82
	60	40.9	2.0	45	90
	72	41.9	2.4	52	104

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Sylvan Lake Dam	3	SM	5/2/19	1600.005.114

VB 5/16/19

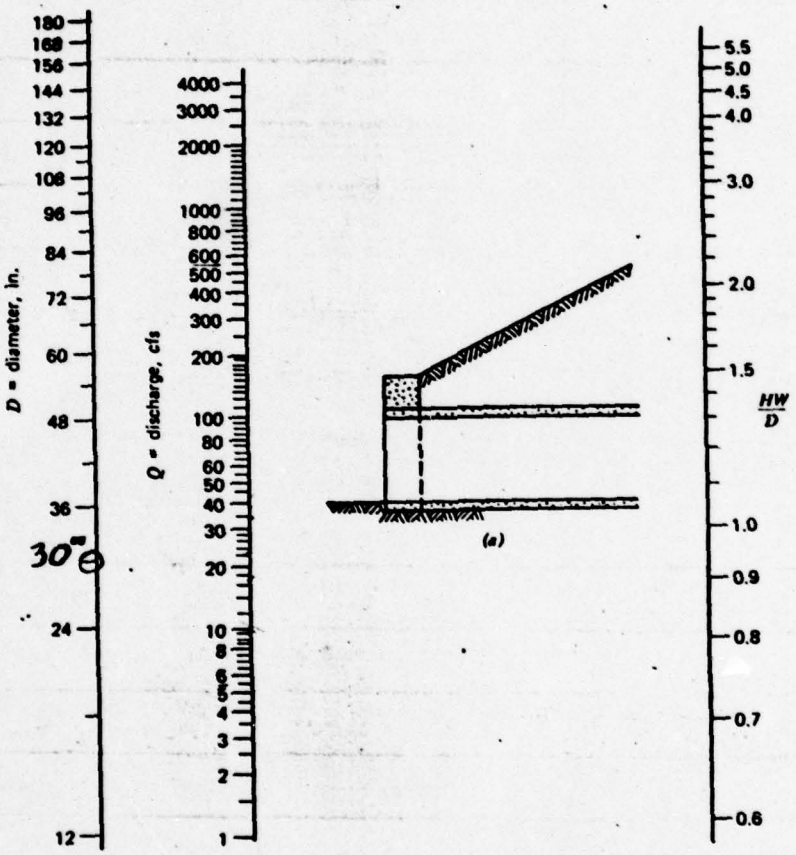


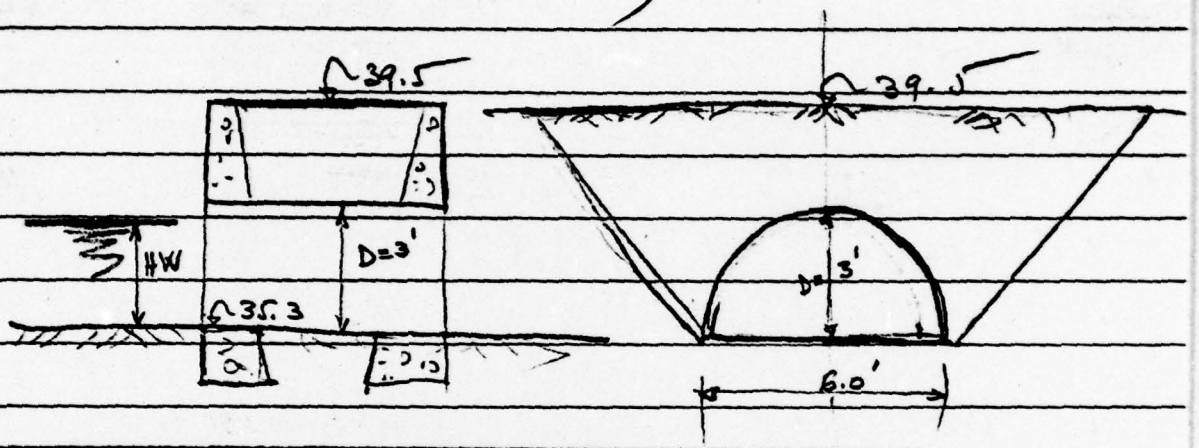
FIGURE 9.21 Typical nomograph for inlet controlled culvert design. (*a*) Square-edged entrance. (From *Handbook of Concrete Culvert Pipe Hydraulics*, Portland Cement Association, 1964.)

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
Sylvan Lake Dam	4	SM VB	5/2/79 5/21/79	1800-005-114

II) ~~ARCH~~ CULVERT

(INLET CONTROL)



HW (ft)	HW LEVEL (ft)	HW/D	Q_o (cfs)	$Q_{eff} = 1.2 Q_c$	
0.5	35.8	0.17			
1.0	36.3	0.33			1/ ratio of "n" values:
1.5	36.8	0.50	34	41	C.M. pipe $n \approx 0.024$
2.0	37.3	0.67	57	68	worn concrete pipe $n \approx 0.01$:
2.5	37.8	0.83	80	96	ratio "n" values ≈ 1.6
3.0	38.3	1.00	100	120	X-sec area 2/
4.0	39.3	1.33	140	168	72" x 44" pipe arch culvert = 17.6 Ft²
Disregards flow over top of fill: 5.0	40.3	1.67	170	204	X-sec area 3/ 3' x 6' semi-circular culvert = 13.0 Ft²
6.0	41.3	2.00	200	240	3/ Pg 26, Tbl 1-15 Hdbk. Steel Drainage & Highway Constr. Products
7.0	42.3	2.33	220	264	ratio pipe areas = 13/17.6 = 0.74

ratio "n" values x ratio areas = Coeff. for Q_{eff}

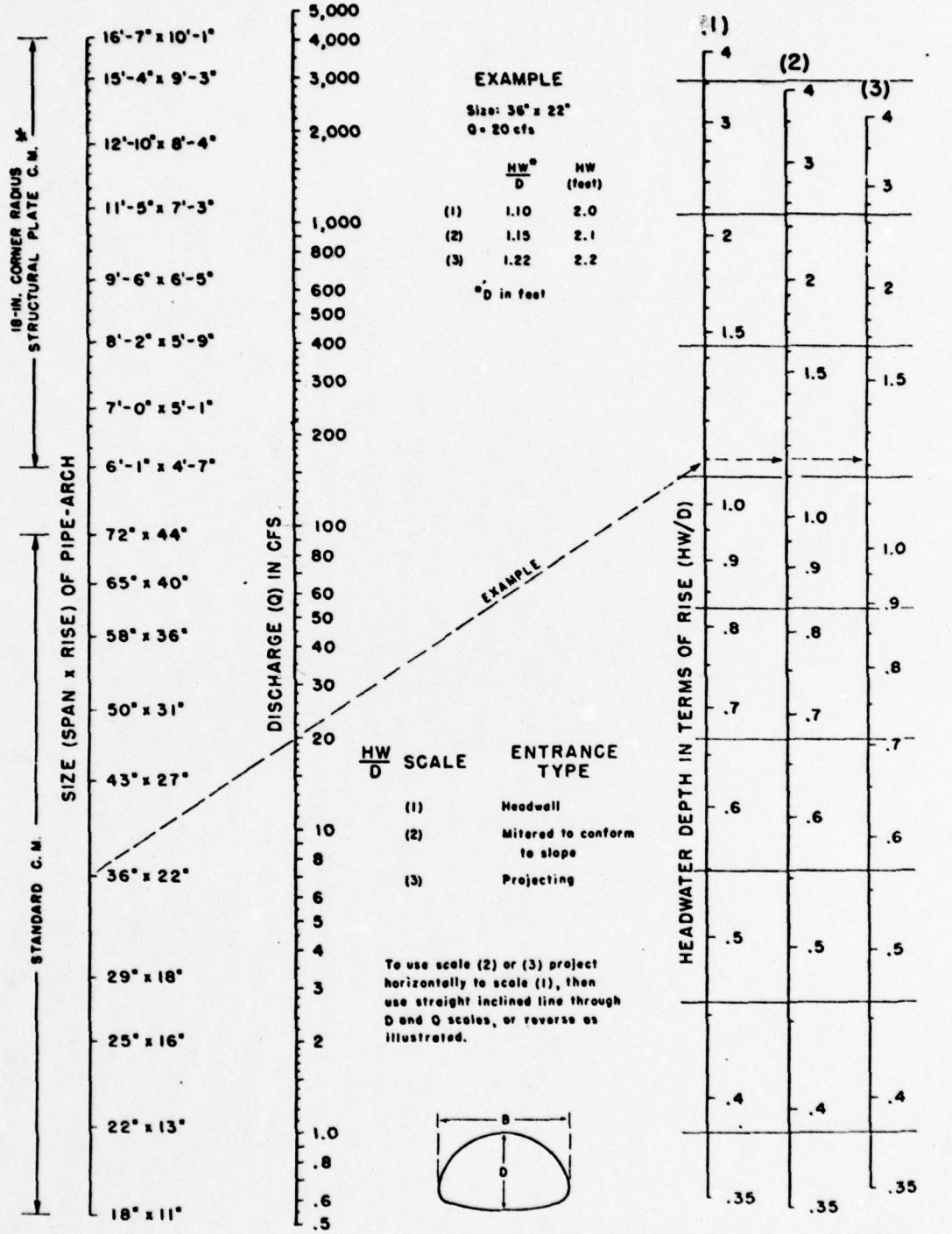
$1.6 \times 0.74 = 1.18$

≈ 1.2

Job #1800-005-114

Sheet 5

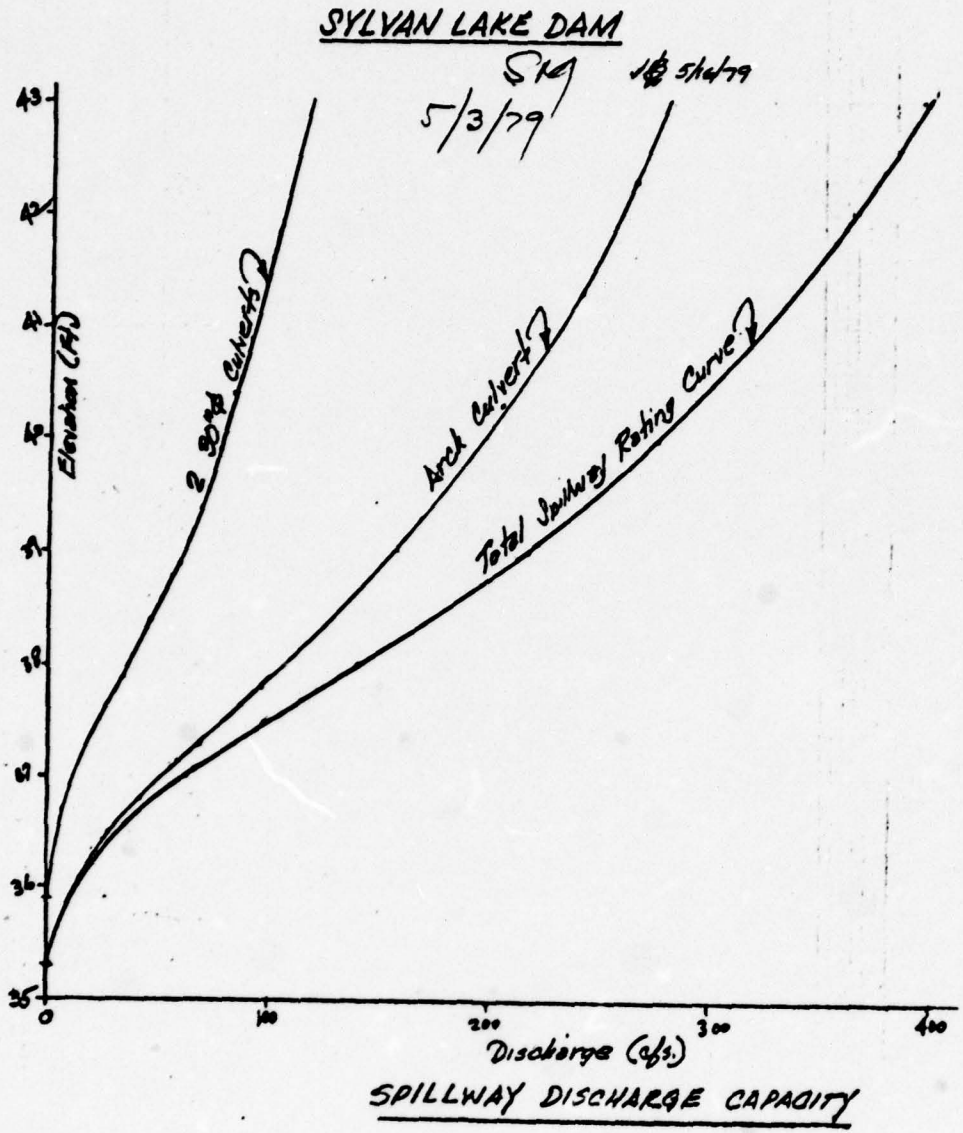
CHART 6



*ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL


SYLVAN LAKE DAM
SK
5/3/79
JB 5/4/79
43
42
41
40
39
38
37
36
35
Elevation (ft)
2 30" Culverts
Arch Culvert
Total Spillway Rating Curve
0
100
200
300
400
Discharge (cfs.)
SPILLWAY DISCHARGE CAPACITY

Sheet 6

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Sylvax Lake Dam	7	SM	4/13/79	1800-005-114

5/18/79

SYLVAN LAKE DAM

TLAG DETERMINATION

I) SCS Curve Number Method

$$T_l = \frac{L^{0.8}(S+1)^{0.7}}{1900\,Y^{0.5}}$$

L = hydraulic length of watershed (ft)

$$S = \frac{1000}{CN} - 10$$

CN = runoff curve number

Y = average watershed land slope (%)

L = 4500 ft

CN = 70

$$Y = \frac{85-20}{4500} = 0.0144 = 1.44\%$$

$$S = \frac{1000}{70} - 10 = 4.29$$

$$T_l = \frac{4500^{0.8}(4.29+1)^{0.7}}{1900 \times 1.44^{0.5}} = \frac{2677}{2280} = 1.18 \text{ hrs}$$

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
SYLVAN LAKE DAM	8	SM	4/13/79	1800-005-112

5/21/79

II. BUREAU OF PUBLIC ROADS

$$T_c = \left(\frac{11.9 \times L^3}{H} \right)^{0.385}$$

L = hydraulic length of water shed (miles) = 0.85 Miles

H = basin relief (ft) = 60

$$T_c = \left(\frac{11.9 \times 0.85^3}{60} \right)^{0.385} = 0.44 \text{ hr.}$$

$$T_e = 0.6\, T_c = \underline{\underline{0.27}} \text{ hr.}$$

III SCS UPLAND METHOD

$$T_c = \frac{L_1}{V_1} + \frac{L_2}{V_2}$$

$L_1 = 2640$ ft $\quad (= 0.5 \times 5280)$

$S = \frac{\Delta H}{L} = \frac{30}{2640} = 1.1\%$ (water course slope)

$\therefore V_1 = 0.5$ fps (Graph from Fig. 3.1 - SCS)

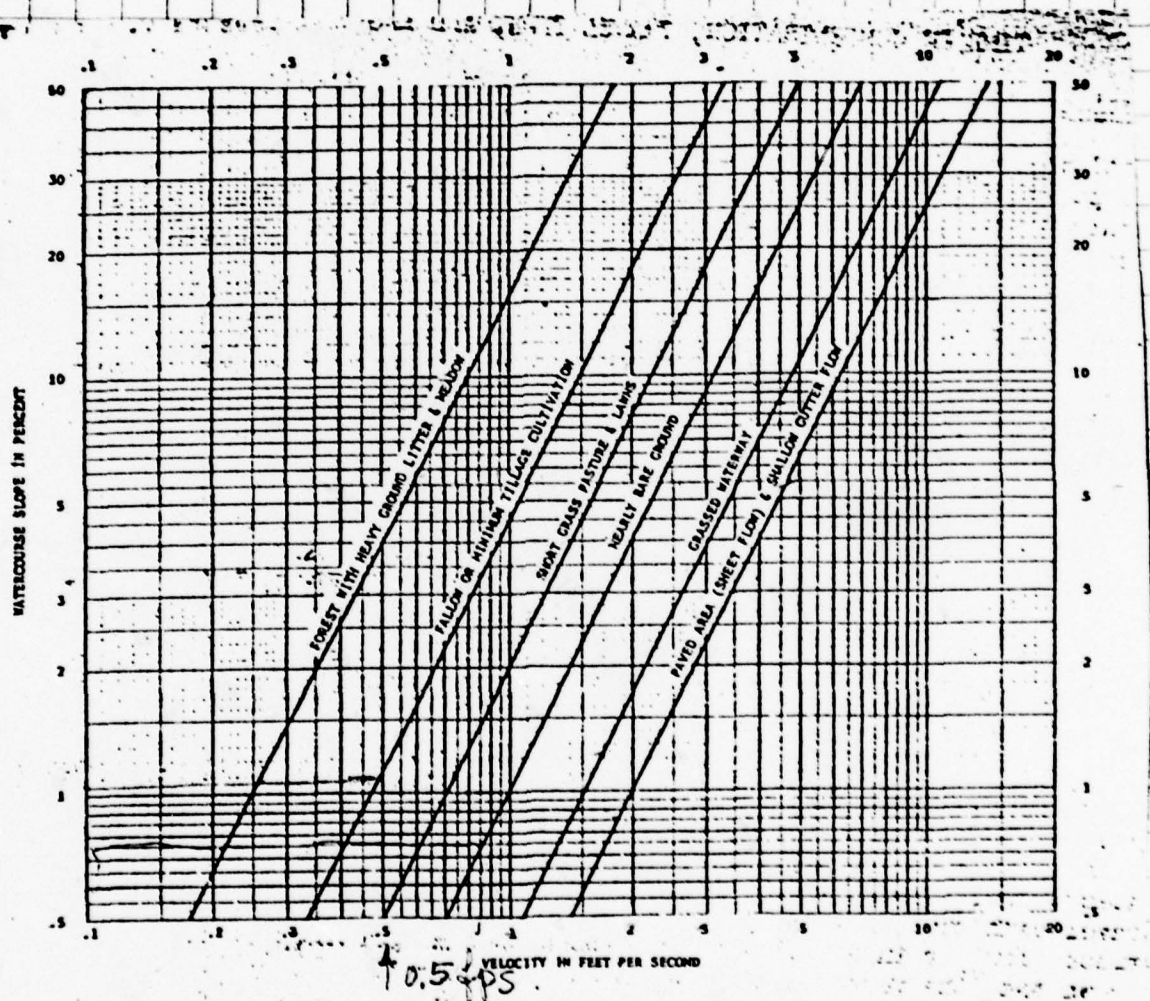
$V_2 = C\sqrt{RS_2}$ (Chezy)

$C = \frac{1.49}{n} R^{1/6}$ (Manning)

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Sylvan Lake Dam	9	SM	4/13/79	1800.005-114

JB 5/16/79



0.5 fps

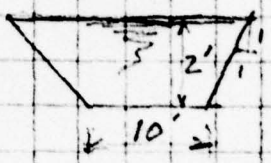
Figure 3-1.--Average velocities for estimating travel time for overland flow.

From SCS
National Engr. Hdbk, Sec 4
Hydrology, Chap. 15

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Sylvan Lake Dam	10	SM	4/13/79	1800-005-114

$L_2 = 0.3 \times 5280 = 1584$ ft ✓B 9/21/79



Assuming $A = 24$ ft^2

$P \approx 16$ ft

$n = 0.05$

$$R = \frac{A}{P} = \frac{24}{16} = 1.5$$

$$C = \frac{1.49}{0.05} 1.5^{1/6} = 31.8$$

$$S_2 = \frac{\Delta H}{L_2} = \frac{20}{1584} = 0.012$$

$$V_2 = 31.8 \sqrt{1.5 \times 0.012} = 4.3 \text{ fps}$$

$$T_c = \frac{2640}{0.5} + \frac{1584}{4.3} = 5648 \text{ sec} = 1.57 \text{ hr.}$$

$$T_c = 0.6\, T_c = \underline{0.94 \text{ hr.}}$$

The two SCS approaches for computing T_c give results of 1.18 hr and 0.94 hr.

$\therefore$ USE $T_c = 1.0$ hr (since BPR method seems more appropriate for basins > 10 sq. mi.)

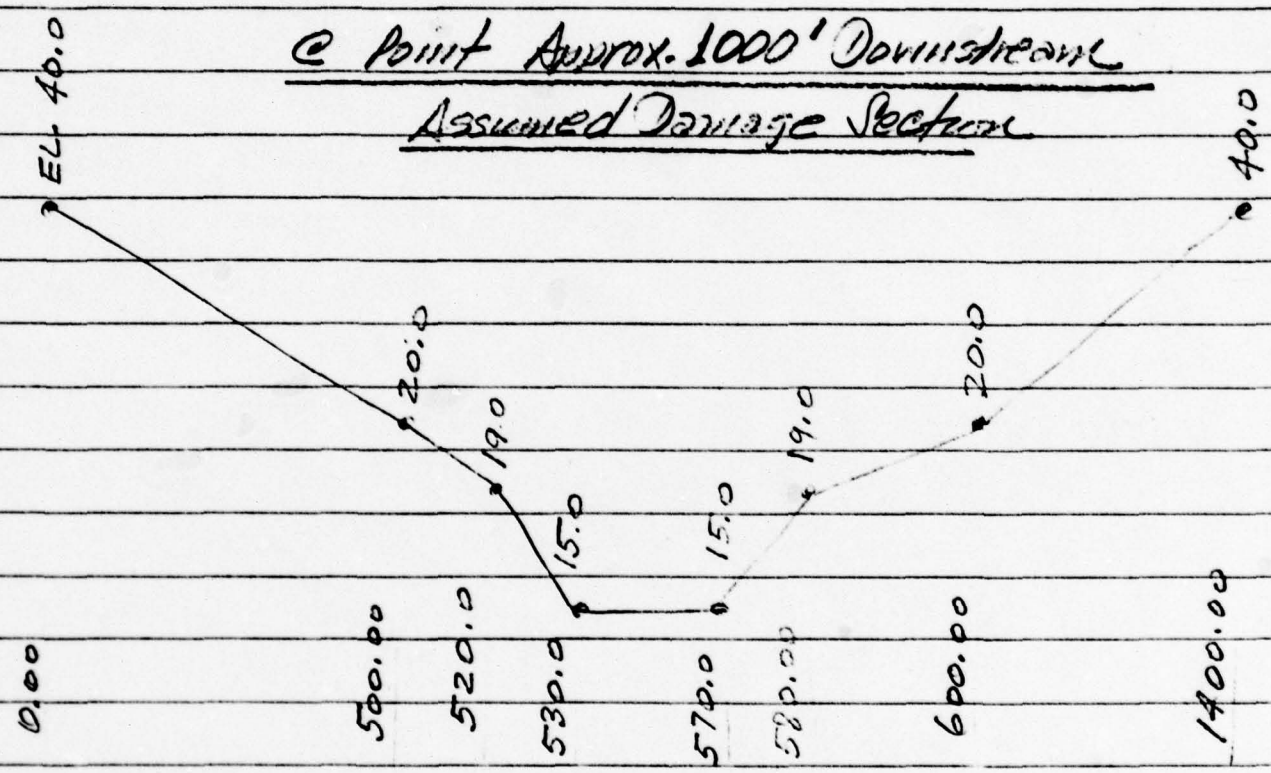
O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
Sylvan Lake Dam	11	SM	5/2/79 (Rev 5/15/79)	800-005-114

X- D/S OF SYLVAN LAKE DAM

@ Point Approx. 1000' Downstream

Assumed Damage Section



Reservoir Drawdown

Since the structure does not have a reservoir drain system, the only way Sylvan Lake could be drawn down is by pumping.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  20 FEB 79
**********

RUN  DATE= 07/20/79.
     TIME= 11.57.50.
```

NATIONAL DAM INSPECTION PROGRAM
SYLVAN LAKE DAM
PMF HYDROGRAPH

JOB SPECIFICATION

NO	NMIN	IDAY	IHR	IMIN	METRIC	IPLT	IPRT	NSTAN
300	15	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS=	.05	.10	.15	.20	.25	.30	.40	.50	1.00

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO SYLVAN LAKE

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
INFLOW= 0	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNO=	ISAME	LOCAL
1	2	.90	0.00	.90	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.50	113.00	124.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMA	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 1.00

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 22 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 1.00 VOL= 1.00

46.	147.	290.	380.	380.	322.	237.	157.	108.	77.	53.
37.	26.	18.	13.	9.	6.	4.	3.	2.	1.	0.

END-OF-PERIOD FLOW

Sh 12

MO.DA	HH.MM	PERIOD	MAIN	EACS	LOSS	COMP Q
1.01	.15	1	.00	0.00	.00	1.
1.01	.30	2	.00	0.00	.00	1.
1.01	.45	3	.00	0.00	.00	1.
1.01	1.00	4	.00	0.00	.00	1.
1.01	1.15	5	.00	0.00	.00	1.
1.01	1.30	6	.00	0.00	.00	1.
1.01	1.45	7	.00	0.00	.00	1.
1.01	2.00	8	.00	0.00	.00	1.
1.01	2.15	9	.00	0.00	.00	1.
1.01	2.30	10	.00	0.00	.00	1.
1.01	2.45	11	.00	0.00	.00	1.
1.01	3.00	12	.00	0.00	.00	1.
1.01	3.15	13	.00	0.00	.00	1.
1.01	3.30	14	.00	0.00	.00	1.
1.01	3.45	15	.00	0.00	.00	0.
1.01	4.00	16	.00	0.00	.00	0.
1.01	4.15	17	.00	0.00	.00	0.
1.01	4.30	18	.00	0.00	.00	0.
1.01	4.45	19	.00	0.00	.00	0.
1.01	5.00	20	.00	0.00	.00	0.
1.01	5.15	21	.00	0.00	.00	0.
1.01	5.30	22	.00	0.00	.00	0.
1.01	5.45	23	.00	0.00	.00	0.
1.01	6.00	24	.00	0.00	.00	0.
1.01	6.15	25	.01	0.00	.01	0.
1.01	6.30	26	.01	0.00	.01	0.
1.01	6.45	27	.01	0.00	.01	0.
1.01	7.00	28	.01	0.00	.01	0.
1.01	7.15	29	.01	0.00	.01	0.
1.01	7.30	30	.01	0.00	.01	0.
1.01	7.45	31	.01	0.00	.01	0.
1.01	8.00	32	.01	0.00	.01	0.
1.01	8.15	33	.01	0.00	.01	0.
1.01	8.30	34	.01	0.00	.01	0.
1.01	8.45	35	.01	0.00	.01	0.
1.01	9.00	36	.01	0.00	.01	0.
1.01	9.15	37	.01	0.00	.01	0.
1.01	9.30	38	.01	0.00	.01	0.
1.01	9.45	39	.01	0.00	.01	0.
1.01	10.00	40	.01	0.00	.01	0.
1.01	10.15	41	.01	0.00	.01	0.
1.01	10.30	42	.01	0.00	.01	0.
1.01	10.45	43	.01	0.00	.01	0.
1.01	11.00	44	.01	0.00	.01	0.
1.01	11.15	45	.01	0.00	.01	0.
1.01	11.30	46	.01	0.00	.01	0.
1.01	11.45	47	.01	0.00	.01	0.
1.01	12.00	48	.01	0.00	.01	0.
1.01	12.15	49	.04	0.00	.04	0.
1.01	12.30	50	.04	0.00	.04	0.
1.01	12.45	51	.04	0.00	.04	0.
1.01	13.00	52	.04	0.00	.04	0.
1.01	13.15	53	.05	0.00	.05	0.
1.01	13.30	54	.05	0.00	.05	0.
1.01	13.45	55	.05	0.00	.05	0.
1.01	14.00	56	.05	0.00	.05	0.
1.01	14.15	57	.06	0.00	.06	0.
1.01	14.30	58	.06	0.00	.06	0.
1.01	14.45	59	.06	0.00	.06	0.
1.01	15.00	60	.06	0.00	.06	0.
1.02	13.45	151	.64	.62	.01	1027.
1.02	14.00	152	.64	.62	.01	1137.
1.02	14.15	153	.80	.78	.01	1233.
1.02	14.30	154	.80	.78	.01	1325.
1.02	14.45	155	.80	.78	.01	1421.
1.02	15.00	156	.80	.78	.01	1514.
1.02	15.15	157	.81	.79	.01	1598.
1.02	15.30	158	1.61	1.60	.01	1705.
1.02	15.45	159	4.52	4.51	.01	2010.
1.02	16.00	160	1.13	1.12	.01	2556.
1.02	16.15	161	.74	.73	.01	3233.
1.02	16.30	162	.74	.73	.01	3001.
1.02	16.45	163	.74	.73	.01	3577.
1.02	17.00	164	.74	.73	.01	3278.
1.02	17.15	165	.58	.57	.01	2855.
1.02	17.30	166	.58	.57	.01	2451.
1.02	17.45	167	.58	.57	.01	2101.
1.02	18.00	168	.58	.57	.01	1943.
1.02	18.15	169	.04	.03	.01	1740.
1.02	18.30	170	.04	.03	.01	1528.
1.02	18.45	171	.04	.03	.01	1272.
1.02	19.00	172	.04	.03	.01	1000.
1.02	19.15	173	.04	.03	.01	748.
1.02	19.30	174	.04	.03	.01	541.
1.02	19.45	175	.04	.03	.01	390.
1.02	20.00	176	.04	.03	.01	289.
1.02	20.15	177	.04	.03	.01	220.
1.02	20.30	178	.04	.03	.01	178.
1.02	20.45	179	.04	.03	.01	166.
1.02	21.00	180	.04	.03	.01	155.
1.02	21.15	181	.04	.03	.01	144.
1.02	21.30	182	.04	.03	.01	135.
1.02	21.45	183	.04	.03	.01	126.
1.02	22.00	184	.04	.03	.01	117.
1.02	22.15	185	.04	.03	.01	109.
1.02	22.30	186	.04	.03	.01	102.
1.02	22.45	187	.04	.03	.01	95.
1.02	23.00	188	.04	.03	.01	89.
1.02	23.15	189	.04	.03	.01	83.
1.02	23.30	190	.04	.03	.01	77.
1.02	23.45	191	.04	.03	.01	72.
1.03	0.00	192	.04	.03	.01	67.
1.03	.15	193	0.00	0.00	0.00	63.
1.03	.30	194	0.00	0.00	0.00	59.
1.03	.45	195	0.00	0.00	0.00	55.
1.03	1.00	196	0.00	0.00	0.00	51.
1.03	1.15	197	0.00	0.00	0.00	48.
1.03	1.30	198	0.00	0.00	0.00	44.
1.03	1.45	199	0.00	0.00	0.00	41.
1.03	2.00	200	0.00	0.00	0.00	39.
1.03	2.15	201	0.00	0.00	0.00	36.
1.03	2.30	202	0.00	0.00	0.00	34.
1.03	2.45	203	0.00	0.00	0.00	31.
1.03	3.00	204	0.00	0.00	0.00	29.
1.03	3.15	205	0.00	0.00	0.00	27.
1.03	3.30	206	0.00	0.00	0.00	26.
1.03	3.45	207	0.00	0.00	0.00	24.
1.03	4.00	208	0.00	0.00	0.00	22.
1.03	4.15	209	0.00	0.00	0.00	21.
1.03	4.30	210	0.00	0.00	0.00	19.

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1.01	15.15	81	.06	0.00	.06	0.	1.03	4.45	211	0.00	0.00	0.00	18.
1.01	15.30	82	.12	0.00	.12	0.	1.03	5.00	212	0.00	0.00	0.00	17.
1.01	15.45	83	.34	.31	.03	14.	1.03	5.15	213	0.00	0.00	0.00	16.
1.01	16.00	84	.09	.07	.01	49.	1.03	5.30	214	0.00	0.00	0.00	15.
1.01	16.15	85	.06	.04	.01	105.	1.03	5.45	215	0.00	0.00	0.00	14.
1.01	16.30	86	.06	.04	.01	148.	1.03	6.00	216	0.00	0.00	0.00	13.
1.01	16.45	87	.06	.04	.01	108.	1.03	6.15	217	0.00	0.00	0.00	12.
1.01	17.00	88	.06	.04	.01	106.	1.03	6.30	218	0.00	0.00	0.00	11.
1.01	17.15	89	.04	.03	.01	151.	1.03	6.45	219	0.00	0.00	0.00	10.
1.01	17.30	90	.04	.03	.01	133.	1.03	7.00	220	0.00	0.00	0.00	10.
1.01	17.45	91	.04	.03	.01	116.	1.03	7.15	221	0.00	0.00	0.00	9.
1.01	18.00	92	.04	.03	.01	108.	1.03	7.30	222	0.00	0.00	0.00	8.
1.01	18.15	93	.00	0.00	.00	97.	1.03	7.45	223	0.00	0.00	0.00	8.
1.01	18.30	94	.00	0.00	.00	85.	1.03	8.00	224	0.00	0.00	0.00	7.
1.01	18.45	95	.00	0.00	.00	70.	1.03	8.15	225	0.00	0.00	0.00	7.
1.01	19.00	96	.00	0.00	.00	54.	1.03	8.30	226	0.00	0.00	0.00	6.
1.01	19.15	97	.00	0.00	.00	40.	1.03	8.45	227	0.00	0.00	0.00	6.
1.01	19.30	98	.00	0.00	.00	28.	1.03	9.00	228	0.00	0.00	0.00	6.
1.01	19.45	99	.00	0.00	.00	19.	1.03	9.15	229	0.00	0.00	0.00	5.
1.01	20.00	80	.00	0.00	.00	13.	1.03	9.30	230	0.00	0.00	0.00	5.
1.01	20.15	81	.00	0.00	.00	9.	1.03	9.45	231	0.00	0.00	0.00	5.
1.01	20.30	82	.00	0.00	.00	8.	1.03	10.00	232	0.00	0.00	0.00	4.
1.01	20.45	83	.00	0.00	.00	7.	1.03	10.15	233	0.00	0.00	0.00	4.
1.01	21.00	84	.00	0.00	.00	7.	1.03	10.30	234	0.00	0.00	0.00	4.
1.01	21.15	85	.00	0.00	.00	7.	1.03	10.45	235	0.00	0.00	0.00	3.
1.01	21.30	86	.00	0.00	.00	6.	1.03	11.00	236	0.00	0.00	0.00	3.
1.01	21.45	87	.00	0.00	.00	6.	1.03	11.15	237	0.00	0.00	0.00	3.
1.01	22.00	88	.00	0.00	.00	5.	1.03	11.30	238	0.00	0.00	0.00	3.
1.01	22.15	89	.00	0.00	.00	5.	1.03	11.45	239	0.00	0.00	0.00	3.
1.01	22.30	90	.00	0.00	.00	5.	1.03	12.00	240	0.00	0.00	0.00	2.
1.01	22.45	91	.00	0.00	.00	4.	1.03	12.15	241	0.00	0.00	0.00	2.
1.01	23.00	92	.00	0.00	.00	4.	1.03	12.30	242	0.00	0.00	0.00	2.
1.01	23.15	93	.00	0.00	.00	4.	1.03	12.45	243	0.00	0.00	0.00	2.
1.01	23.30	94	.00	0.00	.00	3.	1.03	13.00	244	0.00	0.00	0.00	2.
1.01	23.45	95	.00	0.00	.00	3.	1.03	13.15	245	0.00	0.00	0.00	2.
1.02	0.00	96	.00	0.00	.00	3.	1.03	13.30	246	0.00	0.00	0.00	2.
1.02	.15	97	.03	.01	.01	3.	1.03	13.45	247	0.00	0.00	0.00	1.
1.02	.30	98	.03	.01	.01	3.	1.03	14.00	248	0.00	0.00	0.00	1.
1.02	.45	99	.03	.01	.01	6.	1.03	14.15	249	0.00	0.00	0.00	1.
1.02	1.00	100	.03	.01	.01	11.	1.03	14.30	250	0.00	0.00	0.00	1.
1.02	1.15	101	.03	.01	.01	16.	1.03	14.45	251	0.00	0.00	0.00	1.
1.02	1.30	102	.03	.01	.01	20.	1.03	15.00	252	0.00	0.00	0.00	1.
1.02	1.45	103	.03	.01	.01	23.	1.03	15.15	253	0.00	0.00	0.00	1.
1.02	2.00	104	.03	.01	.01	25.	1.03	15.30	254	0.00	0.00	0.00	1.
1.02	2.15	105	.03	.01	.01	26.	1.03	15.45	255	0.00	0.00	0.00	1.
1.02	2.30	106	.03	.01	.01	27.	1.03	16.00	256	0.00	0.00	0.00	1.
1.02	2.45	107	.03	.01	.01	28.	1.03	16.15	257	0.00	0.00	0.00	1.
1.02	3.00	108	.03	.01	.01	28.	1.03	16.30	258	0.00	0.00	0.00	1.
1.02	3.15	109	.03	.01	.01	28.	1.03	16.45	259	0.00	0.00	0.00	1.
1.02	3.30	110	.03	.01	.01	29.	1.03	17.00	260	0.00	0.00	0.00	1.
1.02	3.45	111	.03	.01	.01	29.	1.03	17.15	261	0.00	0.00	0.00	1.
1.02	4.00	112	.03	.01	.01	29.	1.03	17.30	262	0.00	0.00	0.00	1.
1.02	4.15	113	.03	.01	.01	29.	1.03	17.45	263	0.00	0.00	0.00	0.
1.02	4.30	114	.03	.01	.01	29.	1.03	18.00	264	0.00	0.00	0.00	0.
1.02	4.45	115	.03	.01	.01	29.	1.03	18.15	265	0.00	0.00	0.00	0.
1.02	5.00	116	.03	.01	.01	29.	1.03	18.30	266	0.00	0.00	0.00	0.
1.02	5.15	117	.03	.01	.01	29.	1.03	18.45	267	0.00	0.00	0.00	0.
1.02	5.30	118	.03	.01	.01	29.	1.03	19.00	268	0.00	0.00	0.00	0.
1.02	5.45	119	.03	.01	.01	29.	1.03	19.15	269	0.00	0.00	0.00	0.
1.02	6.00	120	.03	.01	.01	29.	1.03	19.30	270	0.00	0.00	0.00	0.
1.02	6.15	121	.09	.07	.01	32.	1.03	19.45	271	0.00	0.00	0.00	0.
1.02	6.30	122	.09	.07	.01	41.	1.03	20.00	272	0.00	0.00	0.00	0.

Sh 14

1.02	0.45	123	.04	.01	.01	54.	1.03	20.15	273	0.00	0.00	0.00	0.
1.02	1.00	124	.04	.01	.01	82.	1.03	20.30	274	0.00	0.00	0.00	0.
1.02	1.15	125	.04	.01	.01	105.	1.03	20.45	275	0.00	0.00	0.00	0.
1.02	1.30	126	.04	.01	.01	125.	1.03	21.00	276	0.00	0.00	0.00	0.
1.02	1.45	127	.04	.01	.01	140.	1.03	21.15	277	0.00	0.00	0.00	0.
1.02	2.00	128	.04	.01	.01	149.	1.03	21.30	278	0.00	0.00	0.00	0.
1.02	2.15	129	.04	.01	.01	156.	1.03	21.45	279	0.00	0.00	0.00	0.
1.02	2.30	130	.04	.01	.01	160.	1.03	22.00	280	0.00	0.00	0.00	0.
1.02	2.45	131	.04	.01	.01	164.	1.03	22.15	281	0.00	0.00	0.00	0.
1.02	3.00	132	.04	.01	.01	166.	1.03	22.30	282	0.00	0.00	0.00	0.
1.02	3.15	133	.04	.01	.01	168.	1.03	22.45	283	0.00	0.00	0.00	0.
1.02	3.30	134	.04	.01	.01	169.	1.03	23.00	284	0.00	0.00	0.00	0.
1.02	3.45	135	.04	.01	.01	169.	1.03	23.15	285	0.00	0.00	0.00	0.
1.02	10.00	136	.04	.01	.01	170.	1.03	23.30	286	0.00	0.00	0.00	0.
1.02	10.15	137	.04	.01	.01	170.	1.03	23.45	287	0.00	0.00	0.00	0.
1.02	10.30	138	.04	.01	.01	171.	1.04	0.00	288	0.00	0.00	0.00	0.
1.02	10.45	139	.04	.01	.01	171.	1.04	.15	289	0.00	0.00	0.00	0.
1.02	11.00	140	.04	.01	.01	171.	1.04	.30	290	0.00	0.00	0.00	0.
1.02	11.15	141	.04	.01	.01	171.	1.04	.45	291	0.00	0.00	0.00	0.
1.02	11.30	142	.04	.01	.01	171.	1.04	1.00	292	0.00	0.00	0.00	0.
1.02	11.45	143	.04	.01	.01	171.	1.04	1.15	293	0.00	0.00	0.00	0.
1.02	12.00	144	.04	.01	.01	171.	1.04	1.30	294	0.00	0.00	0.00	0.
1.02	12.15	145	.53	.32	.01	192.	1.04	1.45	295	0.00	0.00	0.00	0.
1.02	12.30	146	.53	.32	.01	257.	1.04	2.00	296	0.00	0.00	0.00	0.
1.02	12.45	147	.53	.32	.01	369.	1.04	2.15	297	0.00	0.00	0.00	0.
1.02	13.00	148	.53	.32	.01	558.	1.04	2.30	298	0.00	0.00	0.00	0.
1.02	13.15	149	.84	.62	.01	731.	1.04	2.45	299	0.00	0.00	0.00	0.
1.02	13.30	150	.84	.62	.01	890.	1.04	3.00	300	0.00	0.00	0.00	0.
									SUM	20.70	24.30	2.39	57670.
										(676.)	(617.)	(61.)	(1633.03)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3001.	1908.	577.	200.	57677.
CMS	102.	54.	16.	6.	1633.
INCHES		19.72	23.85	24.84	24.84
MM		500.93	605.82	630.91	630.92
AC-FT		940.	1144.	1192.	1192.
THOUS CU M		1161.	1411.	1470.	1470.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HIIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	180.	95.	29.	10.	2884.
CMS	5.	3.	1.	0.	82.
INCHES		.99	1.19	1.24	1.24
MM		25.05	30.29	31.55	31.55
AC-FT		47.	57.	60.	60.
THOUS CU M		58.	71.	73.	73.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HIIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	300.	191.	58.	20.	5768.
CMS	10.	5.	2.	1.	163.
INCHES		1.97	2.39	2.48	2.48
MM		50.09	60.58	63.09	63.09
AC-FT		95.	114.	119.	119.

Sh 15

THOUS CU M		111.	141.	141.	141.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HYD 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	340.	266.	87.	30.	8852.
CMS	10.	8.	2.	1.	245.
INCHES		2.90	3.58	3.73	3.73
MM		73.14	90.87	94.84	94.84
AC-FT		142.	172.	179.	179.
THOUS CU M		175.	212.	220.	220.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HYD 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	120.	382.	115.	40.	11535.
CMS	20.	11.	3.	1.	327.
INCHES		3.44	4.77	4.97	4.97
MM		100.19	121.16	126.18	126.18
AC-FT		189.	229.	238.	238.
THOUS CU M		233.	282.	294.	294.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HYD 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	900.	477.	144.	50.	14419.
CMS	25.	14.	4.	1.	408.
INCHES		4.93	5.96	6.21	6.21
MM		125.23	151.45	157.73	157.73
AC-FT		237.	286.	298.	298.
THOUS CU M		292.	353.	367.	367.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HYD 6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1080.	572.	173.	60.	17303.
CMS	31.	16.	5.	2.	490.
INCHES		5.92	7.16	7.45	7.45
MM		150.28	181.75	189.21	189.28
AC-FT		284.	343.	357.	358.
THOUS CU M		350.	423.	441.	441.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HYD 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1441.	763.	231.	80.	23071.
CMS	41.	22.	7.	2.	653.
INCHES		7.89	9.54	9.94	9.94
MM		200.37	242.33	252.30	252.31
AC-FT		378.	458.	477.	477.
THOUS CU M		467.	565.	588.	588.

Sh 16

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HYD 8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1801.	954.	208.	100.	20838.
CMS	51.	27.	6.	3.	817.
INCHES		4.88	11.93	12.42	12.42
MM		250.48	302.91	315.48	315.48
AC-FT		473.	572.	596.	596.
THOUS CU M		584.	706.	735.	735.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, HYD 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3001.	1908.	577.	200.	57677.
CMS	102.	54.	16.	6.	1633.
INCHES		19.72	23.85	24.84	24.84
MM		500.93	605.82	630.91	630.92
AC-FT		946.	1144.	1192.	1192.
THOUS CU M		1167.	1411.	1470.	1470.

HYDROGRAPH ROUTING

ROUTING THROUGH SYLVAN LAKE

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OUTFLO	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-35.	-1

STAGE	35.30	36.00	36.50	37.00	38.00	39.00	40.00	41.00	42.00	43.00
FLOW	0.00	15.00	35.00	63.00	140.00	218.00	274.00	321.00	363.00	397.00
SURFACE AREA=	0.	20.	28.	46.						
CAPACITY=	0.	100.	102.	781.						
ELEVATION=	21.	30.	34.	50.						

CREL	SPILLD	COOR	EXPW	ELEVL	COOL	CAREA	EXPL
35.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
50.0	0.0	0.0	0.

CREST LENGTH AT OR BELOW	0.	380.	740.	940.

Sh 17

ELEVATION 38.6 39.5 40.3 40.8

STATION OUTFLOW PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	2.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	2.	2.
2.	2.	2.	3.	3.	3.	3.	3.	3.	3.
3.	4.	4.	4.	4.	4.	4.	5.	5.	6.
7.	8.	9.	11.	12.	13.	15.	17.	20.	24.
29.	34.	41.	48.	53.	57.	60.	62.	64.	65.
66.	65.	64.	62.	60.	58.	56.	53.	51.	49.
47.	45.	43.	41.	39.	37.	36.	34.	33.	32.
31.	30.	29.	28.	27.	26.	25.	24.	23.	23.
22.	21.	20.	19.	19.	18.	17.	17.	16.	15.
15.	15.	14.	14.	14.	13.	13.	13.	13.	12.
12.	12.	12.	11.	11.	11.	11.	10.	10.	10.
10.	9.	9.	9.	9.	9.	8.	8.	8.	8.
8.	8.	7.	7.	7.	7.	7.	7.	6.	6.
6.	6.	6.	6.	6.	6.	5.	5.	5.	5.
5.	5.	5.	5.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

STORAGE

81.	81.	81.	81.	87.	81.	81.	81.	87.	87.
81.	87.	81.	81.	87.	81.	81.	81.	81.	87.
81.	81.	81.	81.	87.	81.	81.	87.	87.	87.
87.	81.	81.	81.	87.	81.	81.	87.	87.	87.
81.	87.	81.	81.	87.	81.	81.	81.	87.	87.
81.	87.	81.	81.	87.	81.	81.	87.	87.	87.
81.	81.	81.	81.	87.	81.	81.	87.	87.	87.
88.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	89.	89.	89.	89.	89.	89.	89.	89.	90.
90.	90.	90.	90.	90.	90.	90.	91.	91.	92.
93.	94.	95.	96.	97.	98.	100.	101.	103.	105.
107.	110.	113.	115.	118.	119.	120.	121.	122.	122.
122.	122.	122.	121.	120.	119.	118.	118.	117.	116.
115.	114.	113.	113.	112.	111.	111.	110.	109.	109.
108.	108.	107.	107.	106.	106.	105.	105.	104.	104.
103.	103.	103.	102.	102.	102.	101.	101.	101.	100.
100.	100.	99.	99.	99.	99.	98.	98.	98.	98.
97.	97.	97.	97.	96.	96.	96.	96.	96.	95.

Sh 18

95.	95.	95.	95.	94.	94.	94.	94.	94.	94.
93.	93.	93.	93.	93.	93.	93.	92.	92.	92.
92.	92.	92.	92.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	89.	89.	89.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	88.	88.	88.	88.	88.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.6	35.6
35.6	35.7	35.7	35.8	35.9	35.9	36.0	36.1	36.1	36.2
36.3	36.5	36.6	36.7	36.8	36.9	37.0	37.0	37.0	37.0
37.0	37.0	37.0	37.0	36.9	36.9	36.9	36.8	36.8	36.7
36.7	36.7	36.6	36.6	36.6	36.5	36.5	36.5	36.5	36.4
36.4	36.4	36.3	36.3	36.3	36.3	36.3	36.2	36.2	36.2
36.2	36.1	36.1	36.1	36.1	36.1	36.1	36.0	36.0	36.0
36.0	36.0	36.0	36.0	35.9	35.9	35.9	35.9	35.9	35.9
35.9	35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4

PEAK OUTFLOW IS 66. AT TIME 42.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	66.	54.	26.	19.	2808.
CMS	2.	2.	1.	0.	80.
INCHES		.55	1.05	1.21	1.21
MM		14.05	26.79	30.71	30.71
AC-FT		27.	51.	58.	58.
THOUS CU M		33.	62.	72.	72.

STATION OUTFLOW PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Sh A

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	2.	2.
2.	2.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	3.	3.	3.	3.	3.	4.	4.
4.	5.	5.	5.	5.	6.	6.	6.	6.	7.
7.	7.	7.	8.	8.	8.	9.	10.	11.	12.
14.	17.	21.	26.	30.	34.	40.	47.	54.	63.
77.	95.	111.	125.	136.	144.	149.	152.	154.	155.
154.	152.	148.	143.	137.	131.	125.	118.	112.	106.
100.	95.	90.	85.	80.	75.	71.	67.	63.	60.
58.	55.	53.	50.	48.	46.	44.	42.	40.	38.
36.	35.	34.	32.	31.	30.	29.	28.	27.	26.
25.	24.	23.	22.	22.	21.	20.	19.	19.	18.
17.	17.	16.	15.	15.	15.	14.	14.	14.	13.
13.	13.	13.	12.	12.	12.	11.	11.	11.	11.
11.	10.	10.	10.	10.	9.	9.	9.	9.	9.
8.	8.	8.	8.	8.	8.	7.	7.	7.	7.
7.	7.	6.	6.	6.	6.	6.	6.	6.	5.
5.	5.	5.	5.	5.	5.	5.	5.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	86.	88.	88.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.	88.	88.	88.	88.
88.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	88.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.	89.	90.	90.	90.
90.	91.	91.	91.	91.	92.	92.	92.	92.	92.
93.	93.	93.	93.	93.	94.	94.	95.	96.	98.
99.	101.	103.	105.	108.	110.	112.	115.	118.	121.
126.	131.	136.	141.	145.	147.	149.	150.	151.	151.
151.	150.	149.	147.	145.	143.	141.	139.	137.	135.
133.	131.	130.	128.	127.	125.	124.	123.	121.	120.
119.	118.	117.	116.	115.	115.	114.	113.	112.	112.
111.	110.	110.	109.	108.	108.	107.	107.	106.	106.
105.	105.	104.	104.	103.	103.	103.	102.	102.	101.
101.	101.	100.	100.	100.	100.	99.	99.	99.	98.
98.	98.	98.	97.	97.	97.	97.	97.	96.	96.
96.	96.	95.	95.	95.	95.	95.	94.	94.	94.
94.	94.	94.	93.	93.	93.	93.	93.	93.	93.
92.	92.	92.	92.	92.	92.	92.	92.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.

Sh 20

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.7	35.7	35.7	35.7	35.7	35.8	35.9
36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	37.0
37.2	37.4	37.6	37.8	38.0	38.1	38.1	38.2	38.2	38.2
38.2	38.1	38.1	38.0	38.0	37.9	37.8	37.7	37.6	37.6
37.5	37.4	37.3	37.3	37.2	37.2	37.1	37.1	37.0	37.0
36.9	36.9	36.8	36.8	36.7	36.7	36.7	36.6	36.6	36.6
36.5	36.5	36.5	36.4	36.4	36.4	36.4	36.3	36.3	36.3
36.3	36.2	36.2	36.2	36.2	36.1	36.1	36.1	36.1	36.1
36.1	36.0	36.0	36.0	36.0	36.0	36.0	36.0	35.9	35.9
35.9	35.9	35.9	35.9	35.9	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.7	35.7	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4

PEAK OUTFLOW IS 155. AT TIME 42.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	155.	125.	53.	20.	5667.
CMS	4.	4.	2.	1.	160.
INCHES		1.29	2.19	2.44	2.44
MM		32.76	55.64	61.99	61.99
AC-FT		62.	105.	117.	117.
THOUS CU M		76.	130.	144.	144.

STATION OUTFLOW PLAN 1, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	2.	2.	3.
3.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	4.	4.	4.	4.	4.	5.	5.	5.	6.
6.	7.	7.	8.	8.	8.	9.	9.	10.	10.
10.	11.	11.	11.	12.	12.	13.	14.	17.	21.

Sh 21

20.	31.	31.	43.	53.	67.	73.	84.	97.	112.
132.	154.	171.	197.	232.	261.	281.	292.	288.	277.
201.	241.	222.	205.	193.	184.	176.	168.	160.	152.
144.	137.	130.	123.	118.	114.	104.	99.	93.	88.
83.	78.	74.	70.	66.	62.	59.	57.	54.	52.
49.	47.	45.	43.	41.	39.	37.	35.	34.	33.
32.	31.	30.	29.	28.	27.	26.	25.	24.	23.
22.	21.	20.	20.	19.	18.	18.	17.	16.	16.
15.	15.	14.	14.	14.	13.	13.	13.	13.	12.
12.	12.	12.	11.	11.	11.	11.	10.	10.	10.
10.	10.	9.	9.	9.	9.	8.	8.	8.	8.
8.	8.	7.	7.	7.	7.	7.	7.	6.	6.
6.	6.	6.	6.	6.	5.	5.	5.	5.	5.
5.	5.	5.	5.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	3.	3.	3.	3.	3.

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	88.	88.	89.	89.
89.	90.	90.	90.	90.	90.	91.	91.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	89.	89.	89.	89.	89.
89.	89.	89.	89.	89.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	91.	91.	91.	92.
92.	92.	93.	93.	94.	94.	94.	95.	95.	95.
96.	96.	96.	97.	97.	97.	98.	99.	101.	103.
106.	108.	111.	114.	118.	121.	124.	128.	132.	137.
143.	151.	158.	165.	170.	173.	175.	175.	175.	174.
173.	171.	169.	167.	164.	161.	158.	155.	153.	150.
147.	145.	142.	140.	138.	136.	134.	132.	131.	129.
128.	126.	125.	123.	122.	121.	120.	119.	118.	117.
116.	115.	114.	113.	113.	112.	111.	111.	110.	109.
109.	108.	108.	107.	106.	106.	105.	105.	104.	104.
104.	103.	103.	102.	102.	102.	101.	101.	101.	100.
100.	100.	99.	99.	99.	99.	98.	98.	98.	98.
97.	97.	97.	97.	96.	96.	96.	96.	96.	95.
95.	95.	95.	95.	94.	94.	94.	94.	94.	94.
93.	93.	93.	93.	93.	93.	93.	92.	92.	92.
92.	92.	92.	92.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	89.	89.	89.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.4	35.4	35.4	35.4
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.4	35.4	35.4
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
35.4	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.6	35.6

Sh 22

35.6	35.6	35.6	35.7	35.7	35.7	35.7	35.7	35.7	35.8
35.8	35.8	35.8	35.8	35.8	35.9	35.9	36.0	36.0	36.1
36.3	36.4	36.5	36.7	36.8	37.0	37.1	37.3	37.4	37.6
37.9	38.2	38.3	38.7	38.9	39.0	39.0	39.1	39.1	39.0
39.0	38.9	38.9	38.8	38.7	38.6	38.5	38.4	38.3	38.1
38.1	38.0	37.9	37.8	37.7	37.6	37.5	37.5	37.4	37.3
37.3	37.2	37.1	37.1	37.0	37.0	36.9	36.9	36.8	36.8
36.8	36.7	36.7	36.6	36.6	36.6	36.5	36.5	36.5	36.4
36.4	36.4	36.4	36.3	36.3	36.3	36.3	36.2	36.2	36.2
36.2	36.2	36.1	36.1	36.1	36.1	36.1	36.0	36.0	36.0
36.0	36.0	36.0	36.0	35.9	35.9	35.9	35.9	35.9	35.9
35.9	35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.4	35.4

PEAK OUTFLOW IS 292. AT TIME 42.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	292.	200.	81.	30.	8533.
CMS	8.	6.	2.	1.	242.
INCHES		2.06	3.35	3.61	3.61
MM		52.43	85.02	93.34	93.34
AC-FT		99.	161.	176.	176.
THOUS CU M		122.	198.	217.	217.

STATION OUTFLOW PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	2.	3.	3.	4.
4.	5.	5.	5.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	5.	5.	5.
5.	5.	5.	5.	5.	6.	6.	7.	7.	8.
8.	9.	10.	10.	11.	11.	12.	12.	13.	13.
14.	14.	14.	15.	16.	17.	19.	22.	26.	31.
38.	47.	57.	66.	82.	95.	109.	123.	138.	156.
181.	226.	255.	294.	259.	242.	206.	459.	419.	382.
345.	307.	272.	240.	215.	199.	188.	180.	171.	163.
156.	148.	141.	134.	127.	121.	114.	109.	103.	97.
92.	87.	82.	78.	73.	69.	65.	62.	59.	57.
54.	52.	50.	47.	45.	43.	41.	39.	38.	36.
34.	33.	32.	31.	30.	29.	28.	27.	26.	25.
24.	23.	22.	22.	21.	20.	19.	19.	18.	17.
17.	16.	15.	15.	15.	14.	14.	14.	13.	13.
13.	13.	12.	12.	12.	11.	11.	11.	11.	11.
10.	10.	10.	10.	9.	9.	9.	9.	9.	8.

Sh 23

8.	8.	8.	8.	7.	7.	7.	7.	7.	7.
7.	8.	8.	8.	8.	8.	8.	8.	5.	5.
5.	5.	5.	5.	5.	5.	5.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	3.	3.	3.

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	88.	88.	89.	89.	90.
90.	91.	91.	91.	92.	92.	92.	92.	92.	92.
92.	92.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	91.	91.	91.
91.	91.	91.	91.	91.	92.	92.	92.	93.	93.
94.	94.	95.	95.	96.	96.	97.	97.	98.	98.
99.	99.	99.	100.	100.	101.	102.	103.	106.	108.
112.	115.	119.	123.	127.	131.	136.	140.	145.	151.
160.	170.	179.	184.	186.	186.	184.	183.	181.	180.
176.	176.	174.	171.	168.	165.	163.	160.	157.	154.
151.	149.	146.	144.	142.	139.	137.	136.	134.	132.
130.	129.	127.	126.	125.	123.	122.	121.	120.	119.
118.	117.	116.	115.	114.	114.	113.	112.	111.	111.
110.	109.	109.	108.	108.	107.	107.	106.	106.	105.
105.	104.	104.	103.	103.	103.	102.	102.	101.	101.
101.	100.	100.	100.	100.	99.	99.	99.	98.	98.
98.	98.	97.	97.	97.	97.	97.	96.	96.	96.
96.	95.	95.	95.	95.	95.	95.	94.	94.	94.
94.	94.	93.	93.	93.	93.	93.	93.	93.	92.
92.	92.	92.	92.	92.	92.	92.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	90.	90.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	89.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.4	35.4	35.5	35.5	35.5
35.5	35.5	35.5	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.6	35.6	35.6	35.6	35.7
35.7	35.7	35.7	35.8	35.8	35.8	35.8	35.9	35.9	35.9
35.9	36.0	36.0	36.0	36.0	36.0	36.1	36.2	36.3	36.4
36.6	36.7	36.9	37.1	37.2	37.4	37.6	37.8	38.0	38.2
38.5	38.9	39.2	39.4	39.4	39.4	39.4	39.3	39.3	39.2
39.2	39.1	39.0	38.9	38.8	38.7	38.6	38.5	38.4	38.3
38.2	38.1	38.0	37.9	37.8	37.7	37.7	37.6	37.5	37.4
37.4	37.3	37.3	37.2	37.1	37.1	37.0	37.0	36.9	36.9
36.8	36.8	36.8	36.7	36.7	36.6	36.6	36.6	36.5	36.5
36.5	36.5	36.4	36.4	36.4	36.3	36.3	36.3	36.3	36.2
36.2	36.2	36.2	36.2	36.1	36.1	36.1	36.1	36.1	36.1
36.0	36.0	36.0	36.0	36.0	36.0	35.9	35.9	35.9	35.9

Sh24

35.4	35.4	35.4	35.4	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5

PEAK OUTFLOW IS 554. AT TIME 41.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	554.	291.	109.	44.	11408.
CMS	16.	8.	3.	1.	323.
INCHES		3.01	4.53	4.91	4.91
MM		76.51	114.95	124.76	124.74
AC-FT		145.	217.	238.	238.
THOUS CU M		178.	268.	293.	293.

STATION OUTFLOW PLAN 1, RATIO 5

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	2.	3.	4.	5.
6.	6.	6.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	6.	6.	6.
6.	6.	6.	6.	6.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	6.	6.	6.	6.	6.	6.
6.	6.	6.	6.	7.	7.	8.	8.	9.	10.
11.	11.	12.	12.	13.	14.	14.	15.	16.	17.
19.	19.	20.	21.	22.	23.	26.	29.	34.	43.
64.	84.	79.	95.	110.	120.	142.	158.	176.	201.
521.	734.	615.	784.	707.	629.	566.	512.	463.	
363.	315.	272.	238.	213.	197.	187.	179.	171.	
156.	149.	141.	135.	128.	122.	116.	110.	104.	
94.	89.	84.	80.	75.	71.	67.	63.	61.	
58.	55.	51.	49.	47.	45.	43.	41.	39.	
35.	34.	33.	32.	31.	30.	29.	28.	27.	
25.	24.	23.	22.	21.	21.	20.	19.	18.	
17.	16.	16.	15.	15.	15.	14.	14.	14.	
13.	13.	12.	12.	12.	12.	11.	11.	11.	
10.	10.	10.	10.	10.	9.	9.	9.	9.	
8.	8.	8.	8.	8.	7.	7.	7.	7.	
7.	7.	6.	6.	6.	6.	6.	6.	6.	
5.	5.	5.	5.	5.	5.	5.	5.	4.	
4.	4.	4.	4.	4.	4.	4.	4.	3.	

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.

Sh 25

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	88.	89.	89.	90.	91.
91.	92.	92.	93.	93.	93.	93.	93.	93.	93.
93.	93.	93.	93.	92.	92.	92.	92.	92.	92.
92.	92.	92.	92.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	91.	92.	92.	92.
92.	92.	92.	92.	92.	93.	93.	94.	95.	95.
96.	96.	97.	98.	98.	99.	99.	100.	101.	101.
102.	102.	103.	103.	104.	104.	105.	107.	110.	113.
117.	122.	126.	131.	136.	141.	147.	152.	156.	160.
176.	185.	190.	192.	192.	190.	188.	186.	185.	183.
181.	179.	177.	174.	171.	168.	165.	162.	159.	156.
154.	151.	149.	146.	144.	142.	140.	138.	136.	134.
133.	131.	129.	128.	126.	125.	124.	123.	122.	121.
119.	118.	118.	117.	116.	115.	114.	113.	113.	112.
111.	111.	110.	109.	109.	108.	108.	107.	106.	106.
105.	105.	105.	104.	104.	103.	103.	102.	102.	102.
101.	101.	101.	100.	100.	100.	100.	99.	99.	99.
98.	98.	98.	98.	97.	97.	97.	97.	97.	98.
98.	98.	98.	95.	95.	95.	95.	95.	94.	94.
94.	94.	94.	94.	93.	93.	93.	93.	93.	93.
93.	92.	92.	92.	92.	92.	92.	92.	92.	91.
91.	91.	91.	91.	91.	91.	91.	91.	91.	90.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.4	35.4	35.5	35.5	35.5
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.7	35.7	35.7	35.8
35.8	35.8	35.9	35.9	35.9	35.9	36.0	36.0	36.0	36.1
36.1	36.1	36.1	36.2	36.2	36.2	36.3	36.4	36.5	36.6
36.8	37.0	37.2	37.4	37.6	37.8	38.0	38.2	38.5	38.7
39.1	39.4	39.6	39.7	39.8	39.8	39.5	39.4	39.4	39.3
39.3	39.2	39.1	39.0	38.9	38.8	38.7	38.6	38.5	38.4
38.3	38.2	38.1	38.0	37.9	37.8	37.8	37.7	37.6	37.5
37.5	37.4	37.3	37.3	37.2	37.2	37.1	37.1	37.0	37.0
36.9	36.9	36.8	36.8	36.7	36.7	36.7	36.6	36.6	36.6
36.5	36.5	36.5	36.4	36.4	36.4	36.4	36.3	36.3	36.3
36.3	36.2	36.2	36.2	36.2	36.2	36.1	36.1	36.1	36.1
36.1	36.1	36.0	36.0	36.0	36.0	36.0	36.0	35.9	35.9
35.9	35.9	35.9	35.9	35.9	35.9	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.7	35.7	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5

PEAK OUTFLOW IS 815. AT TIME 41.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME

34 26

CFS	815.	387.	138.	50.	14280.
CMS	23.	11.	4.	1.	405.
INCHES		3.99	5.71	6.15	6.15
MM		101.47	145.07	156.20	156.27
AC-FT		192.	274.	295.	295.
THOUS CU M		236.	338.	364.	364.

STATION OUTFLO, PLAN 1, RATIO 6

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	2.	3.	4.	5.	6.
7.	7.	8.	8.	9.	9.	9.	9.	9.	9.
9.	8.	8.	8.	8.	8.	8.	8.	8.	7.
7.	7.	7.	7.	7.	7.	6.	6.	6.	6.
6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	8.	9.	9.	10.	11.	12.
12.	13.	14.	15.	16.	18.	19.	20.	21.	23.
24.	25.	26.	27.	28.	29.	32.	37.	45.	55.
58.	84.	102.	119.	137.	155.	173.	192.	236.	358.
540.	862.	1021.	1026.	946.	838.	740.	664.	600.	542.
492.	419.	358.	304.	262.	229.	207.	193.	185.	177.
169.	162.	155.	148.	141.	135.	128.	122.	116.	111.
105.	100.	95.	90.	85.	81.	76.	72.	68.	65.
62.	59.	57.	54.	52.	50.	48.	46.	44.	42.
40.	38.	36.	35.	34.	32.	31.	30.	29.	28.
27.	26.	25.	24.	24.	23.	22.	21.	20.	20.
19.	18.	18.	17.	16.	16.	15.	15.	14.	14.
14.	14.	13.	13.	13.	12.	12.	12.	12.	11.
11.	11.	11.	10.	10.	10.	10.	10.	9.	9.
9.	9.	9.	8.	8.	8.	8.	8.	7.	7.
7.	7.	7.	7.	6.	6.	6.	6.	6.	6.
6.	6.	5.	5.	5.	5.	5.	5.	5.	5.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	88.	89.	90.	91.	92.
92.	93.	93.	94.	94.	94.	94.	94.	94.	94.
94.	94.	94.	94.	94.	94.	93.	93.	93.	93.
93.	93.	93.	93.	92.	92.	92.	92.	92.	92.
92.	92.	92.	92.	92.	92.	92.	92.	92.	92.
92.	92.	92.	92.	92.	92.	92.	92.	93.	93.
93.	93.	93.	93.	94.	94.	95.	95.	96.	97.
98.	98.	99.	100.	101.	101.	102.	103.	103.	104.
104.	105.	106.	106.	107.	107.	109.	111.	114.	118.
123.	128.	133.	139.	145.	151.	157.	164.	171.	179.

Sh 27

197.	193.	190.	196.	195.	193.	191.	189.	187.	186.
184.	181.	179.	176.	173.	170.	167.	164.	161.	159.
156.	153.	151.	149.	146.	144.	142.	140.	138.	136.
134.	133.	131.	130.	128.	127.	125.	124.	123.	122.
121.	120.	119.	118.	117.	116.	115.	114.	114.	113.
112.	111.	111.	110.	110.	109.	108.	108.	107.	107.
106.	106.	105.	105.	104.	104.	104.	103.	103.	102.
102.	102.	101.	101.	101.	100.	100.	100.	99.	99.
99.	99.	98.	98.	98.	98.	97.	97.	97.	97.
96.	96.	96.	96.	96.	95.	95.	95.	95.	95.
94.	94.	94.	94.	94.	94.	93.	93.	93.	93.
93.	93.	93.	92.	92.	92.	92.	92.	92.	92.
92.	91.	91.	91.	91.	91.	91.	91.	91.	91.
90.	90.	90.	90.	90.	90.	90.	90.	90.	90.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.4	35.4	35.5	35.5	35.6
35.6	35.6	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.7	35.7	35.7	35.8	35.8	35.8
35.9	35.9	36.0	36.0	36.0	36.1	36.1	36.1	36.2	36.2
36.2	36.2	36.3	36.3	36.3	36.4	36.4	36.5	36.7	36.9
37.1	37.3	37.5	37.7	38.0	38.2	38.4	38.7	38.9	39.2
39.5	39.7	39.8	39.8	39.7	39.7	39.6	39.5	39.5	39.4
39.4	39.3	39.2	39.1	39.0	38.9	38.8	38.7	38.6	38.5
38.4	38.3	38.2	38.1	38.0	37.9	37.8	37.8	37.7	37.6
37.5	37.5	37.4	37.3	37.3	37.2	37.2	37.1	37.1	37.0
37.0	36.9	36.9	36.8	36.8	36.8	36.7	36.7	36.7	36.6
36.6	36.6	36.5	36.5	36.5	36.4	36.4	36.4	36.4	36.3
36.3	36.3	36.3	36.2	36.2	36.2	36.2	36.2	36.1	36.1
36.1	36.1	36.1	36.0	36.0	36.0	36.0	36.0	36.0	36.0
35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.7	35.7
35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.5	35.5	35.5	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5

PEAK OUTFLOW IS 1020. AT TIME 41.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1020.	483.	167.	60.	17160.
CMS	29.	14.	5.	2.	486.
INCHES		5.00	6.90	7.39	7.39
MM		126.90	175.21	187.71	187.71
AC-FT		240.	331.	355.	355.
THOUS CU M		296.	408.	437.	437.

Sh 28

STATION OUTFLOW PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	2.	4.	5.	7.	8.
9.	10.	10.	11.	11.	12.	12.	12.	12.	12.
11.	11.	11.	11.	11.	11.	10.	10.	10.	10.
10.	9.	9.	9.	9.	9.	9.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
9.	9.	10.	10.	11.	11.	12.	13.	14.	16.
18.	20.	22.	25.	25.	27.	28.	30.	31.	33.
34.	35.	37.	39.	41.	43.	48.	55.	65.	82.
102.	122.	143.	165.	187.	228.	325.	454.	599.	790.
1056.	1309.	1418.	1379.	1250.	1097.	962.	859.	776.	698.
617.	530.	445.	369.	308.	263.	229.	208.	194.	186.
179.	172.	165.	158.	152.	145.	139.	133.	127.	121.
116.	110.	105.	100.	95.	90.	86.	81.	77.	73.
69.	66.	62.	60.	58.	55.	53.	51.	49.	47.
45.	43.	41.	39.	37.	36.	34.	33.	32.	31.
30.	29.	28.	27.	26.	25.	24.	23.	23.	22.
21.	20.	19.	19.	18.	17.	17.	16.	16.	15.
15.	14.	14.	14.	13.	13.	13.	13.	12.	12.
12.	12.	11.	11.	11.	11.	10.	10.	10.	10.
10.	9.	9.	9.	9.	9.	8.	8.	8.	8.
8.	7.	7.	7.	7.	7.	7.	6.	6.	6.
6.	6.	6.	6.	6.	5.	5.	5.	5.	5.
5.	5.	5.	4.	4.	4.	4.	4.	4.	4.

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	88.	89.	90.	91.	92.	93.
94.	95.	96.	96.	97.	97.	97.	97.	97.	97.
97.	97.	96.	96.	96.	96.	96.	96.	95.	95.
95.	95.	95.	95.	94.	94.	94.	94.	94.	94.
94.	94.	94.	94.	94.	94.	94.	94.	94.	94.
94.	94.	94.	94.	94.	94.	94.	94.	95.	95.
95.	95.	95.	95.	96.	97.	97.	98.	99.	100.
101.	102.	103.	104.	105.	106.	107.	108.	108.	109.
110.	111.	111.	112.	113.	113.	115.	118.	122.	127.
133.	140.	147.	154.	162.	170.	177.	183.	187.	192.
197.	200.	202.	201.	199.	197.	195.	193.	191.	190.
188.	185.	182.	179.	176.	173.	170.	167.	164.	162.
159.	157.	154.	152.	150.	148.	146.	143.	142.	140.
138.	136.	134.	133.	131.	130.	128.	127.	126.	125.
123.	122.	121.	120.	119.	118.	117.	116.	116.	115.
114.	113.	113.	112.	111.	111.	110.	109.	109.	108.
108.	107.	107.	106.	106.	105.	105.	104.	104.	103.
103.	103.	102.	102.	102.	101.	101.	101.	100.	100.
100.	99.	99.	99.	99.	98.	98.	98.	98.	97.
97.	97.	97.	96.	96.	96.	96.	96.	95.	95.
95.	95.	95.	94.	94.	94.	94.	94.	94.	93.

Sh 29

93.	93.	93.	93.	93.	93.	92.	92.	92.	92.
92.	92.	92.	92.	91.	91.	91.	91.	91.	91.
91.	91.	91.	90.	90.	90.	90.	90.	90.	90.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.4	35.4	35.5	35.5	35.6	35.7
35.7	35.7	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.8	35.8	35.8	35.9	35.9	36.0	36.0
36.1	36.1	36.2	36.2	36.3	36.3	36.3	36.4	36.4	36.4
36.5	36.5	36.5	36.6	36.6	36.6	36.7	36.9	37.0	37.3
37.5	37.8	38.0	38.3	38.6	38.9	39.1	39.3	39.5	39.6
39.8	39.9	40.0	40.0	39.9	39.8	39.7	39.7	39.6	39.6
39.5	39.4	39.3	39.2	39.1	39.0	38.9	38.8	38.7	38.6
38.5	38.4	38.3	38.2	38.1	38.1	38.0	37.9	37.8	37.8
37.7	37.6	37.5	37.5	37.4	37.4	37.3	37.2	37.2	37.1
37.1	37.0	37.0	36.9	36.9	36.9	36.8	36.8	36.7	36.7
36.7	36.6	36.6	36.6	36.5	36.5	36.5	36.5	36.4	36.4
36.4	36.3	36.3	36.3	36.3	36.3	36.2	36.2	36.2	36.2
36.1	36.1	36.1	36.1	36.1	36.1	36.0	36.0	36.0	36.0
36.0	36.0	36.0	35.9	35.9	35.9	35.9	35.9	35.9	35.9
35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.5	35.5	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5

PEAK OUTFLOW IS 1418. AT TIME 40.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1418.	882.	224.	80.	22918.
CMS	40.	19.	6.	2.	649.
INCHES		1.05	9.28	9.87	9.87
MM		178.98	235.68	250.69	250.70
AC-FT		338.	445.	474.	474.
THOUS CU M		417.	549.	584.	584.

STATION OUTFLOW PLAN 1, RATIO 8

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	3.	5.	7.	8.	10.
11.	12.	13.	13.	14.	14.	15.	15.	15.	14.

Sh 30

14.	14.	14.	14.	13.	13.	13.	13.	12.	12.
12.	12.	12.	11.	11.	11.	11.	10.	10.	10.
10.	10.	10.	10.	10.	10.	10.	10.	10.	11.
11.	11.	11.	11.	11.	11.	11.	11.	11.	11.
11.	12.	12.	12.	13.	14.	16.	18.	20.	22.
25.	27.	29.	31.	33.	35.	38.	40.	43.	45.
47.	49.	51.	53.	54.	57.	62.	74.	90.	110.
132.	157.	186.	223.	331.	500.	648.	757.	874.	1075.
1362.	1674.	1760.	1721.	1549.	1354.	1186.	1058.	953.	854.
750.	639.	530.	432.	354.	295.	254.	224.	205.	194.
188.	180.	173.	167.	160.	154.	148.	142.	138.	130.
125.	119.	114.	109.	104.	99.	94.	90.	85.	81.
77.	73.	69.	66.	62.	60.	58.	55.	53.	51.
49.	47.	45.	43.	41.	39.	38.	36.	35.	33.
32.	31.	30.	29.	28.	27.	26.	25.	25.	24.
23.	22.	21.	20.	20.	19.	18.	18.	17.	16.
16.	15.	15.	14.	14.	14.	14.	13.	13.	13.
13.	12.	12.	12.	11.	11.	11.	11.	11.	10.
10.	10.	10.	9.	9.	9.	9.	9.	8.	8.
8.	8.	8.	8.	7.	7.	7.	7.	7.	7.
6.	6.	6.	6.	6.	6.	6.	5.	5.	5.
5.	5.	5.	5.	5.	5.	4.	4.	4.	4.

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	86.	89.	91.	92.	94.	95.
96.	97.	98.	99.	99.	99.	100.	100.	100.	99.
99.	99.	99.	99.	98.	98.	98.	98.	98.	97.
97.	97.	97.	97.	96.	96.	96.	96.	96.	96.
95.	95.	95.	96.	96.	96.	96.	96.	96.	96.
96.	96.	96.	96.	96.	96.	96.	97.	97.	97.
97.	97.	97.	98.	98.	99.	100.	101.	103.	104.
105.	106.	107.	108.	109.	110.	111.	112.	113.	114.
115.	116.	117.	117.	118.	119.	121.	125.	130.	136.
143.	152.	160.	169.	178.	184.	186.	191.	193.	197.
201.	205.	208.	208.	203.	201.	198.	197.	195.	193.
191.	188.	185.	182.	179.	175.	172.	169.	167.	164.
162.	160.	157.	155.	153.	151.	149.	147.	145.	143.
141.	139.	137.	136.	134.	132.	131.	130.	128.	127.
126.	124.	123.	122.	121.	120.	119.	118.	117.	117.
116.	115.	114.	113.	113.	112.	111.	111.	110.	110.
109.	108.	108.	107.	107.	106.	106.	105.	105.	104.
104.	104.	103.	103.	102.	102.	102.	101.	101.	101.
100.	100.	100.	100.	99.	99.	99.	98.	98.	98.
98.	97.	97.	97.	97.	97.	96.	96.	96.	96.
95.	95.	95.	95.	95.	95.	94.	94.	94.	94.
94.	93.	93.	93.	93.	93.	93.	93.	92.	92.
92.	92.	92.	92.	92.	92.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	90.	90.	90.	90.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3

Sh 31

35.3	35.3	35.3	35.3	35.4	35.4	35.5	35.6	35.7	35.7
35.8	35.9	35.9	35.9	36.0	36.0	36.0	36.0	36.0	36.0
36.0	36.0	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9
35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.9	35.9	35.9	36.0	36.0	36.1	36.1	36.2
36.2	36.3	36.4	36.4	36.5	36.5	36.6	36.6	36.6	36.7
36.7	36.7	36.8	36.8	36.8	36.9	37.0	37.1	37.4	37.6
37.9	38.2	38.5	38.9	39.2	39.4	39.5	39.6	39.7	39.8
40.0	40.1	40.1	40.1	40.0	40.0	39.9	39.8	39.7	39.7
39.6	39.5	39.4	39.3	39.2	39.1	39.0	38.9	38.8	38.7
38.6	38.5	38.4	38.3	38.3	38.2	38.1	38.0	37.9	37.9
37.8	37.7	37.7	37.6	37.5	37.5	37.4	37.3	37.3	37.2
37.2	37.1	37.1	37.0	37.0	36.9	36.9	36.9	36.8	36.8
36.7	36.7	36.7	36.6	36.6	36.6	36.5	36.5	36.5	36.5
36.4	36.4	36.4	36.4	36.3	36.3	36.3	36.3	36.2	36.2
36.2	36.2	36.2	36.1	36.1	36.1	36.1	36.1	36.1	36.0
36.0	36.0	36.0	36.0	36.0	35.9	35.9	35.9	35.9	35.9
35.9	35.9	35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5

PEAK OUTFLOW IS 1786. AT TIME 40.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1786.	883.	282.	100.	28678.
CMS	51.	25.	8.	3.	812.
INCHES		4.13	11.66	12.33	12.33
MM		231.78	296.25	313.69	313.70
AC-FT		438.	560.	592.	593.
THOUS CU M		540.	690.	731.	731.

STATION OUTFLOW PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	3.	6.	9.	13.	17.	22.
26.	29.	32.	34.	36.	38.	38.	38.	37.	36.
35.	34.	33.	32.	31.	30.	29.	28.	27.	26.
26.	25.	24.	23.	22.	22.	21.	20.	20.	19.
19.	19.	19.	19.	19.	20.	20.	20.	21.	21.
21.	22.	22.	22.	22.	23.	23.	23.	23.	24.
24.	24.	25.	27.	30.	33.	37.	43.	49.	54.
59.	65.	72.	78.	84.	90.	95.	100.	104.	108.
112.	116.	119.	122.	126.	132.	143.	163.	190.	290.
560.	884.	1112.	1248.	1353.	1452.	1545.	1642.	1844.	2278.
2930.	3482.	3604.	3399.	3021.	2617.	2291.	2051.	1848.	1648.
1420.	1181.	942.	736.	578.	459.	374.	314.	275.	248.
229.	215.	205.	197.	191.	186.	181.	176.	171.	165.

Sh 32

160.	155.	150.	144.	139.	134.	129.	124.	119.	114.
109.	105.	100.	96.	92.	87.	83.	79.	76.	72.
68.	65.	62.	60.	58.	55.	53.	51.	49.	47.
45.	43.	41.	40.	38.	36.	35.	34.	33.	32.
31.	30.	29.	28.	27.	26.	25.	24.	23.	22.
22.	21.	20.	19.	19.	18.	17.	17.	16.	16.
15.	15.	14.	14.	14.	14.	13.	13.	13.	12.
12.	12.	12.	11.	11.	11.	11.	10.	10.	10.
10.	10.	9.	9.	9.	9.	9.	8.	8.	8.
8.	8.	7.	7.	7.	7.	7.	7.	7.	6.
6.	6.	6.	6.	6.	6.	6.	5.	5.	5.
				STORAGE					
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	88.	89.	92.	95.	98.	101.	103.
106.	107.	109.	110.	111.	111.	112.	111.	111.	111.
110.	110.	109.	109.	108.	108.	107.	107.	106.	106.
105.	105.	105.	104.	104.	103.	103.	103.	102.	102.
102.	102.	102.	102.	102.	102.	102.	103.	103.	103.
103.	103.	103.	104.	104.	104.	104.	104.	104.	104.
105.	105.	105.	106.	108.	109.	111.	113.	116.	118.
120.	122.	124.	126.	128.	130.	131.	133.	134.	135.
137.	138.	139.	140.	141.	143.	147.	154.	163.	175.
186.	194.	197.	199.	201.	202.	203.	205.	207.	212.
218.	222.	223.	221.	218.	215.	212.	209.	207.	205.
202.	198.	195.	191.	187.	183.	180.	177.	174.	172.
170.	168.	167.	165.	163.	162.	160.	158.	156.	155.
153.	151.	149.	147.	146.	144.	142.	141.	139.	137.
136.	134.	133.	131.	130.	129.	128.	126.	125.	124.
123.	122.	121.	120.	119.	118.	117.	117.	116.	115.
114.	114.	113.	112.	112.	111.	110.	110.	109.	109.
108.	108.	107.	106.	106.	106.	105.	105.	104.	104.
103.	103.	103.	102.	102.	102.	101.	101.	101.	100.
100.	100.	99.	99.	99.	99.	98.	98.	98.	98.
97.	97.	97.	97.	96.	96.	96.	96.	96.	95.
95.	95.	95.	95.	94.	94.	94.	94.	94.	94.
93.	93.	93.	93.	93.	93.	93.	92.	92.	92.
92.	92.	92.	92.	92.	91.	91.	91.	91.	91.
				STAGE					
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.4	35.4	35.6	35.7	35.9	36.0	36.2
36.3	36.4	36.4	36.5	36.5	36.5	36.6	36.6	36.5	36.5
36.5	36.5	36.4	36.4	36.4	36.4	36.4	36.3	36.3	36.3
36.3	36.2	36.2	36.2	36.2	36.2	36.1	36.1	36.1	36.1
36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1
36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2
36.2	36.2	36.3	36.3	36.4	36.4	36.5	36.6	36.7	36.8
36.9	37.0	37.1	37.2	37.3	37.3	37.4	37.5	37.5	37.6
37.6	37.7	37.7	37.8	37.8	37.9	38.0	38.3	38.6	39.1
39.4	39.7	39.8	39.9	40.0	40.0	40.0	40.1	40.2	40.3
40.5	40.7	40.7	40.6	40.5	40.4	40.3	40.2	40.2	40.1

40.0	39.9	39.7	39.6	39.5	39.3	39.2	39.1	39.0	38.9
38.9	38.8	38.8	38.7	38.6	38.6	38.5	38.5	38.4	38.3
38.3	38.2	38.1	38.1	38.0	37.9	37.9	37.8	37.7	37.7
37.6	37.5	37.5	37.4	37.4	37.3	37.3	37.2	37.2	37.1
37.1	37.0	37.0	36.9	36.9	36.9	36.8	36.8	36.8	36.7
36.7	36.6	36.6	36.6	36.6	36.5	36.5	36.5	36.4	36.4
36.4	36.4	36.3	36.3	36.3	36.3	36.2	36.2	36.2	36.2
36.2	36.1	36.1	36.1	36.1	36.1	36.1	36.0	36.0	36.0
36.0	36.0	36.0	36.0	35.9	35.9	35.9	35.9	35.9	35.9
35.9	35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.5	35.5	35.5

PEAK OUTFLOW IS 3604. AT TIME 40.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3604.	1680.	570.	200.	57476.
CMS	102.	53.	16.	6.	1628.
INCHES		19.43	23.58	24.75	24.75
MM		493.43	598.81	628.70	628.72
AC-FT		932.	1131.	1187.	1188.
THOUS CU M		1150.	1395.	1465.	1465.

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Sh 34

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 .05	RATIO 2 .10	RATIO 3 .15	RATIO 4 .20	RATIO 5 .25	RATIO 6 .30	RATIO 7 .40	RATIO 8 .50	RATIO 9 1.00
HYDROGRAPH AT	INFLOW	.90	1	180.	360.	540.	720.	900.	1080.	1441.	1801.	3601.
		(2.33)		(5.10)	(10.20)	(15.30)	(20.40)	(25.49)	(30.59)	(40.79)	(50.99)	(101.98)
ROUTED TO	OUTFLO	.90	1	66.	155.	292.	554.	815.	1026.	1418.	1786.	3604.
		(2.33)		(1.86)	(4.38)	(8.27)	(15.68)	(23.07)	(29.06)	(40.15)	(50.59)	(102.05)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	35.30	35.30	38.60
STORAGE	87.	87.	162.
OUTFLOW	0.	0.	187.

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
.05	37.03	0.00	122.	66.	0.00	42.75	0.00
.10	38.19	0.00	151.	155.	0.00	42.50	0.00
.15	39.00	.40	175.	292.	3.00	42.00	0.00
.20	39.44	.84	188.	554.	4.00	41.25	0.00
.25	39.68	1.08	192.	815.	4.75	41.00	0.00
.30	39.79	1.19	196.	1026.	5.25	41.00	0.00
.40	39.98	1.38	202.	1418.	6.25	40.75	0.00
.50	40.14	1.54	206.	1786.	6.75	40.75	0.00
1.00	40.89	2.09	223.	3604.	9.25	40.75	0.00

Sh 36

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  28 FEB 79
**********

RUN  DATE= 07/20/79.
     TIME= 12.16.03.
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NATIONAL DAM INSPECTION PROGRAM
SYLVAN LAKE DAM
PMF HYDROGRAPH

JOB SPECIFICATION

NO	NMIN	MIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	3	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 2 NRTIO= 1 LRTIO= 1

RTIOS= .50

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO SYLVAN LAKE

	ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
INFLO=	0	0	0	0	0	1	0	0	

HYDROGRAPH DATA

IMTDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNO=	ISAME	LOCAL
1	2	.90	0.00	.90	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.50	113.00	129.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTRK	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMA	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 1.00

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 22 END OF PERIOD ORDINATES. TC= 0.00 HOURS. LAG= 1.00 VOL= 1.00

46.	147.	296.	380.	380.	322.	237.	157.	108.	77.
53.	37.	20.	10.	13.	9.	6.	4.	3.	2.
1.	0.								

END-OF-PERIOD FLOW

Sh 37

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.00	0.00	.00	1.	1.02	13.45	151	.04	.02	.01	1027.
1.01	.30	2	.00	0.00	.00	1.	1.02	14.00	152	.04	.02	.01	1137.
1.01	.45	3	.00	0.00	.00	1.	1.02	14.15	153	.80	.78	.01	1233.
1.01	1.00	4	.00	0.00	.00	1.	1.02	14.30	154	.80	.78	.01	1325.
1.01	1.15	5	.00	0.00	.00	1.	1.02	14.45	155	.80	.78	.01	1421.
1.01	1.30	6	.00	0.00	.00	1.	1.02	15.00	156	.80	.78	.01	1514.
1.01	1.45	7	.00	0.00	.00	1.	1.02	15.15	157	.81	.79	.01	1598.
1.01	2.00	8	.00	0.00	.00	1.	1.02	15.30	158	1.61	1.60	.01	1705.
1.01	2.15	9	.00	0.00	.00	1.	1.02	15.45	159	4.52	4.51	.01	2010.
1.01	2.30	10	.00	0.00	.00	1.	1.02	16.00	160	1.13	1.12	.01	2556.
1.01	2.45	11	.00	0.00	.00	1.	1.02	16.15	161	.74	.73	.01	3233.
1.01	3.00	12	.00	0.00	.00	1.	1.02	16.30	162	.74	.73	.01	3601.
1.01	3.15	13	.00	0.00	.00	1.	1.02	16.45	163	.74	.73	.01	3577.
1.01	3.30	14	.00	0.00	.00	1.	1.02	17.00	164	.74	.73	.01	3278.
1.01	3.45	15	.00	0.00	.00	0.	1.02	17.15	165	.58	.57	.01	2855.
1.01	4.00	16	.00	0.00	.00	0.	1.02	17.30	166	.58	.57	.01	2451.
1.01	4.15	17	.00	0.00	.00	0.	1.02	17.45	167	.58	.57	.01	2161.
1.01	4.30	18	.00	0.00	.00	0.	1.02	18.00	168	.58	.57	.01	1943.
1.01	4.45	19	.00	0.00	.00	0.	1.02	18.15	169	.04	.03	.01	1740.
1.01	5.00	20	.00	0.00	.00	0.	1.02	18.30	170	.04	.03	.01	1528.
1.01	5.15	21	.00	0.00	.00	0.	1.02	18.45	171	.04	.03	.01	1272.
1.01	5.30	22	.00	0.00	.00	0.	1.02	19.00	172	.04	.03	.01	1000.
1.01	5.45	23	.00	0.00	.00	0.	1.02	19.15	173	.04	.03	.01	748.
1.01	6.00	24	.00	0.00	.00	0.	1.02	19.30	174	.04	.03	.01	541.
1.01	6.15	25	.01	0.00	.01	0.	1.02	19.45	175	.04	.03	.01	390.
1.01	6.30	26	.01	0.00	.01	0.	1.02	20.00	176	.04	.03	.01	289.
1.01	6.45	27	.01	0.00	.01	0.	1.02	20.15	177	.04	.03	.01	220.
1.01	7.00	28	.01	0.00	.01	0.	1.02	20.30	178	.04	.03	.01	178.
1.01	7.15	29	.01	0.00	.01	0.	1.02	20.45	179	.04	.03	.01	160.
1.01	7.30	30	.01	0.00	.01	0.	1.02	21.00	180	.04	.03	.01	155.
1.01	7.45	31	.01	0.00	.01	0.	1.02	21.15	181	.04	.03	.01	144.
1.01	8.00	32	.01	0.00	.01	0.	1.02	21.30	182	.04	.03	.01	135.
1.01	8.15	33	.01	0.00	.01	0.	1.02	21.45	183	.04	.03	.01	126.
1.01	8.30	34	.01	0.00	.01	0.	1.02	22.00	184	.04	.03	.01	117.
1.01	8.45	35	.01	0.00	.01	0.	1.02	22.15	185	.04	.03	.01	109.
1.01	9.00	36	.01	0.00	.01	0.	1.02	22.30	186	.04	.03	.01	102.
1.01	9.15	37	.01	0.00	.01	0.	1.02	22.45	187	.04	.03	.01	95.
1.01	9.30	38	.01	0.00	.01	0.	1.02	23.00	188	.04	.03	.01	89.
1.01	9.45	39	.01	0.00	.01	0.	1.02	23.15	189	.04	.03	.01	83.
1.01	10.00	40	.01	0.00	.01	0.	1.02	23.30	190	.04	.03	.01	77.
1.01	10.15	41	.01	0.00	.01	0.	1.02	23.45	191	.04	.03	.01	72.
1.01	10.30	42	.01	0.00	.01	0.	1.03	0.00	192	.04	.03	.01	67.
1.01	10.45	43	.01	0.00	.01	0.	1.03	.15	193	0.00	0.00	0.00	63.
1.01	11.00	44	.01	0.00	.01	0.	1.03	.30	194	0.00	0.00	0.00	59.
1.01	11.15	45	.01	0.00	.01	0.	1.03	.45	195	0.00	0.00	0.00	55.
1.01	11.30	46	.01	0.00	.01	0.	1.03	1.00	196	0.00	0.00	0.00	51.
1.01	11.45	47	.01	0.00	.01	0.	1.03	1.15	197	0.00	0.00	0.00	48.
1.01	12.00	48	.01	0.00	.01	0.	1.03	1.30	198	0.00	0.00	0.00	44.
1.01	12.15	49	.04	0.00	.04	0.	1.03	1.45	199	0.00	0.00	0.00	41.
1.01	12.30	50	.04	0.00	.04	0.	1.03	2.00	200	0.00	0.00	0.00	39.
1.01	12.45	51	.04	0.00	.04	0.	1.03	2.15	201	0.00	0.00	0.00	36.
1.01	13.00	52	.04	0.00	.04	0.	1.03	2.30	202	0.00	0.00	0.00	34.
1.01	13.15	53	.05	0.00	.05	0.	1.03	2.45	203	0.00	0.00	0.00	31.
1.01	13.30	54	.05	0.00	.05	0.	1.03	3.00	204	0.00	0.00	0.00	29.
1.01	13.45	55	.05	0.00	.05	0.	1.03	3.15	205	0.00	0.00	0.00	27.
1.01	14.00	56	.05	0.00	.05	0.	1.03	3.30	206	0.00	0.00	0.00	26.
1.01	14.15	57	.06	0.00	.06	0.	1.03	3.45	207	0.00	0.00	0.00	24.
1.01	14.30	58	.06	0.00	.06	0.	1.03	4.00	208	0.00	0.00	0.00	22.
1.01	14.45	59	.06	0.00	.06	0.	1.03	4.15	209	0.00	0.00	0.00	21.
1.01	15.00	60	.06	0.00	.06	0.	1.03	4.30	210	0.00	0.00	0.00	19.

Sh 3B

1.01	15.15	61	.06	0.00	.06	0.	1.03	9.45	211	0.00	0.00	0.00	18.	
1.01	15.30	62	.12	0.00	.12	0.	1.03	5.00	212	0.00	0.00	0.00	17.	
1.01	15.45	63	.34	.31	.03	14.	1.03	5.15	213	0.00	0.00	0.00	16.	
1.01	16.00	64	.09	.07	.01	49.	1.03	5.30	214	0.00	0.00	0.00	15.	
1.01	16.15	65	.06	.04	.01	105.	1.03	5.45	215	0.00	0.00	0.00	14.	
1.01	16.30	66	.06	.04	.01	148.	1.03	6.00	216	0.00	0.00	0.00	13.	
1.01	16.45	67	.06	.04	.01	168.	1.03	6.15	217	0.00	0.00	0.00	12.	
1.01	17.00	68	.06	.04	.01	166.	1.03	6.30	218	0.00	0.00	0.00	11.	
1.01	17.15	69	.04	.03	.01	151.	1.03	6.45	219	0.00	0.00	0.00	10.	
1.01	17.30	70	.04	.03	.01	133.	1.03	7.00	220	0.00	0.00	0.00	10.	
1.01	17.45	71	.04	.03	.01	118.	1.03	7.15	221	0.00	0.00	0.00	9.	
1.01	18.00	72	.04	.03	.01	108.	1.03	7.30	222	0.00	0.00	0.00	8.	
1.01	18.15	73	.00	0.00	.00	97.	1.03	7.45	223	0.00	0.00	0.00	8.	
1.01	18.30	74	.00	0.00	.00	89.	1.03	8.00	224	0.00	0.00	0.00	7.	
1.01	18.45	75	.00	0.00	.00	70.	1.03	8.15	225	0.00	0.00	0.00	7.	
1.01	19.00	76	.00	0.00	.00	54.	1.03	8.30	226	0.00	0.00	0.00	6.	
1.01	19.15	77	.00	0.00	.00	40.	1.03	8.45	227	0.00	0.00	0.00	6.	
1.01	19.30	78	.00	0.00	.00	28.	1.03	9.00	228	0.00	0.00	0.00	6.	
1.01	19.45	79	.00	0.00	.00	19.	1.03	9.15	229	0.00	0.00	0.00	5.	
1.01	20.00	80	.00	0.00	.00	13.	1.03	9.30	230	0.00	0.00	0.00	5.	
1.01	20.15	81	.00	0.00	.00	9.	1.03	9.45	231	0.00	0.00	0.00	5.	
1.01	20.30	82	.00	0.00	.00	8.	1.03	10.00	232	0.00	0.00	0.00	4.	
1.01	20.45	83	.00	0.00	.00	7.	1.03	10.15	233	0.00	0.00	0.00	4.	
1.01	21.00	84	.00	0.00	.00	7.	1.03	10.30	234	0.00	0.00	0.00	4.	
1.01	21.15	85	.00	0.00	.00	7.	1.03	10.45	235	0.00	0.00	0.00	3.	
1.01	21.30	86	.00	0.00	.00	6.	1.03	11.00	236	0.00	0.00	0.00	3.	
1.01	21.45	87	.00	0.00	.00	6.	1.03	11.15	237	0.00	0.00	0.00	3.	
1.01	22.00	88	.00	0.00	.00	5.	1.03	11.30	238	0.00	0.00	0.00	3.	
1.01	22.15	89	.00	0.00	.00	5.	1.03	11.45	239	0.00	0.00	0.00	3.	
1.01	22.30	90	.00	0.00	.00	5.	1.03	12.00	240	0.00	0.00	0.00	2.	
1.01	22.45	91	.00	0.00	.00	4.	1.03	12.15	241	0.00	0.00	0.00	2.	
1.01	23.00	92	.00	0.00	.00	4.	1.03	12.30	242	0.00	0.00	0.00	2.	
1.01	23.15	93	.00	0.00	.00	4.	1.03	12.45	243	0.00	0.00	0.00	2.	
1.01	23.30	94	.00	0.00	.00	3.	1.03	13.00	244	0.00	0.00	0.00	2.	
1.01	23.45	95	.00	0.00	.00	3.	1.03	13.15	245	0.00	0.00	0.00	2.	
1.02	0.00	96	.00	0.00	.00	3.	1.03	13.30	246	0.00	0.00	0.00	2.	
1.02	.15	97	.03	.01	.01	3.	1.03	13.45	247	0.00	0.00	0.00	1.	
1.02	.30	98	.03	.01	.01	3.	1.03	14.00	248	0.00	0.00	0.00	1.	
1.02	.45	99	.03	.01	.01	6.	1.03	14.15	249	0.00	0.00	0.00	1.	
1.02	1.00	100	.03	.01	.01	11.	1.03	14.30	250	0.00	0.00	0.00	1.	
1.02	1.15	101	.03	.01	.01	16.	1.03	14.45	251	0.00	0.00	0.00	1.	
1.02	1.30	102	.03	.01	.01	20.	1.03	15.00	252	0.00	0.00	0.00	1.	
1.02	1.45	103	.03	.01	.01	23.	1.03	15.15	253	0.00	0.00	0.00	1.	
1.02	2.00	104	.03	.01	.01	25.	1.03	15.30	254	0.00	0.00	0.00	1.	
1.02	2.15	105	.03	.01	.01	26.	1.03	15.45	255	0.00	0.00	0.00	1.	
1.02	2.30	106	.03	.01	.01	27.	1.03	16.00	256	0.00	0.00	0.00	1.	
1.02	2.45	107	.03	.01	.01	28.	1.03	16.15	257	0.00	0.00	0.00	1.	
1.02	3.00	108	.03	.01	.01	28.	1.03	16.30	258	0.00	0.00	0.00	1.	
1.02	3.15	109	.03	.01	.01	28.	1.03	16.45	259	0.00	0.00	0.00	1.	
1.02	3.30	110	.03	.01	.01	29.	1.03	17.00	260	0.00	0.00	0.00	1.	
1.02	3.45	111	.03	.01	.01	29.	1.03	17.15	261	0.00	0.00	0.00	1.	
1.02	4.00	112	.03	.01	.01	29.	1.03	17.30	262	0.00	0.00	0.00	1.	
1.02	4.15	113	.03	.01	.01	29.	1.03	17.45	263	0.00	0.00	0.00	0.	
1.02	4.30	114	.03	.01	.01	29.	1.03	18.00	264	0.00	0.00	0.00	0.	
1.02	4.45	115	.03	.01	.01	29.	1.03	18.15	265	0.00	0.00	0.00	0.	
1.02	5.00	116	.03	.01	.01	29.	1.03	18.30	266	0.00	0.00	0.00	0.	
1.02	5.15	117	.03	.01	.01	29.	1.03	18.45	267	0.00	0.00	0.00	0.	
1.02	5.30	118	.03	.01	.01	29.	1.03	19.00	268	0.00	0.00	0.00	0.	
1.02	5.45	119	.03	.01	.01	29.	1.03	19.15	269	0.00	0.00	0.00	0.	
1.02	6.00	120	.03	.01	.01	29.	1.03	19.30	270	0.00	0.00	0.00	0.	
1.02	6.15	121	.09	.07	.01	32.	1.03	19.45	271	0.00	0.00	0.00	0.	
1.02	6.30	122	.09	.07	.01	41.	1.03	20.00	272	0.00	0.00	0.00	0.	

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1.02	6.45	123	.09	.01	.01	59.	1.03	20.15	273	0.00	0.00	0.00	0.
1.02	7.00	124	.09	.01	.01	82.	1.03	20.30	274	0.00	0.00	0.00	0.
1.02	7.15	125	.09	.01	.01	105.	1.03	20.45	275	0.00	0.00	0.00	0.
1.02	7.30	126	.09	.01	.01	125.	1.03	21.00	276	0.00	0.00	0.00	0.
1.02	7.45	127	.09	.01	.01	140.	1.03	21.15	277	0.00	0.00	0.00	0.
1.02	8.00	128	.09	.01	.01	149.	1.03	21.30	278	0.00	0.00	0.00	0.
1.02	8.15	129	.09	.01	.01	156.	1.03	21.45	279	0.00	0.00	0.00	0.
1.02	8.30	130	.09	.01	.01	160.	1.03	22.00	280	0.00	0.00	0.00	0.
1.02	8.45	131	.09	.01	.01	164.	1.03	22.15	281	0.00	0.00	0.00	0.
1.02	9.00	132	.09	.01	.01	166.	1.03	22.30	282	0.00	0.00	0.00	0.
1.02	9.15	133	.09	.01	.01	168.	1.03	22.45	283	0.00	0.00	0.00	0.
1.02	9.30	134	.09	.01	.01	169.	1.03	23.00	284	0.00	0.00	0.00	0.
1.02	9.45	135	.09	.01	.01	169.	1.03	23.15	285	0.00	0.00	0.00	0.
1.02	10.00	136	.09	.01	.01	170.	1.03	23.30	286	0.00	0.00	0.00	0.
1.02	10.15	137	.09	.01	.01	170.	1.03	23.45	287	0.00	0.00	0.00	0.
1.02	10.30	138	.09	.01	.01	171.	1.04	0.00	288	0.00	0.00	0.00	0.
1.02	10.45	139	.09	.01	.01	171.	1.04	.15	289	0.00	0.00	0.00	0.
1.02	11.00	140	.09	.01	.01	171.	1.04	.30	290	0.00	0.00	0.00	0.
1.02	11.15	141	.09	.01	.01	171.	1.04	.45	291	0.00	0.00	0.00	0.
1.02	11.30	142	.09	.01	.01	171.	1.04	1.00	292	0.00	0.00	0.00	0.
1.02	11.45	143	.09	.01	.01	171.	1.04	1.15	293	0.00	0.00	0.00	0.
1.02	12.00	144	.09	.01	.01	171.	1.04	1.30	294	0.00	0.00	0.00	0.
1.02	12.15	145	.53	.52	.01	192.	1.04	1.45	295	0.00	0.00	0.00	0.
1.02	12.30	146	.53	.52	.01	257.	1.04	2.00	296	0.00	0.00	0.00	0.
1.02	12.45	147	.53	.52	.01	389.	1.04	2.15	297	0.00	0.00	0.00	0.
1.02	13.00	148	.53	.52	.01	558.	1.04	2.30	298	0.00	0.00	0.00	0.
1.02	13.15	149	.64	.62	.01	731.	1.04	2.45	299	0.00	0.00	0.00	0.
1.02	13.30	150	.64	.62	.01	890.	1.04	3.00	300	0.00	0.00	0.00	0.
									SUM	26.70	24.30	2.39	57670.
										(678.)	(617.)	(61.)	(1633.03)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3001.	1908.	577.	200.	57677.
CMS	102.	54.	16.	6.	1633.
INCHES		19.72	23.85	24.84	24.84
MM		500.93	605.82	630.91	630.92
AC-FT		940.	1144.	1192.	1192.
THOUS CU M		1161.	1411.	1470.	1470.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1001.	954.	288.	100.	28838.
CMS	51.	27.	8.	3.	817.
INCHES		9.86	11.93	12.42	12.42
MM		250.46	302.91	315.46	315.46
AC-FT		470.	572.	596.	596.
THOUS CU M		580.	706.	735.	735.

PLAN 2 SAME AS PLAN 1

Sh 40

HYDROGRAPH ROUTING

ROUTING THROUGH SYLVAN LAKE

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OUTFLO	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSAK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-35.	-1

STAGE	35.30	36.00	36.50	37.00	38.00	39.00	40.00	41.00	42.00	43.00
FLOW	0.00	15.00	35.00	63.00	140.00	218.00	274.00	321.00	363.00	397.00
SURFACE AREA=	0.	20.	28.	46.						
CAPACITY=	0.	100.	162.	781.						
ELEVATION=	21.	36.	39.	56.						

CHEL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
35.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
38.6	0.0	0.0	0.

CREST LENGTH	0.	380.	740.	940.
AT OR BELOW ELEVATION	38.6	39.5	40.3	40.8

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
300.	1.00	25.00	2.00	35.30	30.00

STATION OUTFLO, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	3.	5.	7.	8.	10.
11.	12.	13.	13.	14.	14.	15.	15.	15.	14.
14.	14.	14.	14.	13.	13.	13.	13.	12.	12.
12.	12.	12.	11.	11.	11.	11.	10.	10.	10.
10.	10.	10.	10.	10.	10.	10.	10.	10.	11.
11.	11.	11.	11.	11.	11.	11.	11.	10.	11.
11.	12.	12.	12.	13.	14.	16.	18.	20.	22.
25.	27.	29.	31.	33.	35.	38.	40.	43.	45.
47.	49.	51.	53.	54.	57.	62.	74.	90.	110.
132.	151.	182.	223.	337.	500.	648.	757.	874.	1075.
1386.	1674.	1780.	1721.	1549.	1359.	1180.	1058.	953.	854.
750.	639.	550.	432.	354.	295.	254.	224.	205.	194.
180.	180.	173.	167.	160.	154.	148.	142.	136.	130.
125.	119.	119.	109.	109.	99.	94.	90.	85.	81.

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77.	73.	69.	66.	62.	60.	58.	55.	53.	51.
49.	47.	45.	43.	41.	39.	38.	36.	35.	33.
32.	31.	30.	29.	28.	27.	26.	25.	25.	24.
23.	22.	21.	20.	20.	19.	18.	18.	17.	16.
16.	15.	15.	14.	14.	14.	14.	13.	13.	13.
13.	12.	12.	12.	11.	11.	11.	11.	11.	10.
10.	10.	10.	9.	9.	9.	9.	9.	8.	8.
8.	8.	8.	8.	7.	7.	7.	7.	7.	7.
6.	6.	6.	6.	6.	6.	6.	5.	5.	5.
5.	5.	5.	5.	5.	5.	4.	4.	4.	4.
				STORAGE					
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	88.	89.	91.	92.	94.	95.
96.	97.	98.	99.	99.	99.	100.	100.	100.	99.
99.	99.	99.	99.	98.	98.	98.	98.	98.	97.
97.	97.	97.	97.	96.	96.	96.	96.	96.	96.
95.	95.	95.	96.	96.	96.	96.	96.	96.	96.
96.	96.	96.	96.	96.	96.	96.	97.	97.	97.
97.	97.	97.	98.	98.	99.	100.	101.	103.	104.
105.	106.	107.	108.	109.	110.	111.	112.	113.	114.
115.	116.	117.	117.	118.	119.	121.	125.	130.	136.
143.	152.	160.	169.	176.	184.	188.	191.	193.	197.
201.	205.	208.	208.	203.	201.	198.	197.	195.	193.
191.	188.	185.	182.	179.	175.	172.	169.	167.	164.
162.	160.	157.	155.	153.	151.	149.	147.	145.	143.
141.	139.	137.	136.	134.	132.	131.	130.	128.	127.
126.	124.	123.	122.	121.	120.	119.	118.	117.	117.
116.	115.	114.	113.	113.	112.	111.	111.	110.	110.
109.	108.	108.	107.	107.	106.	106.	105.	105.	104.
104.	104.	103.	103.	102.	102.	102.	101.	101.	101.
100.	100.	100.	100.	99.	99.	99.	98.	98.	98.
98.	97.	97.	97.	97.	97.	96.	96.	96.	96.
95.	95.	95.	95.	95.	95.	94.	94.	94.	94.
94.	93.	93.	93.	93.	93.	93.	93.	92.	92.
92.	92.	92.	92.	92.	92.	91.	91.	91.	91.
91.	91.	91.	91.	91.	91.	90.	90.	90.	90.
				STAGE					
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.4	35.4	35.5	35.6	35.7	35.7
35.8	35.9	35.9	35.9	36.0	36.0	36.0	36.0	36.0	36.0
36.0	36.0	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9
35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.9	35.9	35.9	36.0	36.0	36.1	36.1	36.2
36.2	36.3	36.4	36.4	36.5	36.5	36.6	36.6	36.6	36.7
36.7	36.7	36.8	36.8	36.8	36.9	37.0	37.1	37.4	37.6
37.9	38.2	38.5	38.9	39.2	39.4	39.5	39.6	39.7	39.8
40.0	40.1	40.1	40.1	40.0	40.0	39.9	39.8	39.7	39.7
39.6	39.5	39.4	39.3	39.2	39.1	39.0	38.9	38.8	38.7

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38.6	38.5	38.4	38.3	38.3	38.2	38.1	38.0	37.9	37.9
37.8	37.7	37.7	37.6	37.5	37.5	37.4	37.3	37.3	37.2
37.2	37.1	37.1	37.0	37.0	36.9	36.9	36.9	36.8	36.8
36.7	36.7	36.7	36.6	36.6	36.6	36.5	36.5	36.5	36.5
36.4	36.4	36.4	36.4	36.3	36.3	36.3	36.3	36.2	36.2
36.2	36.2	36.2	36.1	36.1	36.1	36.1	36.1	36.1	36.0
36.0	36.0	36.0	36.0	36.0	35.9	35.9	35.9	35.9	35.9
35.9	35.9	35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
35.7	35.7	35.7	35.7	35.6	35.6	35.6	35.6	35.6	35.6
35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.5	35.5
35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5

PEAK OUTFLOW IS 1786. AT TIME 40.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1786.	863.	282.	100.	28678.
CMS	51.	25.	8.	3.	812.
INCHES		4.13	11.06	12.35	12.35
MM		231.18	298.25	313.69	313.70
AC-FT		438.	560.	592.	593.
THOUS CU M		540.	690.	731.	731.

DAM BREACH DATA

BRWID	Z	ELBM	IFAIL	WSEL	FAILEL
300.	1.00	25.00	2.00	35.30	40.00

STATION OUTFLO, PLAN 2, RATIO 1

BEGIN DAM FAILURE AT 40.50 HOURS

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	1.	3.	5.	7.	8.	10.
11.	12.	13.	13.	14.	15.	15.	15.	15.	14.
14.	14.	14.	14.	13.	13.	13.	13.	12.	12.
12.	12.	12.	11.	11.	11.	11.	10.	10.	10.
10.	10.	10.	10.	10.	10.	10.	10.	10.	11.
11.	11.	11.	11.	11.	11.	11.	11.	11.	11.
11.	12.	12.	12.	13.	14.	16.	18.	20.	22.
25.	27.	29.	31.	33.	35.	38.	40.	43.	45.
47.	49.	51.	53.	56.	57.	62.	74.	90.	110.
132.	157.	182.	223.	337.	500.	648.	757.	874.	1075.
1382.	1667.	3515.	3118.	3281.	2054.	2079.	1626.	1264.	969.
847.	511.	384.	279.	201.	149.	116.	91.	84.	79.
73.	69.	64.	60.	56.	52.	49.	45.	42.	40.
37.	35.	32.	30.	28.	26.	25.	23.	21.	20.
19.	17.	16.	15.	14.	13.	12.	12.	11.	10.
9.	9.	8.	8.	7.	7.	6.	6.	6.	5.
5.	4.	4.	4.	4.	3.	3.	3.	3.	3.
2.	2.	2.	2.	2.	2.	2.	2.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

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1.	1.	1.	1.	1.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STORAGE

87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	87.	87.	87.	87.	87.	87.
87.	87.	87.	87.	88.	89.	91.	92.	94.	95.
96.	97.	98.	99.	99.	99.	100.	100.	100.	99.
99.	99.	99.	99.	98.	98.	98.	98.	98.	97.
97.	97.	97.	97.	96.	96.	96.	96.	96.	96.
95.	95.	95.	96.	96.	96.	96.	96.	96.	96.
96.	96.	96.	96.	96.	96.	96.	97.	97.	97.
97.	97.	97.	98.	98.	99.	100.	101.	103.	104.
105.	106.	107.	108.	109.	110.	111.	112.	113.	114.
115.	116.	117.	117.	118.	119.	121.	125.	130.	136.
143.	152.	160.	169.	178.	184.	188.	191.	193.	197.
201.	205.	180.	136.	96.	62.	37.	21.	10.	4.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

STAGE

35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.3
35.3	35.3	35.3	35.3	35.4	35.4	35.5	35.6	35.7	35.7
35.8	35.9	35.9	35.9	36.0	36.0	36.0	36.0	36.0	36.0
36.0	36.0	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9
35.9	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
35.8	35.8	35.9	35.9	35.9	36.0	36.0	36.1	36.1	36.2
36.2	36.3	36.4	36.4	36.5	36.6	36.8	36.8	36.8	36.7
36.7	36.7	36.8	36.8	36.8	36.9	37.0	37.1	37.4	37.6
37.9	38.2	38.5	38.9	39.2	39.4	39.5	39.6	39.7	39.8
40.0	40.1	39.2	37.7	35.6	33.8	31.8	29.9	27.9	26.0
25.8	25.7	25.6	25.4	25.4	25.3	25.2	25.2	25.2	25.2
25.2	25.2	25.2	25.2	25.2	25.1	25.1	25.1	25.1	25.1
25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.0
25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Sh 44

25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
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25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0

PEAK OUTFLOW IS 3827. AT TIME 40.92 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3776.	1211.	332.	113.	32609.
CMS	107.	34.	9.	3.	923.
INCHES		12.52	13.74	14.04	14.04
MM		317.97	348.96	356.70	356.71
AC-FT		601.	659.	674.	674.
THOUS CU M		741.	813.	831.	831.

Sh 45

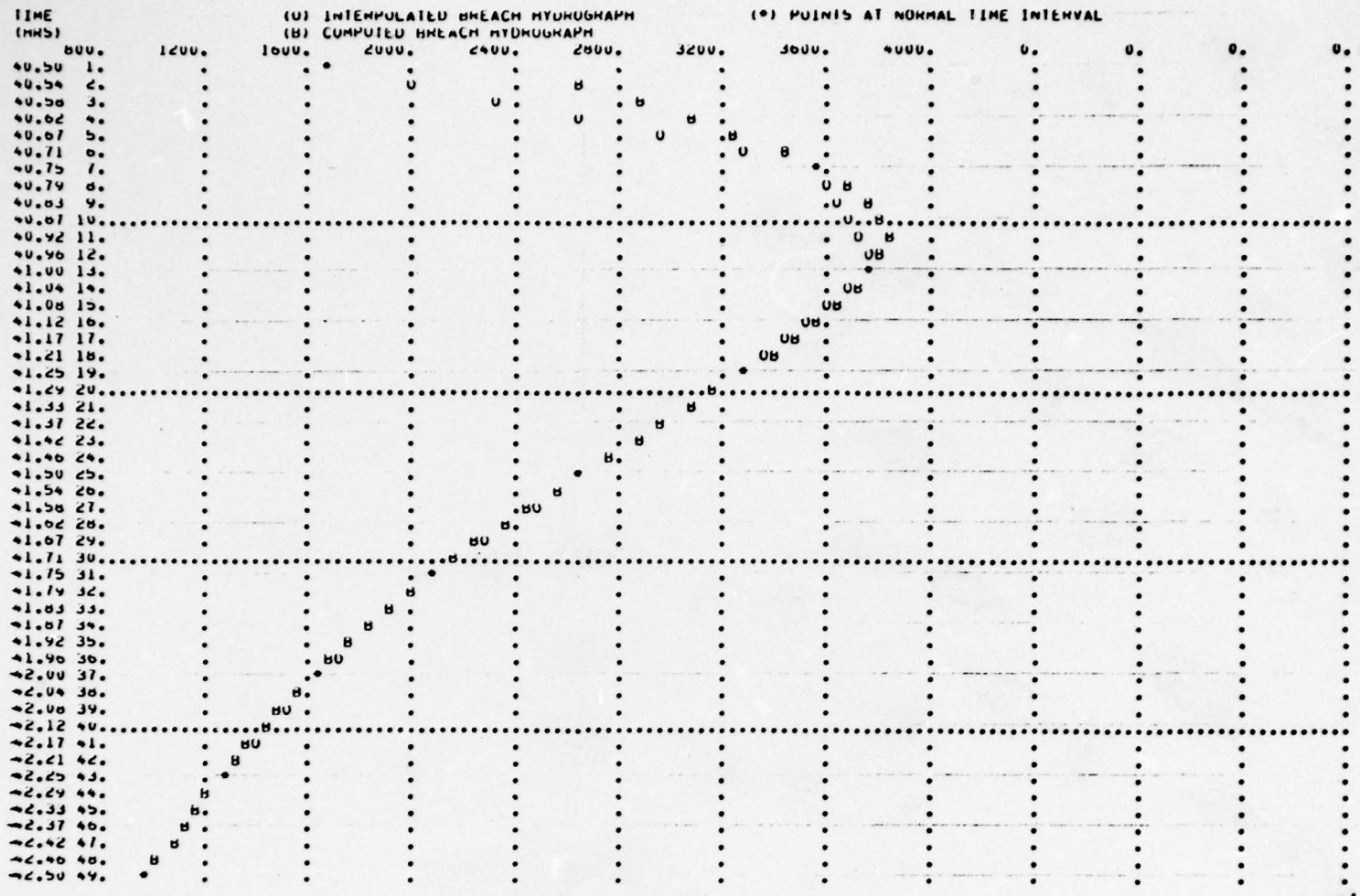
THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .042 HOURS DURING BREACH FORMATION.
DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .250 HOURS.
THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.
INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	-	COMPUTED BREACH HYDROGRAPH (CFS)	=	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
40.500	0.000	1687.		1687.		0.	0.	0.
40.542	.042	2002.		2631.		-629.	-629.	-2.
40.583	.083	2317.		2866.		-550.	-1179.	-4.
40.625	.125	2631.		3070.		-438.	-1617.	-6.
40.667	.167	2946.		3253.		-307.	-1924.	-7.
40.708	.208	3260.		3423.		-163.	-2087.	-7.
40.750	.250	3575.		3575.		-0.	-2087.	-7.
40.792	.292	3609.		3690.		-81.	-2168.	-7.
40.833	.333	3643.		3765.		-122.	-2290.	-8.
40.875	.375	3676.		3811.		-135.	-2425.	-8.
40.917	.417	3710.		3827.		-116.	-2541.	-9.
40.958	.458	3744.		3814.		-70.	-2610.	-9.
41.000	.500	3778.		3778.		0.	-2610.	-9.
41.042	.542	3695.		3723.		-27.	-2638.	-9.
41.083	.583	3612.		3650.		-38.	-2675.	-9.
41.125	.625	3530.		3568.		-38.	-2714.	-9.
41.167	.667	3447.		3477.		-30.	-2744.	-9.
41.208	.708	3364.		3381.		-17.	-2761.	-10.
41.250	.750	3281.		3281.		0.	-2761.	-10.
41.292	.792	3177.		3178.		-2.	-2763.	-10.
41.333	.833	3072.		3075.		-3.	-2766.	-10.
41.375	.875	2968.		2973.		-5.	-2772.	-10.
41.417	.917	2863.		2868.		-4.	-2776.	-10.
41.458	.958	2759.		2761.		-2.	-2778.	-10.
41.500	1.000	2654.		2654.		0.	-2778.	-10.
41.542	1.042	2558.		2550.		9.	-2770.	-10.
41.583	1.083	2463.		2449.		13.	-2756.	-9.
41.625	1.125	2367.		2352.		14.	-2742.	-9.
41.667	1.167	2271.		2259.		12.	-2730.	-9.
41.708	1.208	2175.		2168.		7.	-2722.	-9.
41.750	1.250	2079.		2079.		0.	-2722.	-9.
41.792	1.292	2004.		1995.		9.	-2713.	-9.
41.833	1.333	1928.		1915.		13.	-2700.	-9.
41.875	1.375	1853.		1838.		14.	-2686.	-9.
41.917	1.417	1777.		1765.		12.	-2674.	-9.
41.958	1.458	1701.		1694.		7.	-2667.	-9.
42.000	1.500	1626.		1626.		0.	-2667.	-9.
42.042	1.542	1566.		1560.		6.	-2661.	-9.
42.083	1.583	1505.		1496.		9.	-2652.	-9.
42.125	1.625	1445.		1435.		10.	-2643.	-9.
42.167	1.667	1385.		1376.		8.	-2634.	-9.
42.208	1.708	1325.		1319.		5.	-2629.	-9.
42.250	1.750	1264.		1264.		0.	-2629.	-9.
42.292	1.792	1215.		1211.		4.	-2625.	-9.
42.333	1.833	1166.		1159.		7.	-2618.	-9.
42.375	1.875	1117.		1109.		8.	-2610.	-9.
42.417	1.917	1068.		1061.		7.	-2603.	-9.
42.458	1.958	1019.		1014.		4.	-2598.	-9.
42.500	2.000	969.		969.		0.	-2598.	-9.

UVF

STATIONOUTFLO

TIME (HRS) (U) INTERPOLATED BREACH HYDROGRAPH (B) COMPUTED BREACH HYDROGRAPH (*) POINTS AT NORMAL TIME INTERVAL



Sh 47

DUMP

•••••••••• •••••••••• •••••••••• •••••••••• ••••••••••

HYDROGRAPH ROUTING

ROUTING DOWNSTREAM OF SYLVAN LAKE DAM

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
HAZARD	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0900	.0450	.0900	15.0	40.0	1000.	.00500

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 40.00 500.00 20.00 520.00 19.00 530.00 15.00 570.00 15.00
580.00 19.00 600.00 20.00 1400.00 40.00

STORAGE	0.00	1.31	2.81	4.52	7.08	11.91	19.33	29.32	41.90	57.06
	74.81	95.14	118.05	143.55	171.63	202.29	235.54	271.37	309.78	350.78
OUTFLOW	0.00	151.41	494.04	1003.64	1781.67	2881.43	4436.53	6553.24	9325.32	12838.83
	17174.30	22408.02	28012.88	35858.95	44213.86	53743.11	64510.39	76577.70	90005.56	104853.14
STORAGE	15.00	16.32	17.63	18.95	20.26	21.58	22.89	24.21	25.53	26.84
	28.16	29.47	30.79	32.11	33.42	34.74	36.05	37.37	38.68	40.00
OUTFLOW	0.00	151.41	494.04	1003.64	1781.67	2881.43	4436.53	6553.24	9325.32	12838.83
	17174.30	22408.02	28012.88	35858.95	44213.86	53743.11	64510.39	76577.70	90005.56	104853.14

STATION HAZARD, PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1781.	883.	282.	100.	28676.
CMS	50.	25.	8.	3.	812.
INCHES		9.12	11.66	12.35	12.35
MM		231.74	296.25	313.67	313.68
AC-FT		436.	560.	592.	592.
THOUS CU M		540.	690.	731.	731.

Sh 48

MAXIMUM STORAGE = 7.

MAXIMUM STAGE IS 20.3

STATION MAZAMO: PLAN 2, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3912.	1211.	332.	113.	32609.
CMS	111.	34.	9.	3.	923.
INCHES		12.52	13.74	14.04	14.04
MM		317.94	348.96	356.70	356.71
AC-FT		601.	659.	674.	674.
THOUS CU M		741.	813.	831.	831.

MAXIMUM STORAGE = 17.

MAXIMUM STAGE IS 22.5

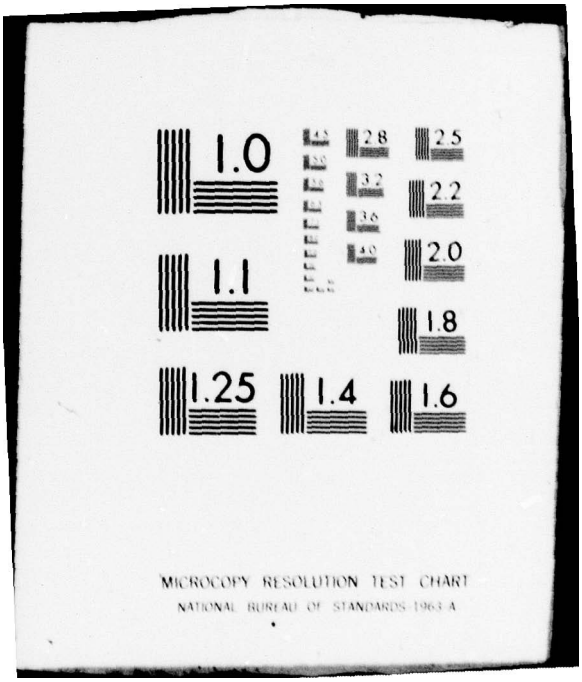
94 49

AD-A074 324 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. SYLVAN LAKE DAM (NJ-00151), DELAWA--ETC(U)
MAY 79 J J WILLIAMS DACW61-79-C-0011

UNCLASSIFIED NL

2 OF 2
AD A074824

END
DATE FILMED
10-79
DDC


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

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS 1 .50
HYDROGRAPH AT	INFLOW	.90	1	1801.
		(2.33)		(50.99)
			2	1801.
				(50.99)
ROUTED TO	OUTFLO	.90	1	1780.
		(2.33)		(50.39)
			2	3778.
				(106.98)
ROUTED TO	HAZARD	.90	1	1781.
		(2.33)		(50.44)
			2	3912.
				(110.78)

SH 50

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	35.30	35.30	38.00
STORAGE	87.	87.	102.
OUTFLOW	0.	0.	187.

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
.50	40.14	1.54	206.	1780.	0.75	40.75	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	35.30	35.30	38.00
STORAGE	87.	87.	102.
OUTFLOW	0.	0.	187.

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
.50	40.09	1.49	205.	3827.	2.50	40.92	40.50

PLAN 1 STATION HAZARD

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1781.	20.3	40.75

PLAN 2 STATION HAZARD

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	3912.	22.5	41.00

APPENDIX

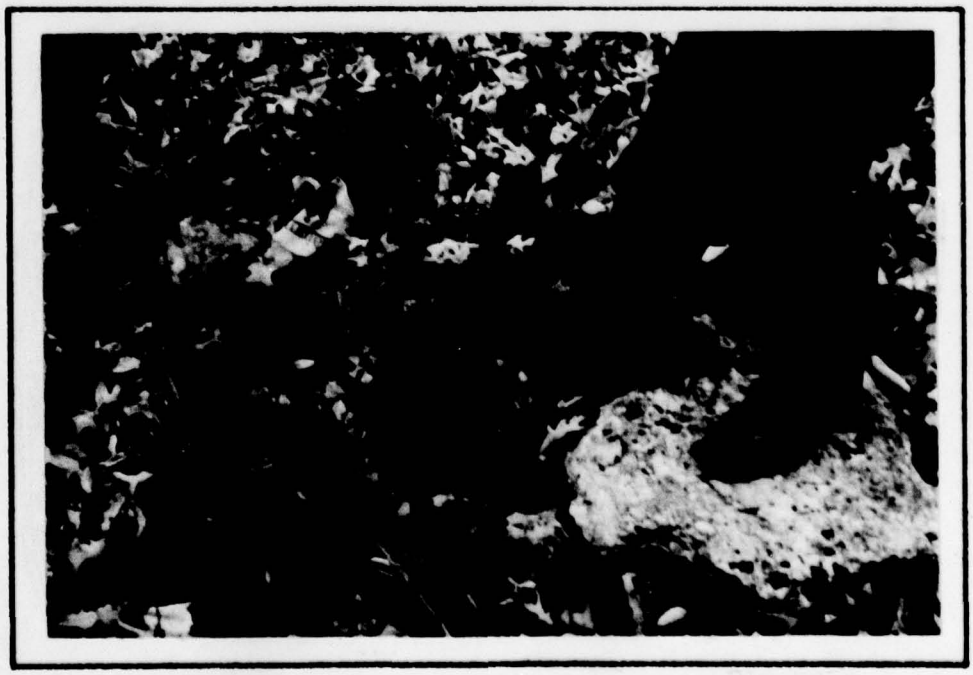
D

Photographs

UPSTREAM SLOPE OF SYLVAN LAKE DAM
SHOWING LACK OF VEGETATIVE COVER 4/13/79

MILL STREAM VALLEY IMMEDIATELY
DOWNSTREAM OF SYLVAN LAKE DAM 4/13/79

TYPICAL LARGE TREES
ON DOWNSTREAM SLOPE
OF SYLVAN LAKE DAM
4/13/79



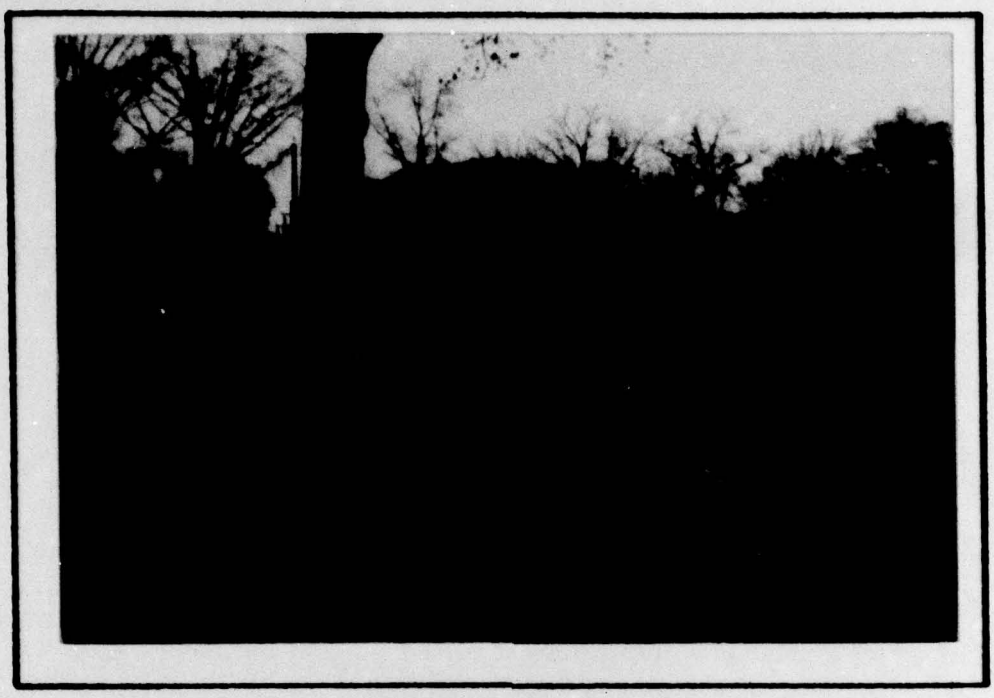
SEEPAGE ON DOWNSTREAM SLOPE
OF SYLVAN LAKE DAM 4/13/79

OUTLET CHANNEL
LOOKING UPSTREAM
TOWARDS SYLVAN LAKE
4/13/79

AUXILIARY CHANNEL
LOOKING UPSTREAM
TOWARDS OUTLET CHANNEL
4/13/79

THREE FOOT BY SIX FOOT SEMI-CIRCULAR CULVERT ON OUTLET CHANNEL 340 FEET DOWNSTREAM OF SYLVAN LAKE 4/13/79

OUTLET CHANNEL CONSTRICTION ABOUT 400 FEET DOWNSTREAM OF SYLVAN LAKE 4/13/79



OVERVIEW OF LESSER LAKE DAM ABOUT
700 FEET UPSTREAM OF SYLVAN LAKE 4/13/79

DOWNSTREAM FACE
OF LESSER LAKE DAM
4/13/79

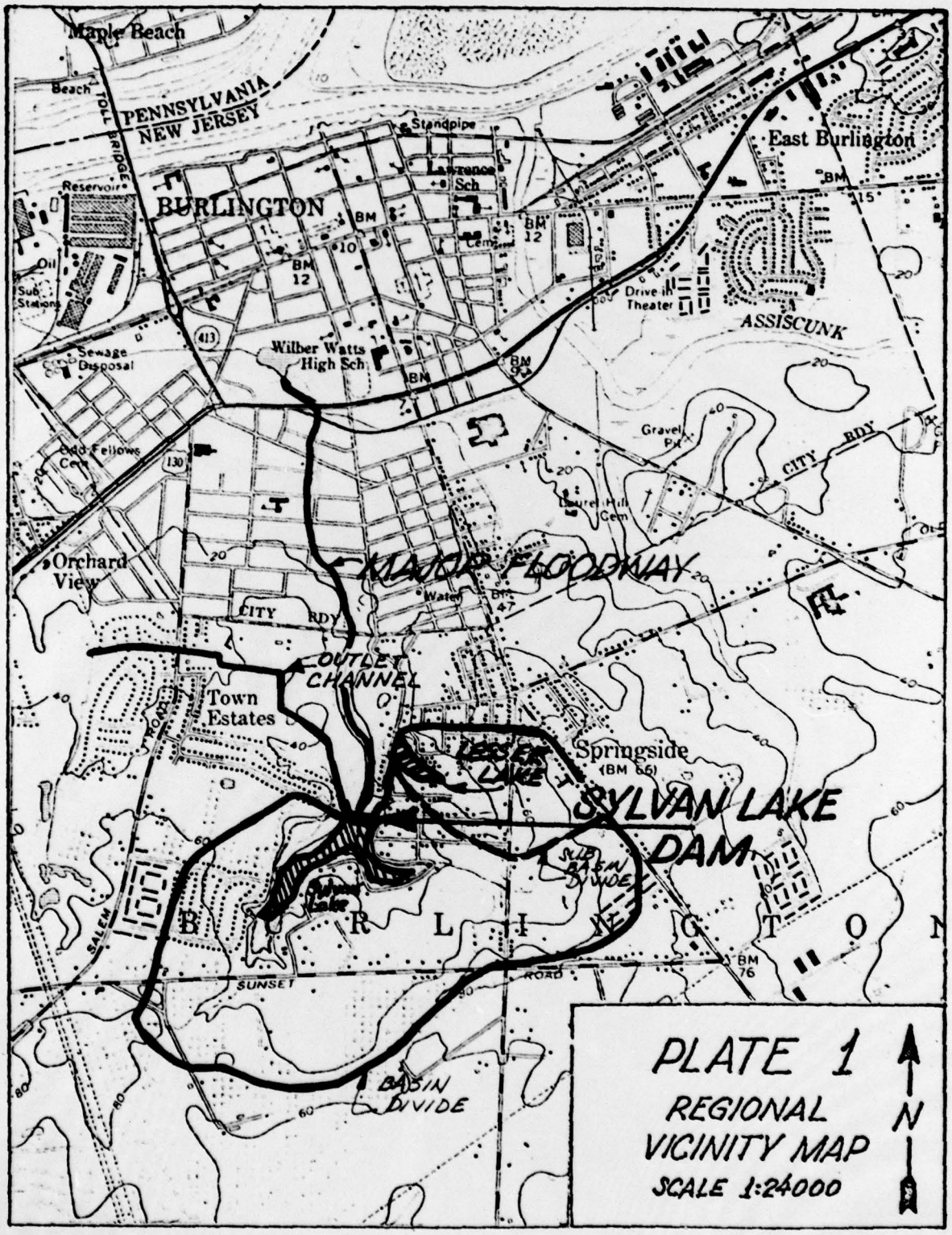
APPENDIX

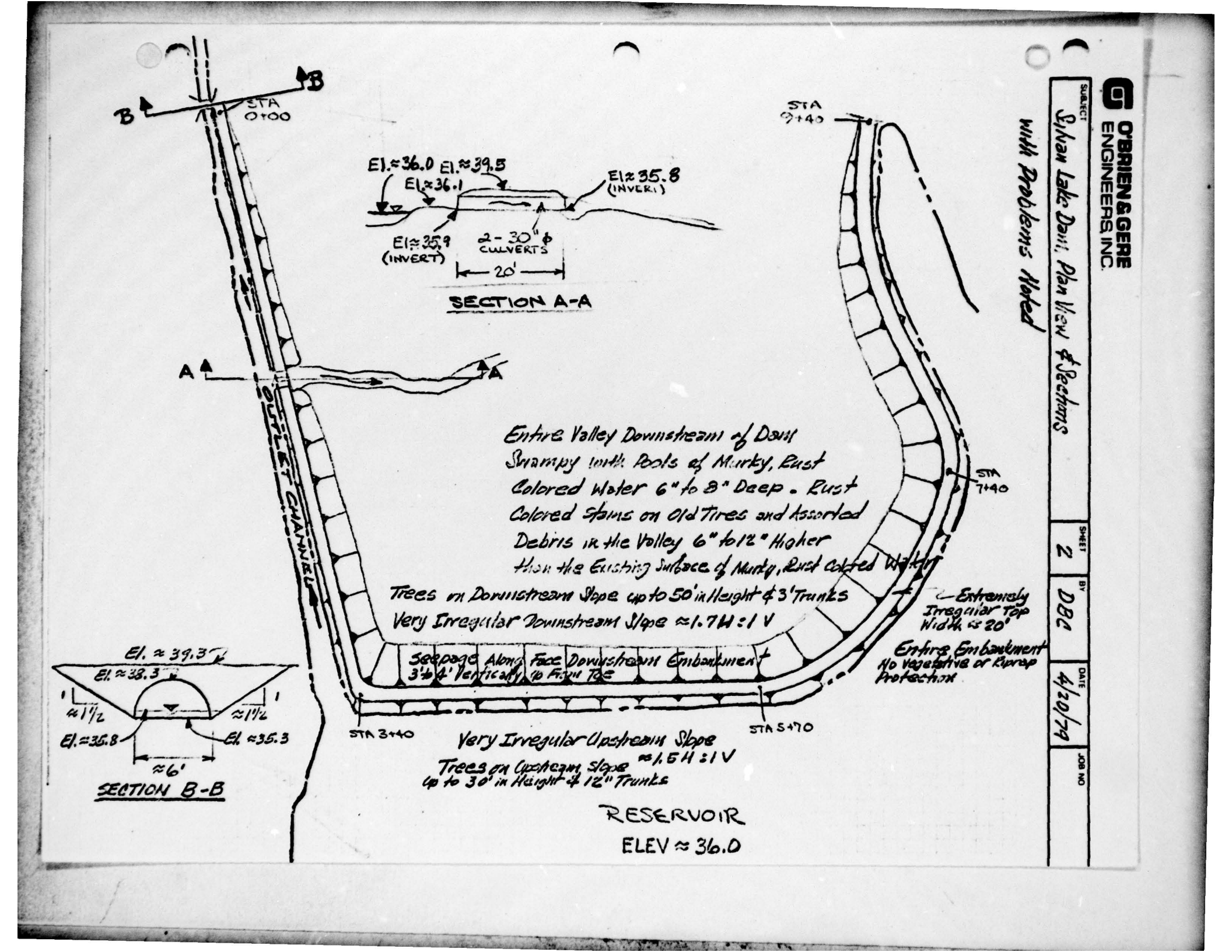
E

Drawings

TABLE OF CONTENTS APPENDIX E

Regional Vicinity Map	Sheet 1
Plan View of Dam with Problems Noted	Sheet 2
Top of Dam Profile	Sheet 3
Outlet channel Layout	Sheet 4
Typical Sections	Sheet 5
Plan & Profile of Dam as of 1947	Sheet 6
Plan & Profile of Outlet channel as of 1947	Sheets 7-8


Maple Beach
Beach
TOLL BRIDGE
PENNSYLVANIA
NEW JERSEY
Standpipe
East Burlington
Lawrence Sch
Reservoir
BURLINGTON
BM
Cem
Oil
Sub Station
Drive in Theater
ASSISCUNK
Sewage Disposal
Wilber Watts High Sch
Gravel Pit
Odd Fellows Cem
CITY RDY
Laurel Hill Cem
Orchard View
MAJOR FLOODWAY
Water
OUTLET CHANNEL
Town Estates
LESTER LAKE
Springside
(BM 66)
SYLVAN LAKE DAM
SUB BASIN DIVIDE
SALEM
SUNSET
ROAD
BM 76
BABIN DIVIDE
PLATE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N



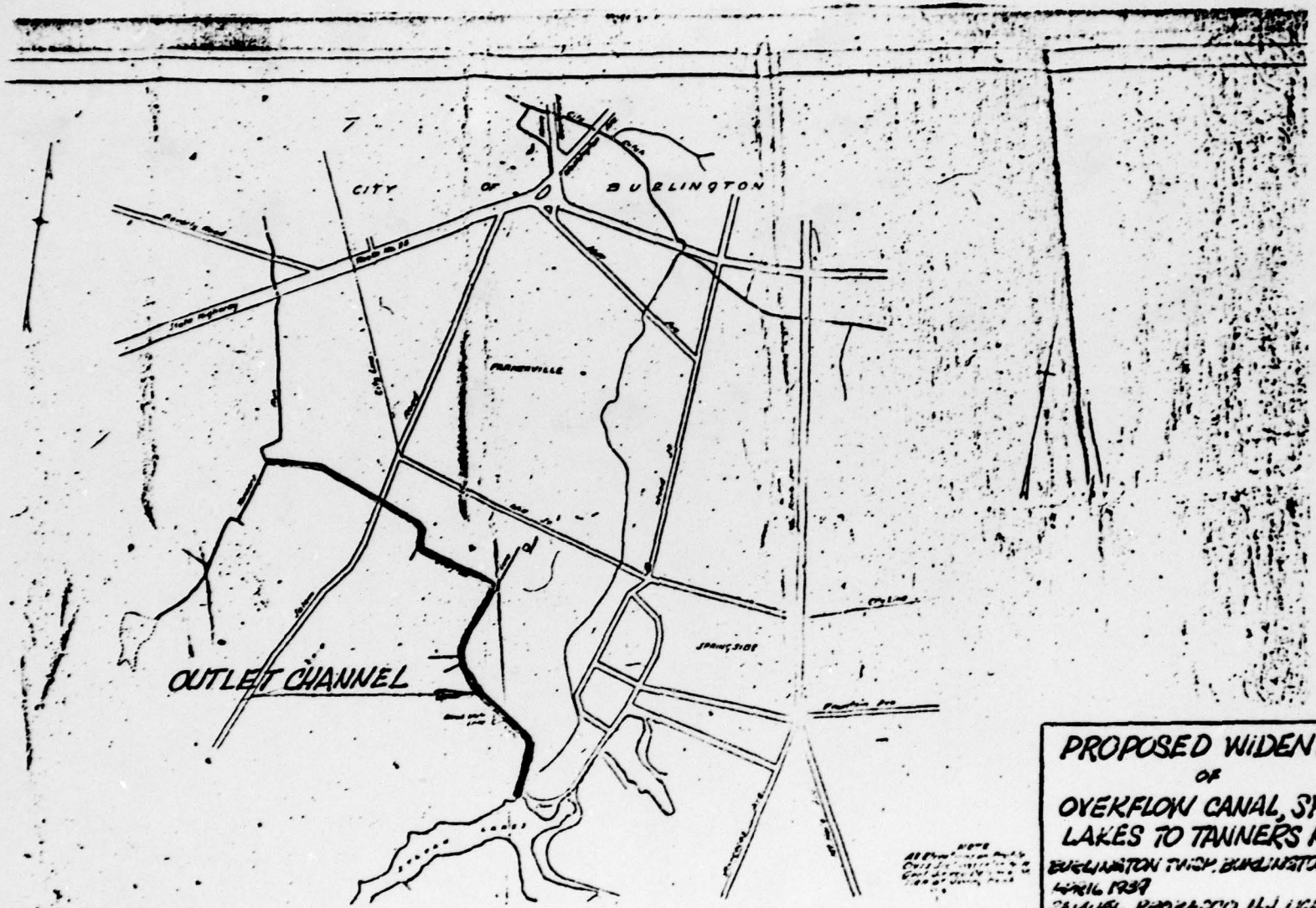
O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Sylvan Lake Dam, Plan View & Sections with Problems Noted	2	DBC	4/20/79	

O'BRIEN & GERE ENGINEERS, INC.

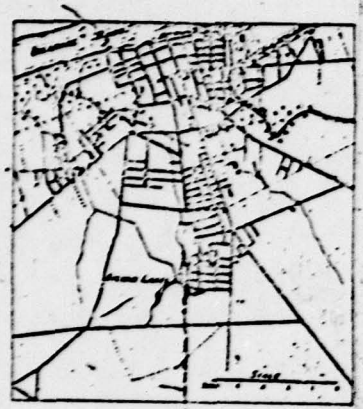
SUBJECT	SHEET	BY	DATE	JOB NO
SYLVAN LAKE DAM	3	DBC	4/18/79	

TOP OF DAM PROFILE



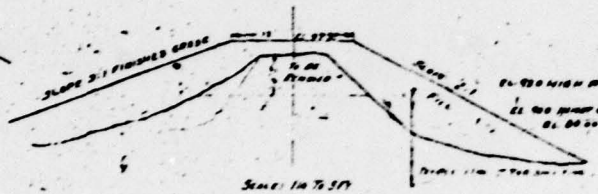
PROPOSED WIDENING
OF
OVERFLOW CANAL, SYLVAN LAKES TO TANNERS RUN
BURLINGTON TWSP. BURLINGTON CO., N.J.
APRIL 1939

Sheet 4



KEY MAP

TYPICAL SECTION
EMBANKMENT
THROUGH WASH OUT



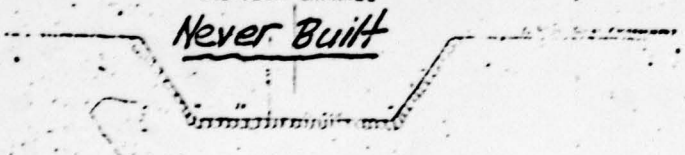
Scale: 1in To 5ft

ESTIMATE OF QUANTITIES			
Item	Description	Quantity	Cost
1	Earth Excavation	600	
2	Earth Fill	6000	
3	Sheet Piling	3900	

APPROVAL OF MUNICIPALITY

APPROVAL OF STATE

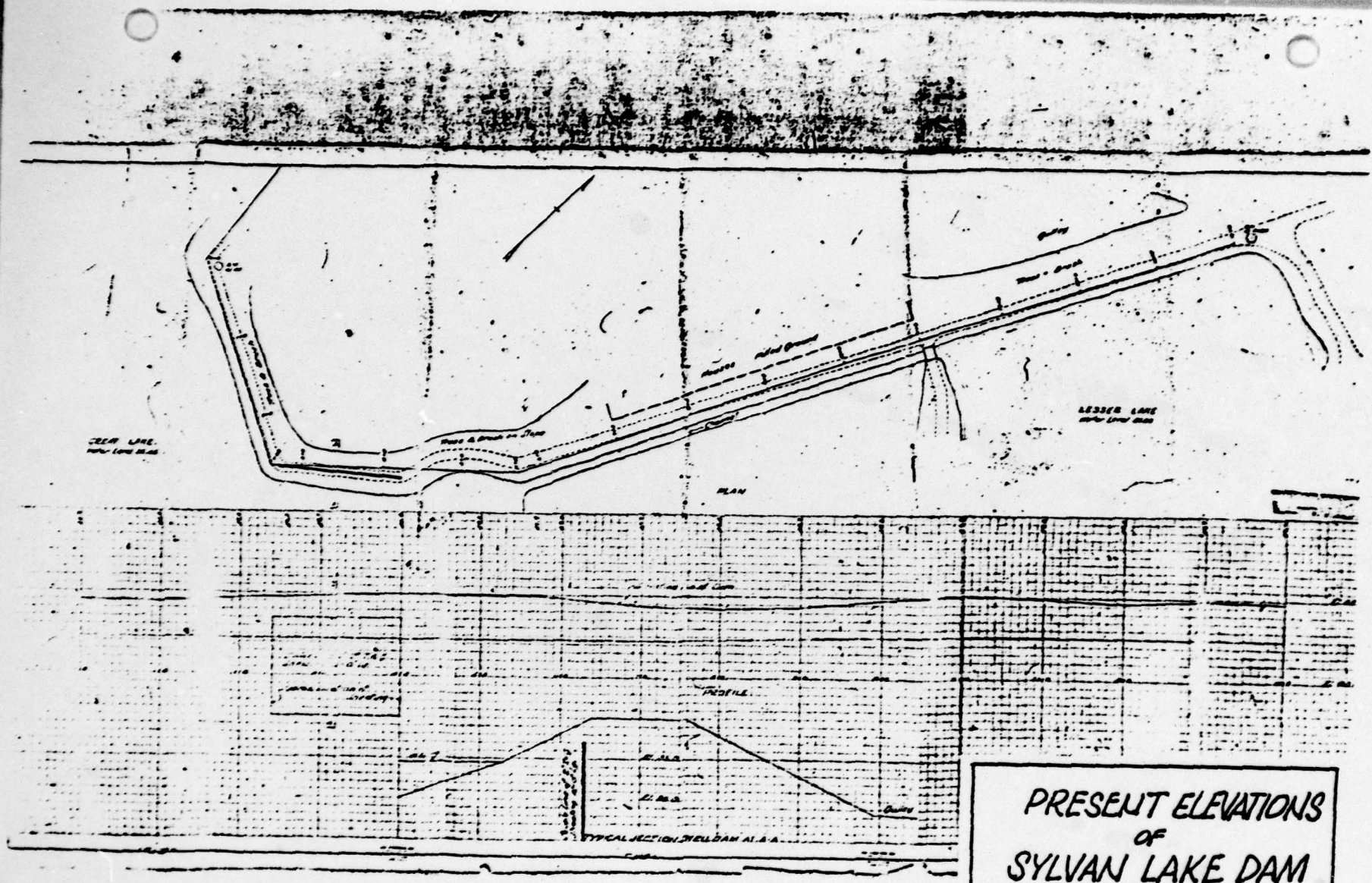
TYPICAL SECTION
OVERFLOW CHANNEL
Never Built



Scale: 1in To 5ft

SYLVAN LAKES PARK
BURLINGTON, N.J.
PROPOSED REPAIRS TO DAM
SCALE: As Shown
JANUARY 1939
AUGUST 1939
SAMUEL R. PROBASCO
CITY ENGINEER
BURLINGTON, N.J.

Sheet 5

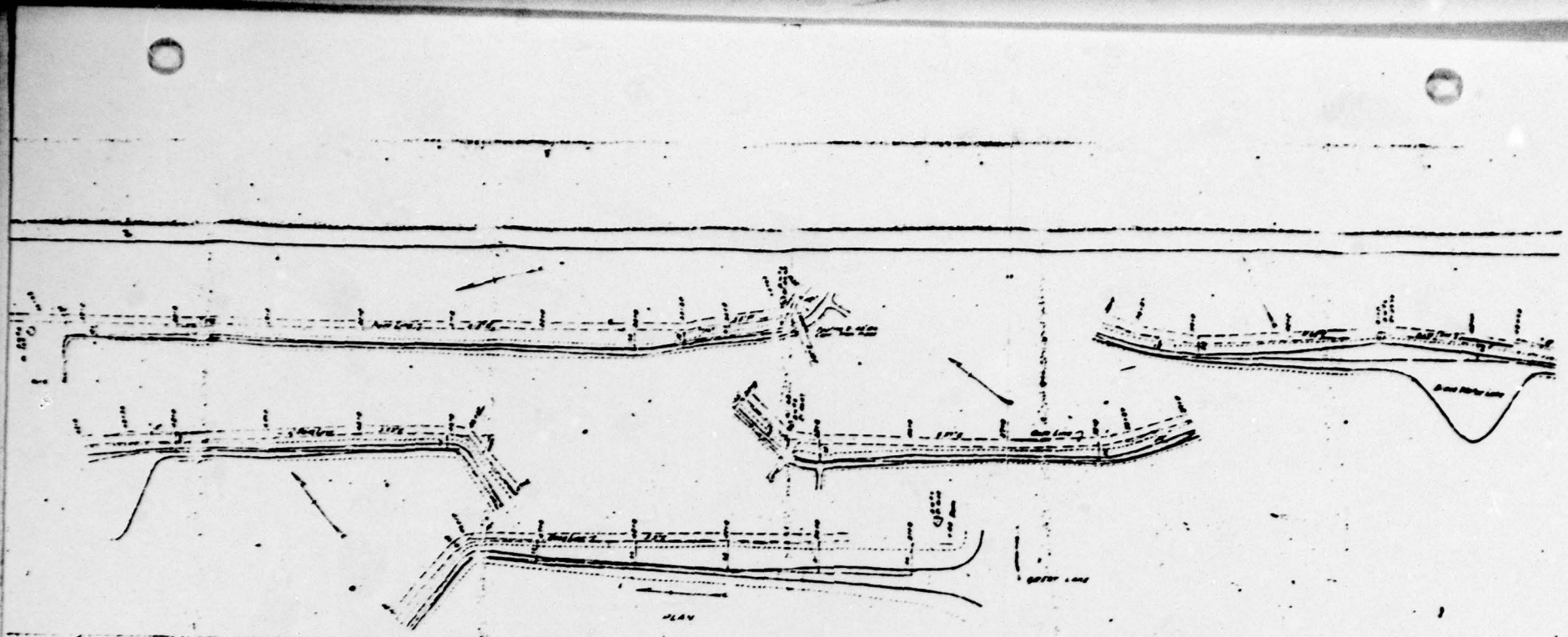


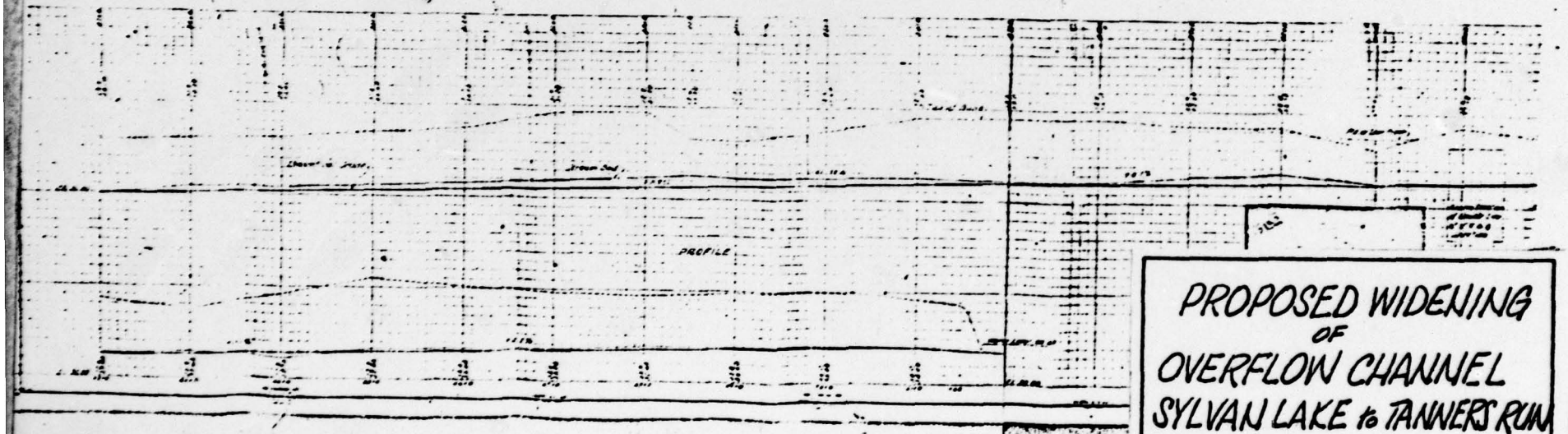
PRESENT ELEVATIONS OF SYLVAN LAKE DAM BURLINGTON TWP., N.J.

Mar. 1947

Samuel R. Probasco
City Eng'r., City of Burlington N.J.

Sheet 6





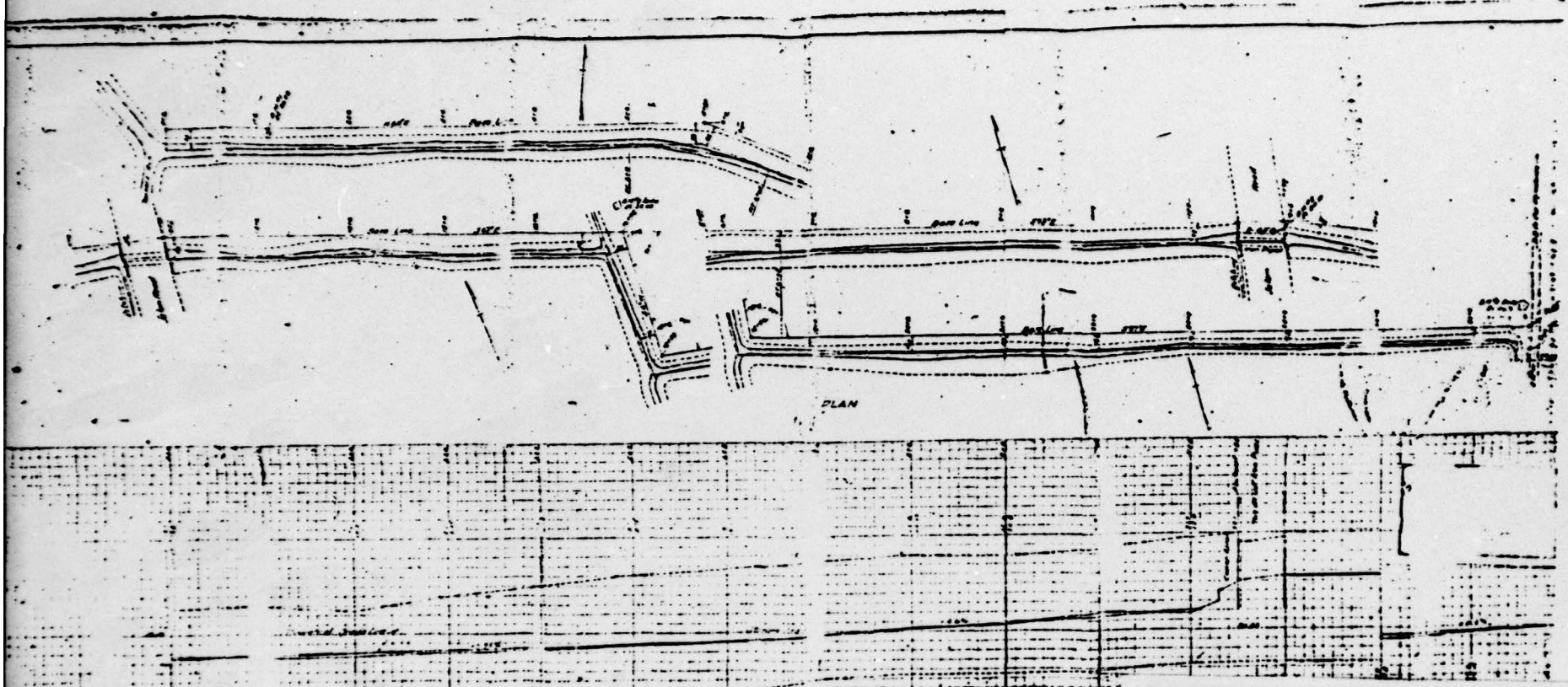
PROPOSED WIDENING OF OVERFLOW CHANNEL SYLVAN LAKE to TANNERS RUN

BURLINGTON TWP, BURLINGTON CO, N.J.

APRIL 1949

Samuel R. Probasco
City Engr., City of Burlington, N.J.

Sheet 7



PROPOSED WIDENING OF OVERFLOW CHANNEL SYLVAN LAKE to TANNERS RUN

BURLINGTON TWP, BURLINGTON Co., N.J.
APRIL 1947
Samuel R. Probasco
City Engr. City of Burlington, N.J.

Sheet 8

APPENDIX

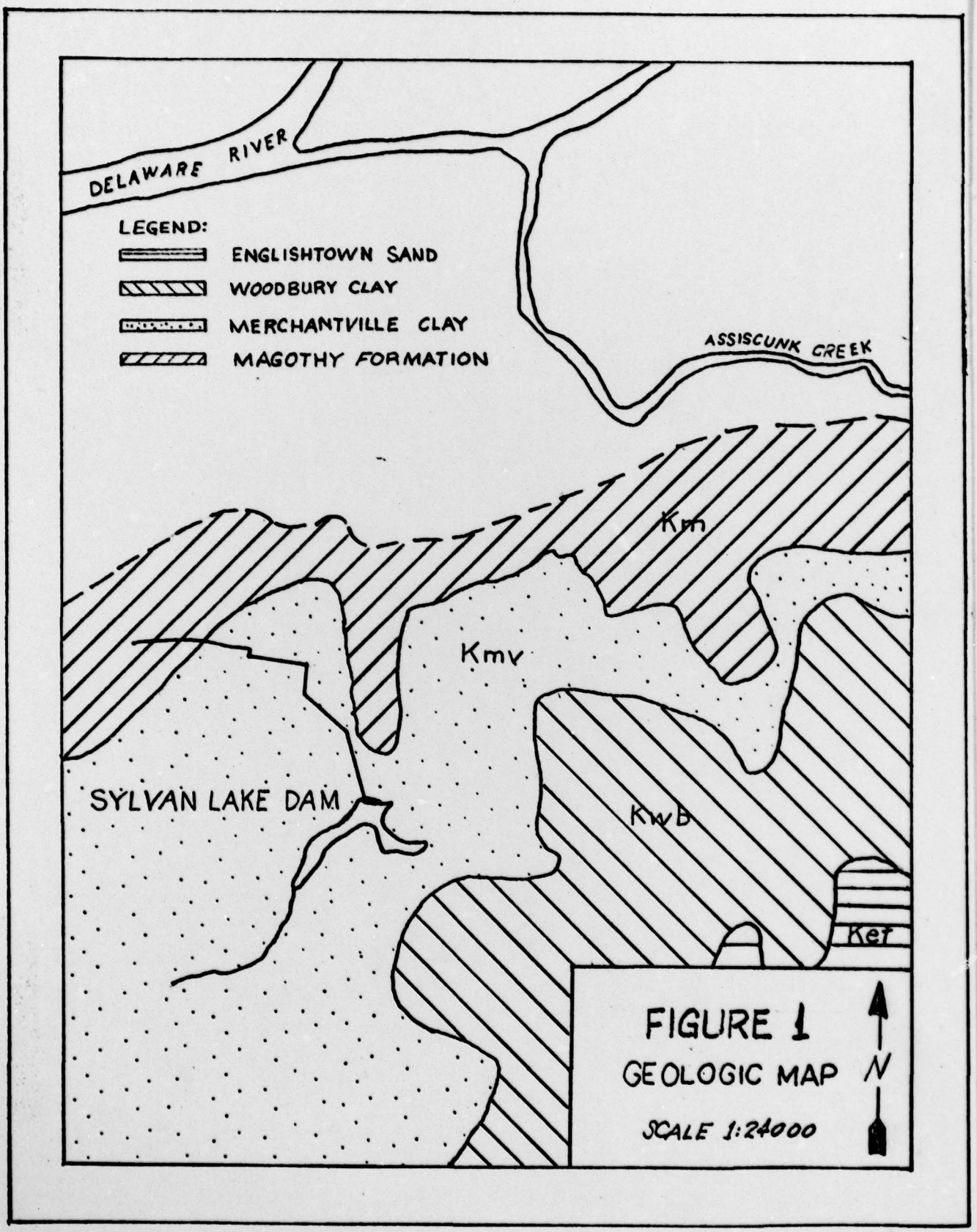
F

Site Geology

SITE GEOLOGY

SYLVAN LAKE DAM

Sylvan Lake is located in the Coastal Plain physiographic province which is composed of unconsolidated sedimentary deposits. These beds form a wedge-shaped mass that is exposed at the fall line to the north of the site and thickens in a southeasterly direction towards the Atlantic Ocean. The surficial deposit at the dam site is a shallow bed of Cretaceous clay known as the Merchantville formation. This deposit is underlain by the alternating beds of light colored sands and lignitic clays typical of the Magathy formation. Written accounts suggest that the latter may form both the foundation and embankment for Sylvan Lake Dam. No faults or major structural defects are noted in the vicinity of the dam or lake.


DELAWARE RIVER
LEGEND:
ENGLISHTOWN SAND
WOODBURY CLAY
MERCHANTVILLE CLAY
MAGOTHY FORMATION
ASSISCUNK CREEK
Km
Kmv
KwB
Ket
SYLVAN LAKE DAM
N
FIGURE 1
GEOLOGIC MAP
SCALE 1:24000