

AD-A068 645

NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. PROSPERTOWN DAM (NJ-00455), DELAWARE--ETC(U)
MAY 79 R J MCDERMOTT

DACW61-78-C-0124

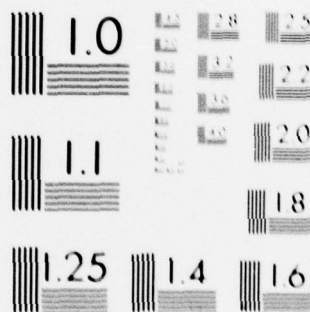
NL

UNCLASSIFIED

1 OF 2

AD
A068645

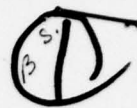




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD A068645

LEVEL



DELAWARE RIVER BASIN
LAHAWAY CREEK, OCEAN COUNTY
NEW JERSEY

PROSPERTOWN DAM

NJ00455

DDC
RECEIVED
MAY 16 1979
C

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

Approved for public release;
distribution unlimited



ORIGINAL CONTAINS COLOR PLATES: ALL DDC
REPRODUCTIONS WILL BE IN BLACK AND WHITE.

DDC FILE COPY

DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

79 05 14 209
May, 1979

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DDC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**



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 MAY 1979

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

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Prospertown Dam in Ocean 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, Prospertown Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition and the spillway is considered adequate. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within three months from the date of approval of this report, a qualified professional engineer should be engaged to monitor the seepage on the downstream slope and near the discharge culvert by visual observation and measurements on a monthly basis to determine the source and seriousness of the seepage and a complete inspection of the toe drain should be performed. A detailed topographic survey of the dam and surrounding areas should be made. The survey results and the seepage observations and measurements should be studied carefully to determine the subsurface effects of the seepage. The survey, observations, measurements and results of the study should also be made part of the permanent record for the dam. Any remedial measures found necessary should be initiated within calendar year 1980.

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

(1) The toe drain should be inspected and cleaned or reconstructed as may be necessary to insure proper operation.

This document has been approved
for public release and sale; its
distribution is unlimited.

NOTICE

THIS DOCUMENT HAS BEEN REPRODUCED
FROM THE BEST COPY FURNISHED US BY
THE SPONSORING AGENCY. ALTHOUGH IT
IS RECOGNIZED THAT CERTAIN PORTIONS
ARE ILLEGIBLE, IT IS BEING RELEASED
IN THE INTEREST OF MAKING AVAILABLE
AS MUCH INFORMATION AS POSSIBLE.

NAPEN-D

Honorable Brendan T. Byrne

(2) Riprap obstructing discharge at the discharge culvert outlet should be removed.

(3) Eroded area along the embankment crest and at the edge of the paved parking area near the north end of the dam should be filled and stabilized with ground cover vegetation. Bare spots on the embankment slope should be stabilized and planted with ground cover vegetation.

(4) Drainage from the paved area at the north end of the dam should be controlled so as to stop erosion of the embankment.

(5) The auxiliary spillway crest should be graded to remove all ruts and stabilized with ground cover vegetation. Vehicular traffic should be prohibited in this area.

(6) Tall grass in the auxiliary spillway channel should be cut and maintained at a lower height.

(7) Vegetation hanging over the downstream channel, and brush and small trees in the flood plain between the dam and the Route 537 bridge should be removed.

(8) The asphalt coating on the anti-vortex assembly should be renewed after rust is removed.

(9) The owner of the dam should initiate a formal program of annual inspection and maintenance with special attention given to the toe drain to assure proper drainage of the embankment without seepage. The observations and measurements should be recorded on a stabilized check list similar to the one used in this report. Inspection check-lists, complete records of maintenance, and design calculations plus construction drawings for post construction changes should be included in a permanent file.

ACCESSION for	
NTIS	Write Section ☒
DDC	Buff Section ☐
UNANNOUNCED	☐
JUL 1 1971	
BY	
DISPATCHED BY	
DATE	
A	

NAPEN-D

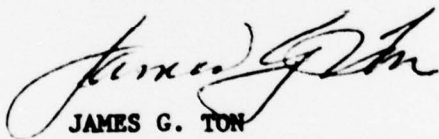
Honorable Brendan T. Byrne

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 Edwin B. Forsythe of the Sixth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

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

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

Sincerely,



JAMES G. TON
Colonel, Corps of Engineers
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

PROSPERTOWN DAM (NJ00455)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 2 February and 14 March 1979 by Storch Engineers under contract to the State of New Jersey. The State, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Prospertown Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition and the spillway is considered adequate. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within three months from the date of approval of this report, a qualified professional engineer should be engaged to monitor the seepage on the downstream slope and near the discharge culvert by visual observation and measurements on a monthly basis to determine the source and seriousness of the seepage and a complete inspection of the toe drain should be performed. A detailed topographic survey of the dam and surrounding areas should be made. The survey results and the seepage observations and measurements should be studied carefully to determine the subsurface effects of the seepage. The survey, observations, measurements and results of the study should also be made part of the permanent record for the dam. Any remedial measures found necessary should be initiated within calendar year 1980.

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

(1) The toe drain should be inspected and cleaned or reconstructed as may be necessary to insure proper operation.

(2) Riprap obstructing discharge at the discharge culvert outlet should be removed.

(3) Eroded area along the embankment crest and at the edge of the paved parking area near the north end of the dam should be filled and stabilized with ground cover vegetation. Bare spots on the embankment slope should be stabilized and planted with ground cover vegetation.

(4) Drainage from the paved area at the north end of the dam should be controlled so as to stop erosion of the embankment.

(5) The auxiliary spillway crest should be graded to remove all ruts and stabilized with ground cover vegetation. Vehicular traffic should be prohibited in this area.

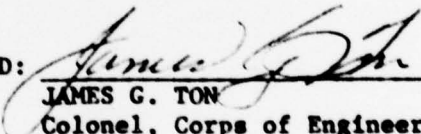
(6) Tall grass in the auxiliary spillway channel should be cut and maintained at a lower height.

(7) Vegetation hanging over the downstream channel, and brush and small trees in the flood plain between the dam and the Route 537 bridge should be removed.

(8) The asphalt coating on the anti-vortex assembly should be renewed after rust is removed.

(9) The owner of the dam should initiate a formal program of annual inspection and maintenance with special attention given to the toe drain to assure proper drainage of the embankment without seepage. The observations and measurements should be recorded on a stabilized check list similar to the one used in this report. Inspection check-lists, complete records of maintenance, and design calculations plus construction drawings for post construction changes should be included in a permanent file.

APPROVED:


JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE:

2 May 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Prosperstown Dam, I.D. NJ00455
State Located:	New Jersey
County Located:	Ocean
Drainage Basin:	Delaware River
Stream:	Lahaway Creek
Date Inspected:	February 2, 1979 and March 14, 1979

Assessment of General Condition of Dam

Information available for this study is adequate for a Phase I assessment. Based on available records, past operational performance, visual inspections and Phase I engineering analyses, Prosperstown Dam is in fair overall condition. It is outwardly structurally stable and is hydraulically adequate to pass the SDF (Spillway Design Flood) without overtopping the dam. The SDF for Prosperstown Dam is a 100-year storm.

Unsatisfactory conditions observed during the field inspections consist of seepage areas on the downstream embankment slope and adjacent to the discharge culvert outlet, trees and brush in the downstream flood plain and overhanging the natural stream bed, tall grass and large tufts in the auxiliary spillway channel, vehicle ruts and lack of ground cover vegetation at the auxiliary spillway crest, and erosion at the north end of the embankment at the edge of the paved area and along the upstream embankment slope adjacent to the principal spillway.

The following remedial measures should be implemented by the owner in the near future:

- 1) The toe drain should be inspected and cleaned or reconstructed as may be necessary to insure proper operation.
- 2) Riprap obstructing discharge at discharge culvert outlet should be removed.
- 3) Eroded areas along the embankment crest and at the edge of the paved parking area near the north end of the dam should be filled and stabilized with ground cover vegetation. Bare spots on the downstream embankment slope should be stabilized and planted with ground cover vegetation.
- 4) Drainage from the paved area at the north end of the dam should be controlled so as to stop erosion of the embankment.
- 5) The auxiliary spillway crest should be graded to remove all ruts and stabilized with ground cover vegetation. Vehicular traffic should be prohibited in this area.
- 6) Tall grass in the auxiliary spillway channel should be cut and maintained at a lower height.
- 7) Vegetation hanging over the downstream channel, and brush and small trees in the flood plain between the dam and the Route 537 bridge should be removed.
- 8) The asphalt coating on the anti-vortex assembly should be renewed after rust is removed.

The owner of the dam should initiate a formal program of annual inspection and maintenance in the near future with special attention given to the toe drain to assure proper drainage of the embankment without seepage. These inspections should be performed by a qualified professional engineer and the observations and measurements should be recorded on standardized check-list forms. Inspection check-lists, complete records of maintenance, and design calculations plus construction drawings for post construction changes should be included in a permanent file, available for public inspection.

Repairs should be performed as required and the following maintenance should be performed annually: continue removing brush and trees from the embankment; remove brush and small trees from the downstream flood plain between the dam and the Route 537 bridge; fill and stabilize eroded areas with ground cover vegetation; and clear debris from the principal spillway grate and from the downstream channel.

Furthermore, the lake should be lowered at least once every five years for the purpose of removing sediment and to permit complete inspection and repair of the dam and appurtenances.

A qualified professional engineer should be engaged soon to monitor the seepage on the downstream slope and near the discharge culvert by visual observation and measurements on a monthly basis to determine the source and seriousness of the seepage and a complete inspection of the toe drain should be performed. A detailed topographic survey of the dam and surrounding areas should be performed by a

qualified professional engineer or licensed land surveyor. The survey results and the seepage observations and measurements should be studied carefully to determine the subsurface effects of the seepage. The survey, observations, measurements and results of the study should also be made part of the permanent record for the dam.

Richard J. McDermott
Richard J. McDermott, P.E.



OVERVIEW - PROSPERTOWN DAM

2 FEB. 1979

TABLE OF CONTENTS

	<u>Page</u>
ASSESSMENT OF GENERAL CONDITION OF DAM	i
OVERVIEW PHOTO	
TABLE OF CONTENTS	vi
PREFACE	viii
SECTION 1 - PROJECT INFORMATION	1
1.1 General	
1.2 Description of Project	
1.3 Pertinent Data	
SECTION - ENGINEERING DATA	11
2.1 Design	
2.2 Construction	
2.3 Operation	
2.4 Evaluation	
SECTION 3 - VISUAL INSPECTION	15
3.1 Findings	
SECTION 4 - OPERATIONAL PROCEDURES	20
4.1 Procedures	
4.2 Maintenance of the Dam	
4.3 Maintenance of Operating Facilities	
4.4 Description of Warning System	
4.5 Evaluation of Operational Adequacy	

TABLE OF CONTENTS (cont.)

	<u>Page</u>
SECTION 5 - HYDRAULIC/HYDROLOGIC	22
5.1 Evaluation of Features	
SECTION 6 - STRUCTURAL STABILITY	24
6.1 Evaluation of Structural Stability	
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS	26
7.1 Dam Assessment	
7.2 Recommendations	
PLATES	
1 KEY MAP	
2 VICINITY MAP	
3 SOIL MAP	
4 GENERAL PLAN	
5 TYPICAL SECTION DAM AND PRINCIPAL SPILLWAY	
6 SOIL BORING DATA	
7 PHOTO LOCATION PLAN	
APPENDICES	
1 Check List - Visual Inspection Check List - Engineering DATA	
2 Photographs	
3 Engineering Data	
4 Hydrologic Computations	
5 Bibliography	

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. 30214. 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 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 the 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 I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PROSPERTOWN DAM, I.D. NJ00455

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP), under agreement with the Philadelphia District of the Corps of Engineers, has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams.

b. Purpose of Inspection

Visual inspections of Prospertown Dam were made on February 2, 1979 and March 14, 1979, to generally assess the structural integrity and operational adequacy of the dam and appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

The facilities at Prospertown Dam consist of an earthfill embankment with two uncontrolled spillways, one outlet works and a small interceptor ditch. (See Plates 4 and 5 and Overview Photo)

Discharge from the spillways enters Lahaway Creek downstream from the toe of dam, flows under the Route 537 bridge and eventually into Crosswicks Creek.

The earthfill embankment is about 643 feet long and extends approximately north/south. The embankment crest is about 20 feet wide with a gravel road at its center (See Photo 2). The downstream embankment (See Photo 4) slope is 2.5 horizontal to 1 vertical. The upstream face of the embankment (See Photo 3) has a compound slope consisting of 3.5 horizontal to 1 vertical from elevation 104.5 to the upstream toe at about elevation 88, except in the area between elevation 100.5 and 99.5 where the slope is 10 horizontal to 1 vertical. Dense grass covers the entire downstream slope and the upstream slope from the normal pool water level up about one half the distance to the crest. The entire crest and upper half of the upstream slope are bare, as well as the area adjacent to the principal spillway, where the slope has been eroded. The embankment soil consists of compacted sand, silt and clay with a gravel crest road and riprap in the splash zone from elevation 102 to 99.5.

The principal spillway (See Photo 1) consists of a corrugated metal pipe riser, 72 inches in diameter. The spillway is located approximately 125 feet south of the north embankment limit and about 36 feet east of the embankment center line. The circumferential spillway crest is about 18.8 feet long, and is located about 4.5 feet below the embankment crest.

The top of the riser is enclosed in a 7 foot square anti-vortex assembly, made of asphalt coated corrugated metal sheets with a steel grated opening at the center. The top of the anti-vortex assembly is set at about elevation 102, 2 feet above the spillway crest. Water flows into the riser through openings on the underside of the enclosure assembly and through the grate above. The anti-vortex assembly also serves as a trash rack and safety barrier.

The corrugated metal riser is approximately 14 feet high and is set on a reinforced concrete slab 12 inches thick and 10 feet square. The riser invert is paved with 4 inches of concrete and is at elevation 86.3.

The spillway discharges through an asphalt coated corrugated metal pipe 48 inches in diameter which extends through the embankment, sloping down from the riser at 0.5 percent gradient. The upstream invert of the discharge culvert is at elevation 86.5. The culvert discharges onto a riprap apron at the downstream toe of the embankment at invert elevation 86.0.

The outlet works for Prospertown Dam consists of a slide gate controlled corrugated metal pipe, 24 inches in diameter and 40 feet long, which discharges into the corrugated metal pipe riser. The outlet pipe leading to the riser is horizontal with its invert at elevation 88.5. The pipe extends from a point outside of the upstream toe of the embankment to the riser.

The overflow entrance to the auxiliary spillway is located at the south end of the dam (See Photo 5). The spillway channel curves toward the north, sloping down at 0.4 percent and outfalls via a steeply sloped bank into Lahaway Creek (See Photo 6) about 50 feet upstream from

the Route 537 bridge. The spillway has a trapezoidal cross section with 3 horizontal to 1 vertical side slopes and a bottom width of 65 feet.

An interceptor ditch, is located about 30 feet north of the north end of the embankment crest. The ditch is trapezoidal with 3 horizontal to 1 vertical side slopes and a bottom width of 3 feet. The ditch is horizontal with its invert at elevation 104.

b. Location

Prospectown Dam impounds Prospectown Lake and is located at the west end of the Lake about 300 feet east of Route 537 (Ocean and Monmouth County Boundary) in Jackson Township, Ocean County, New Jersey. Outflow from Prospectown Dam enters Lahaway Creek a tributary of Crosswicks Creek in the Delaware River Basin. Prospectown Dam is located on land owned by the State of New Jersey.

c. Size and Hazard Classification

Size and Hazard Classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams", published by the U.S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

<u>Category</u>	<u>Impoundment</u>	
	<u>Storage (Ac-ft)</u>	<u>Height (Ft)</u>
Small	<1000 and >50	<40 and >25
Intermediate	>1000 and <50,000	>40 and <100
Large	>50,000	>100

HAZARD POTENTIAL CLASSIFICATION

<u>Category</u>	<u>Loss of Life</u>	<u>Economic Loss</u>
	(Extent of Development)	(Extent of Development)
Low	None expected (no permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than few	Excessive (Extensive community, industry or agriculture)

The characteristics of Prospertown Dam are:

Storage = 780 acre-feet

Height = 18.5 feet

Potential Loss of Life: No inhabitable structures within 2 miles of dam in flood plain as delineated by SDF outflow.

Potential Economic Loss: Route 537 bridge approximately 500 feet downstream of the dam would be washed out, if the dam were to be breached.

Therefore, Prospertown Dam is classified as "Small" size and "Significant" hazard potential.

d. Ownership

Prospertown Dam is owned by the State of New Jersey and operated by the State of New Jersey Department of Environmental Protection, Division of Fish, Game and Shellfisheries, Labor and Industry Building, Trenton, New Jersey 08625.

e. Purpose of Dam

Prospertown Dam impounds Prospertown Lake which serves primarily as a public recreational facility. The lake has two secondary purposes: conservation of wildlife and flood control.

These purposes are consistent with the "Application for Permit for Construction and Repair of Dam" filed on July 30, 1964.

f. Design and Construction History

The firm of Mauzy, Morrow and Associates, 58 Madison Avenue, Lakewood, New Jersey; developed the engineering data for the site; prepared the construction drawings and specifications; and performed site inspections during the construction of the dam.

Seepage was observed along the downstream embankment slope and erosion was noted adjacent to the principal spillway discharge culvert during field inspections performed in late 1966. Further investigation and analysis of the seepage led to the design and development of a toe drain system. The toe drain was installed in late Spring of 1968. Subsequent inspections indicated that the seepage had been stabilized.

No formal remedial work was planned for the erosion problem at the discharge culvert outlet. However, a timber enclosure was constructed around the outlet in order to channelize and re-direct flow so as to reduce erosion. The structure has apparently reduced erosion slightly

g. Normal Operational Procedure

Operation of this dam is under the jurisdiction of the State of New Jersey, Department of Environmental Protection, Division of Fish, Game and Shellfisheries. Reportedly there is no formal operational procedure for the dam. The lake is not drawn down on a regular basis and the principal spillway has not been inspected thoroughly since construction in 1964. Vegetation on the embankment slopes and in the auxiliary spillway is cut down periodically during the growing season. Brush and trees are removed from the slopes periodically.

1.3 Pertinent Data

a. Drainage Area = 3.3 square miles

b. Discharge at Dam Site

Maximum known flood at dam site	Unknown
Outlet works at normal pool elevation	30 c.f.s.
Diversion tunnel low pool outlet at pool elevation	N.A.
Diversion tunnel outlet at pool elevation	N.A.
Gated spillway capacity at pool elevation	N.A.
Ungated spillway capacity at top of dam (Principal Spillway)	227 c.f.s.
Ungated spillway capacity at top of dam (Auxiliary Spillway)	780 c.f.s.
Total spillway capacity at top of dam	1007 c.f.s.

c. Elevation (Assumed Datum)

Top of Dam	104.5
Maximum pool-design surcharge (SDF)	104.5
Full flood control pool	101.5
Recreational pool	100.0
Principal spillway crest	100.0
Auxiliary spillway crest	101.5
Upstream portal invert diversion tunnel	N.A.
Stream bed at centerline of dam	86
Maximum tailwater	90 (Estimated)

d. Reservoir

Length of maximum pool	5700 feet
Length of recreational pool	5700 feet
Length of flood control pool	5700 feet

e. Storage (Acre-feet)

Principal spillway pool	402
Recreational pool	402
Flood control pool	515
Design surcharge (SDF)	780
Top of dam	780

f. Reservoir Surface (Acres)

Top of Dam	103
Maximum Pool (SDF)	103
Flood control pool	82.5
Recreational pool	70.5
Principal spillway crest	70.5

g. Dam

Type	Earthfill
Length	643 feet
Height	18.5 feet
Side slopes - Upstream	3.5 horiz to 1 vert.
- Downstream	2.5 horiz to 1 vert.
Zoning	None
Impervious core	None
Cutoff	None
Grout curtain	None

h. Diversion and Regulating Tunnel N.A.

i. Principal Spillway

Type	72" Diameter CMP Riser
Length of weir (Circumferential)	18.8 feet
Crest elevation	100.0 feet
Gates	N.A.
Upstream channel	N.A.
Downstream channel	48" CMP Discharge Culvert

j. Auxiliary Spillway

Type	Trapezoidal grassed channel
Bottom Width	65 feet
Side Slopes	3 horiz. to 1 vert.
Crest Elevation	101.5
Gates	None
Upstream Slope	0.25 feet/foot (Design)
Downstream Slope	0.004 feet/foot (Design)

k. Regulating Outlets

1 - 24" diameter CMP with manual slide gate

SECTION 2: ENGINEERING DATA

2.1 Design

The firm of Mauzy, Morrow and Associates, 58 Madison Avenue, Lakewood, New Jersey prepared the original design for Prospertown Dam including the engineering design report, construction drawings and specifications. The engineering report entitled "Engineering Report on design Criteria for Prospertown Dam and Spillway" presents an analysis of the hydrology, hydraulics, foundation soil and embankment stability for Prospertown Dam and appurtenances, however there is no structural analysis of the principal spillway system (anti-vortex assembly, foundation slab and connections). In preparation of the above report, the following data were developed:

1. Hydrology for the study area.
2. Hydraulic characteristics and capacities of the proposed spillway facilities.
3. Topographic Survey
4. Four soil borings with a sampling interval of 5 feet, ranging in depth from 20 to 60 feet, along the proposed dam alignment.
5. Foundation and embankment stability analysis, including studies of permeability and rotational slide surfaces.

The following construction drawings dated July, 1964 were prepared based on the analyses performed in the above mentioned report:

1. Location Plan and Drainage Area
2. Dam, Lake, Surface and Flood Plain
3. General Plan
4. Cross Section Dam and Spillway
5. Longitudinal Section and Borings
6. Details-Corrugated Metal Riser Pipe Assembly.
7. Hydrograph of Routing

The construction drawings and specifications were prepared by Mauzy, Morrow and Associates.

The spillway facilities at Prospertown Dam were hydraulically designed by routing the design storm flood. The Soil Conservation Service dimensionless unit hydrograph method was used to develop the inflow hydrograph. As designed either the principal spillway or the auxiliary spillway will attenuate the peak inflow of 480 c.f.s. to yield a maximum discharge of 150 c.f.s. The auxiliary spillway was designed to pass the design flood as described above should the principal spillway stop functioning.

Shortly after construction was completed seepage was observed at the downstream slope. A toe drain was designed by the Division of Fish, Game and Shellfisheries to alleviate the seepage problem.

2.2 Construction

Prospertown Dam was constructed in 1965. During construction, the design engineers, Mauzy, Morrow and Associates, performed site inspections. The work observed during these inspections was in accordance with the construction drawings and specifications. This conformance was verified in the report recommending acceptance of the work by Mauzy, Morrow and Associates on December 23, 1966.

Jersey Testing Laboratories performed field density tests during the dam construction. Data as developed by such testing are contained in seven reports dated September 27 and 28, 1965. Areas of the embankment where the specified compaction was not attained were recompacted and the required field density of 95 percent was attained at the locations tested.

The toe drain was constructed in 1968. The system as installed consisted of perforated corrugated metal pipe, backfilled with granular soil that would conduct flow, but prevent migration of fine particles into the drain.

2.3 Operation

The approval of the application to construct Prospertown Dam was granted subject to several conditions. One requirement was an annual inspection with a written report and photographs. The NJDEP file contains annual reports for the period from 1968 after the toe drain was installed to 1974. All of the reports indicate that the dam and appurtenances were in good condition.

2.4 Evaluation

a. Availability

Comprehensive engineering data, design calculations and construction drawings for the dam and appurtenances, except the toe drain are available from the NJDEP file. This information is available for inspection at the offices of the Bureau of Flood Plain Management, 1474 Prospect Street, Trenton, N.J.

b. Adequacy

The engineering data available from the NJDEP file is adequate to permit an assessment of the hydraulic capacity of the spillways and the overall stability of the embankment. However, the data does not include a structural analysis of the principal spillway structure.

No design calculations, construction drawings or specifications are available for the toe drain.

c. Validity

Based on the findings of the field inspection, the information contained in the NJDEP file for Prospertown Dam is essentially accurate with respect to the as-built conditions at the site. Furthermore, a cursory engineering review indicates that the design areas investigated in the calculations and the field investigations were consistent with standard engineering practice.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

Prospertown Dam was inspected on February 2, 1979 and March 14, 1979 by members of the staff of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1. The embankment of the dam, appurtenant structures and adjacent areas were examined.
2. The embankment and accessible appurtenant structures were measured and key elevations were determined by hand level.
3. The embankment, appurtenant structures and adjacent areas were photographed.
4. Areas of suspected seepage were noted and located.
5. The downstream flood plain was toured to establish downstream development and restricting structures for a least 2 miles.

Information presented in the following paragraphs of this Section consists of observations made during the field inspection.

b. Dam

The crest of the earthfill embankment is straight and for the most part level. At the south end of the crest, adjacent to the auxiliary spillway the crest has been lowered slightly, apparently a result of vehicular traffic, as evidenced by tracks and ruts in this area. There was no indication of subsidence or distress.

There was evidence of riprap along the upstream slope near the principal spillway. The riprap was apparently buried along the remaining embankment length. The crest and upstream slope were eroded around the principal spillway causing a narrowing of the crest width.

Erosion was observed at the north end of the embankment crest at the edge of an asphalt paved parking area. Pavement was undermined and breaking off at this boundary.

Erosion of soil from the embankment crest and the downstream slope was evidenced by the accumulation of soil along the upstream sides of grass tufts on the slope.

Most of the embankment slopes are covered with dense grass. A shallow grassed drainage swale extending from the interceptor ditch to the discharge culvert outlet was observed at the north end of the dam. The swale was soft and wet.

A soft area about 150 feet long in the north/south direction is centered at about 190 feet south of the discharge culvert outlet. This area is about 8 feet below the embankment crest at about elevation 94.5. Several very wet bare spots were observed in this area.

Two small seepage areas were observed trickling into the natural downstream channel in the area of the discharge culvert outlet. One area was located in the embankment toe immediately adjacent to the outlet and may be attributed to seepage along the discharge culvert. The other area was located in the north downstream channel embankment and is probably ground water. There was no evidence of cracking, settling or animal burrows along the embankment.

Generally, surficial soils at the dam site consist of silt and sand with some clay and significant organic matter in the lake basin. Underlying soils are composed of dark green fine sand, silt and clay of medium to stiff consistency, known as Hornerstown Marl, which were deposited during the Tertiary Period. Bedrock is generally more than 100 feet below the surface. These data were in accordance with logs of soil borings performed at the dam site in 1964.

c. Appurtenant Structures

Principal Spillway

Most of the principal spillway was submerged or buried, and therefore could not be inspected. At the lake surface the spillway was enclosed by a square asphalt coated corrugated sheet metal structure with a grated opening in the center. Slight debris collection was noted on the grate, otherwise it was in good condition with some rust at the water level where the coating was not intact

Auxiliary Spillway

The auxiliary spillway consists of a trapezoidal grassed channel, essentially in present appearance as designed and constructed. Vehicle tracks and ruts were observed at

the spillway crest and the vegetation in this area was partially destroyed. The channel area downstream was covered with tall grass and numerous large tufts spread throughout. Such tall vegetation will retard discharge through the channel.

Moderate erosion was observed at the downstream end of the auxiliary spillway channel where discharge enters the natural downstream channel via a steep natural stream bank.

Outlet Works

The outlet works for the dam were submerged and buried except for the upper portion of the manual slide gate stem and the operating mechanism. There was no gate wheel on the stem and the gate was apparently closed.

Discharge Culvert

Most of the discharge culvert is contained within the embankment or is submerged and could not be inspected. The outlet consists of a 48 inch diameter asphalt coated corrugated metal pipe with a metal flared outlet section. A timber channelization structure was observed around the outfall, however it apparently has been dislodged by past heavy flows.

A riprap apron located immediately downstream from the flared end section, extends about 15 feet downstream and widens to about 25 feet at that point. It was noted that riprap had also been placed in the culvert opening to a height of about 2 feet obstructing discharge.

The natural channel banks were eroded slightly in the area around the culvert outlet.

d. Reservoir Area

Prosper town Lake is slightly greater than one mile long with a variable width averaging about 400 feet. The immediate shoreline is undeveloped except for a small public park with a timber fishing pier 10 feet wide and 40 feet long and a bathing beach on the north shore adjacent to the dam. The shoreline slopes up away from the lake and varies from about 2 to 10 percent. The surrounding area is generally rolling with several pronounced swales. Most of the watershed is covered with dense timber, mainly pine trees. The remaining 20 percent of the land area consists of pastures, grassland, unpaved roads and water surface.

e. Downstream Channel

Discharge from Prosper town Dam enters a natural winding stream know as Lahaway Creek. Immediately downstream from the dam the stream is about 15 feet wide with almost vertical banks approximately 2 feet high. The flood plain contains dense brush and tree growth which extensively overhang the stream bed. A bridge for Route 537 is located about 500 feet downstream from the discharge culvert. The bridge opening is about 16 feet wide by 7 feet high.

The flood plain for Lahaway Creek downstream from the bridge generally is well defined and contains no noticeable development for at least two miles.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The water level in Prospertown Lake is normally naturally controlled by overflow at the principal spillway, even during intense storms. There is no formal or informal procedure for operating the dam and appurtenances.

4.2 Maintenance of Dam

Reportedly, the only regular maintenance performed at the dam is removal of brush and trees from the embankment and periodic cutting of grass along the slopes and in the auxiliary spillway channel. The lake is not drawn down on a regular basis to permit inspection of facilities nor for removal of sediment around the outlet works.

Maintenance documentation is not available. Judging from the present condition of the dam, maintenance has been inadequate.

4.3 Maintenance of Operating Facilities

Reportedly, the principal spillway has not been inspected since the dam was constructed in 1965 and the slide gate on the outlet works is tested annually.

There is no maintenance documentation for these facilities.

4.4 Description of Warning System

There is no warning system for the dam and there is reportedly no program of periodic monitoring of the lake level during intense storms.

4.5 Evaluation of Operational Adequacy

The dam and appurtenances are in fair condition, but appear to have been poorly maintained. The dam and appurtenances have served adequately since construction, however without an improved inspection and maintenance program the facility will deteriorate rapidly into poor condition.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

Size and hazard classification were used in conjunction with "Recommended Guidelines for Safty Inspection of Dams" published by the U.S. Army Corps of Engineers to establish the SDF (Spillway Design Flood) for Prospertown Dam. The appropriate design range for this facility is 100-year frequency storm to 1/2 PMF (Probable Maximum Flood). Since the characteristics for Prospertown Dam as described in Section 1, fall into the lower end of the prescribed categories, the 100-year storm is used as the SDF.

The peak SDF inflow rate is 743 c.f.s. for Prospertown Lake (see Appendix 4), as calculated in accordance with analytical procedures contained in Special Report 38 published by the NJDEP. Hydraulic analysis of the spillway capacities indicates that the spillways would pass approximately 1007 c.f.s. with the water level at the dam crest. Therefore, since the maximum combined spillway capacity is greater than the SDF peak inflow, the spillways are hydraulically adequate.

It was assumed that the anti-vortex assembly would have a negligible effect on the inflow of water into the principal spillway. The spillway discharge calculations discussed above do not include discharge through the outlet works.

This is consistent with the present mode of operation since the control mechanism for the slide gate is not readily accessible.

b. Experience Data

Reportedly Prospertown Dam has never experienced overtopping or flow through the auxiliary spillway since construction in 1965.

c. Visual Observation

At the time of the field inspection there was no evidence of past overtopping. There was erosion at the downstream end of the auxiliary spillway, but it is apparently a result of surface runoff and not overflow from the reservoir.

d. Overtopping Potential

According to the hydrologic and hydraulic analysis the SDF for Prospertown Dam will pass through the spillways without overtopping of the dam.

e. Drawdown Time

Experience data for lowering the lake level is not available. A rough calculation was performed to determine the approximate drawdown time (See Appendix 4). Four drawdown steps were used and normal inflow was ignored. On this basis it would take approximately 10 days to draw the lake down.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

Observations made during the field inspection did not outwardly evidence weakness in the foundation soil, subsidence or slope instability. However, a seepage area was observed on the downstream slope of the embankment, and seepage areas were observed adjacent to the discharge culvert.

Erosion was observed along the embankment crest on the upstream slope near the principal spillway and at the north end of the crest at the outer edge of the paved parking area. Otherwise there was no serious erosion or deleterious vegetation.

b. Design and Construction Data

Soil borings were performed along the embankment alignment prior to construction of the dam. Samples were analyzed for soil type, gradation, water content and permeability.

The embankment configuration was analyzed for foundation stability and seepage by the design engineer. These data and calculations are contained in "Engineering Report on Design Criteria for Prospertown Dam" prepared by Mauzy, Morrow and Associates and are on file with the NJDEP. The dam was constructed in 1965.

Field density tests were performed on the compacted embankment by Jersey Testing Laboratories of Newark, New Jersey. The initial tests found several areas where

compaction was less than the specified 95%. These areas were recompactd until the criteria established were satisfied. Shortly after construction was completed seepage was noted on the downstream slope of the embankment. The seepage problem was alleviated by the installation of a toe drain.

c. Operating Records

Operating records for the dam and appurtenances are not available.

d. Post Construction Changes

The only post construction change noticed during the field inspection was a timber channelization structure around the discharge culvert outlet. The structure apparently is intended to reduce erosion of the embankment toe adjacent to the outlet.

e. Seismic Stability

Prospertown Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams," which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions, if stable under static loading conditions. Prospertown Dam appears to be stable under static loading based on the field inspection observations.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on the hydraulic and hydrologic analyses performed, the spillway facilities at Prospertown Dam are adequate and are capable of accommodating storm runoff equivalent to that computed for the SDF.

Based on the field inspections performed for this study and calculations performed by Mauzy, Morrow and Associates for design, the dam is stable. However, the seepage areas observed during the field inspection indicate that either the toe drain has stopped functioning or that seepage paths have developed through the dam.

b. Adequacy of Information

Information sources for this study include: 1) field investigations, 2) calculations, boring logs, engineering reports, drawings, dam inspection reports, miscellaneous correspondence and the "Application for Permit for Construction or Repair of Dam" in the NJDEP File, 3) USGS quadrangles and 4) consultation with Division of Fish, Game and Shellfisheries personnel. This information is adequate for a Phase I Assessment as outlined in "Recommended Guidelines for Saefty Inspection of Dams."

c. Necessity for Additional Data/Evaluation

Additional data are necessary to assess the dam relative to the seriousness and the causes of seepage observed on

the downstream slope of the embankment. These data should include: a comprehensive topographic survey; seepage observations and measurements, and an investigation of the existing condition of the toe drain.

7.2 Recommendations

a. Remedial Measures

It is recommended that the following remedial measures be undertaken by the owner in the near future:

- 1) The toe drain should be inspected and cleaned or reconstructed as may be necessary to insure proper operation.
- 2) Riprap obstructing discharge at discharge culvert outlet should be removed.
- 3) Eroded areas along the embankment crest and at the edge of the paved parking area near the north end of the dam should be filled and stabilized with ground cover vegetation. Bare spots on the downstream embankment slope should be stabilized and planted with ground cover vegetation.
- 4) Drainage from the paved area at the north end of the dam should be controlled so as to stop erosion of the embankment.
- 5) The auxiliary spillway crest should be graded to remove all ruts and stabilized with ground cover vegetation. Vehicular traffic should be prohibited in this area.

- 6) Tall grass in the auxiliary spillway channel should be cut and maintained at a lower height.
- 7) Vegetation hanging over the downstream channel, and brush and small trees in the flood plain between the dam and the Route 537 bridge should be removed.
- 8) The asphalt coating on the anti-vortex assembly should be renewed after rust is removed.

The implementation of the above measures will require proper detailed design and that applicable NJDEP approvals be obtained.

b. Maintenance

The owner of the dam should initiate a formal program of annual inspection and maintenance in the near future with special attention given to the toe drain to assure proper drainage of the embankment without seepage. These inspections should be performed by a qualified professional engineer and the observations and measurements should be recorded on standardized check-list forms. Inspection check-lists, complete records of maintenance, and design calculations plus construction drawings for post construction changes should be included in a permanent file, available for public inspection.

Repairs should be performed as required and the following maintenance should be performed annually: continue removing brush and trees from the embankment; remove brush and small trees from the downstream flood plain between the dam and the Route 537 bridge; fill and stabilize eroded areas with ground cover vegetation; and clear debris from the principal spillway grate and from the downstream channel.

Furthermore, the lake should be lowered at least once every five years for the purpose of removing sediment and to permit complete inspection and repair of the dam and appurtenances.

c. Additional Studies

A qualified professional engineer should be engaged soon to monitor the seepage on the downstream slope and near the discharge culvert by visual observation and measurements on a monthly basis to determine the source and seriousness of the seepage and a complete inspection of the toe drain should be performed. A detailed topographic survey of the dam and surrounding areas should be performed by a qualified professional engineer or licensed land surveyor. The survey results and the seepage observations and measurements should be studied carefully to determine the subsurface effects of the seepage. The survey, observations, measurements and results of the study should also be made part of the permanent record for the dam.

PLATES

PROSPERTOWN DAM

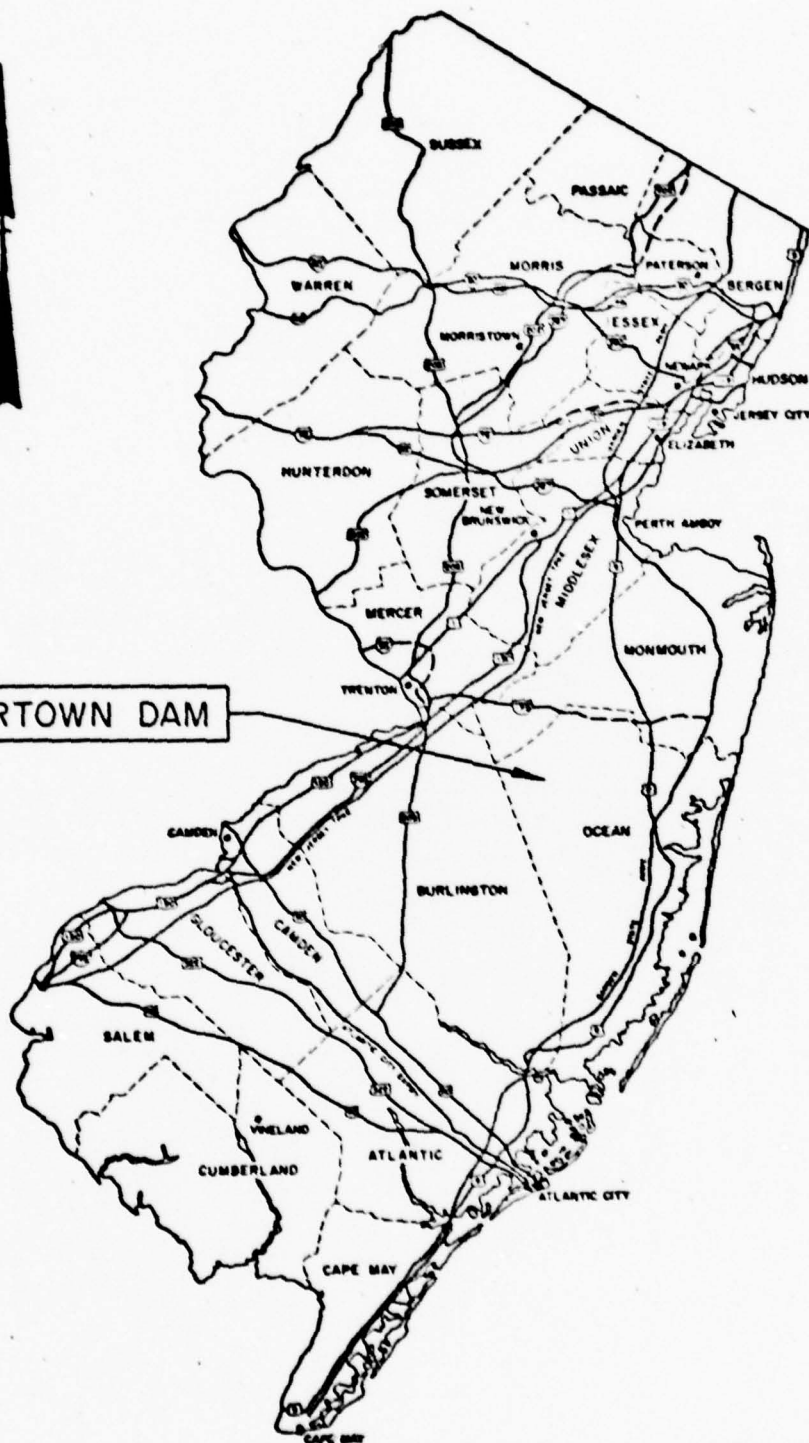


PLATE I

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

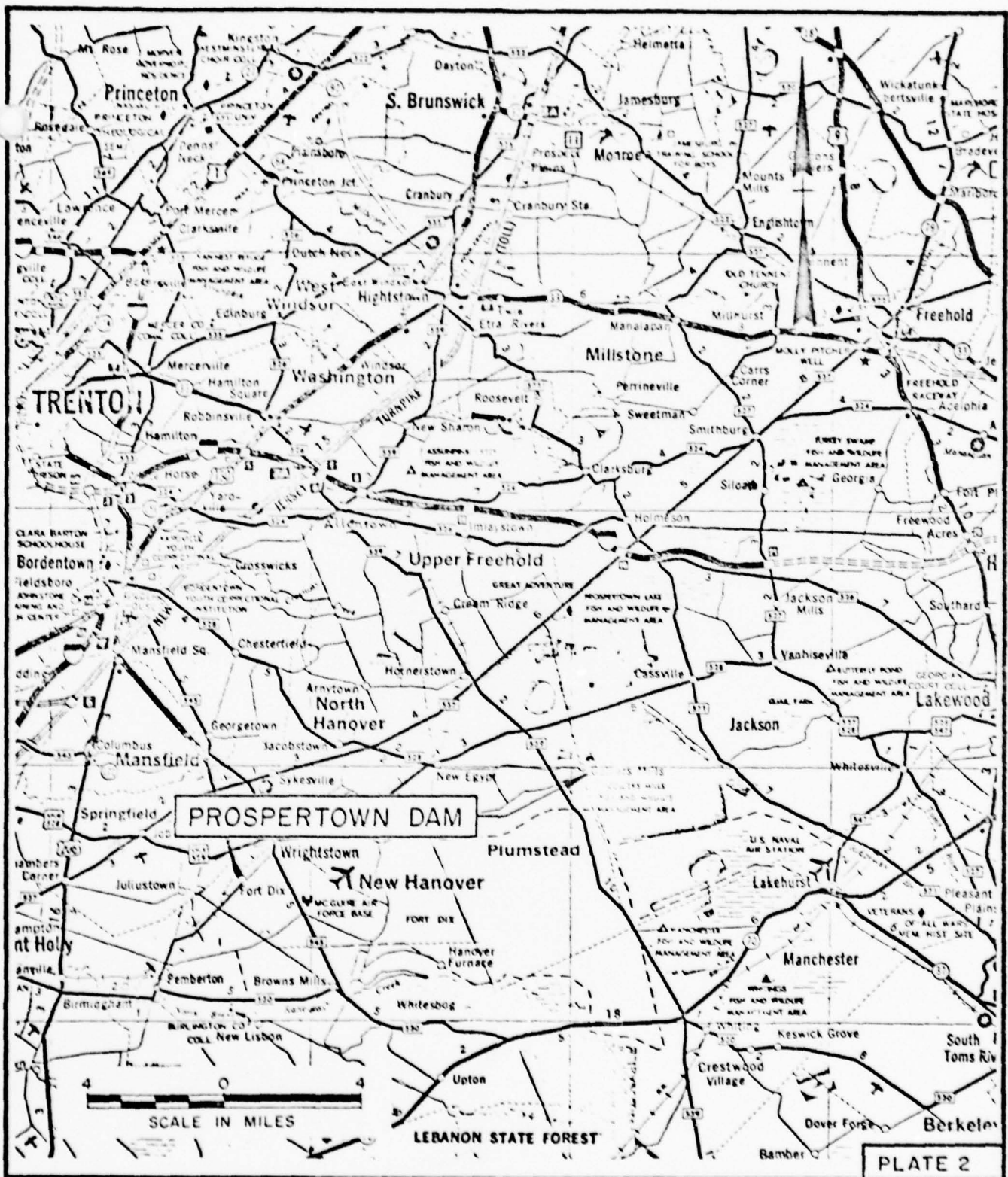
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS
KEY MAP
PROSPERTOWN DAM

I.D. N. J. 00455

SCALE: NONE

DATE: MARCH, 1979



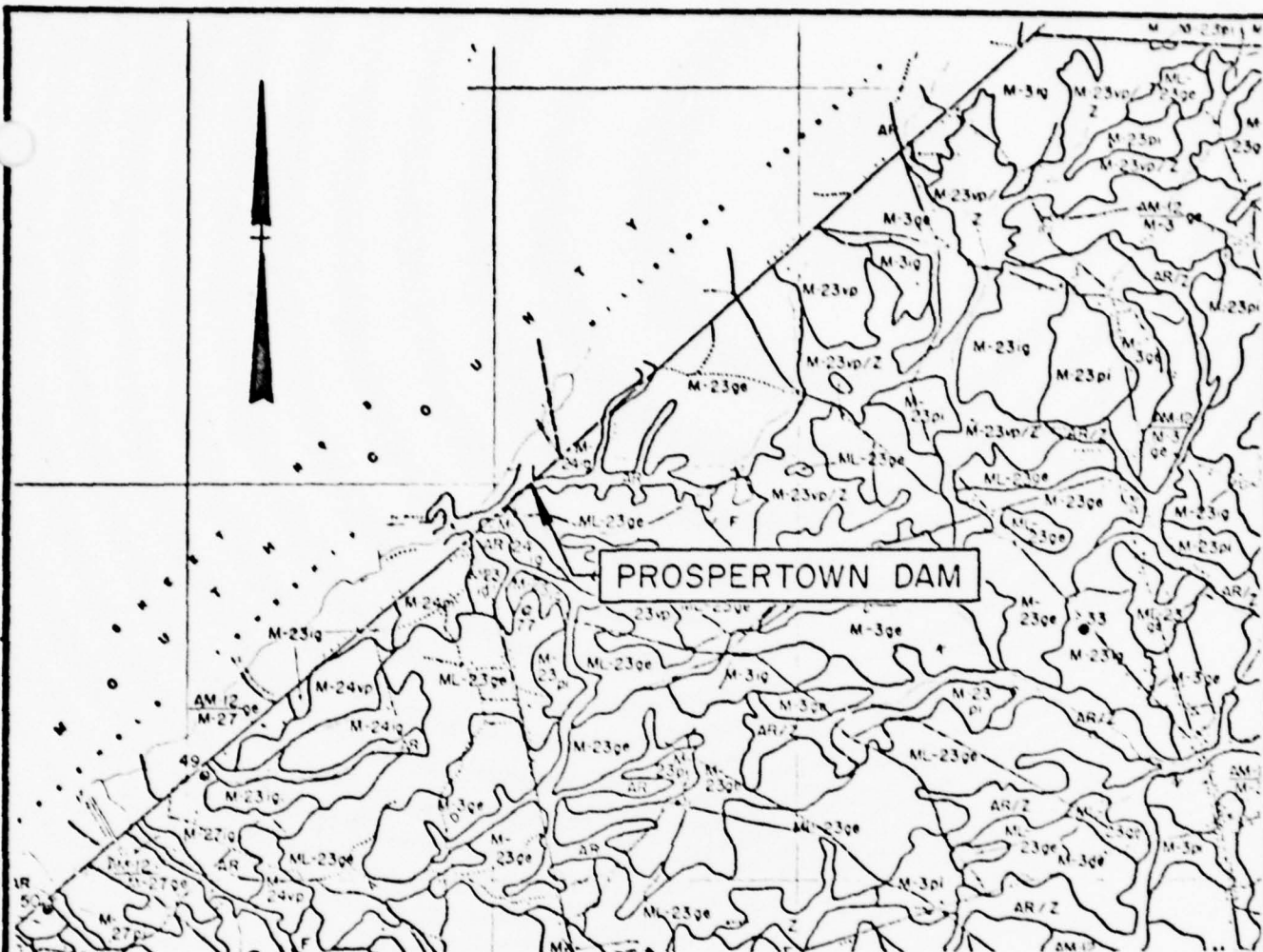
STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS VICINITY MAP PROSPERTOWN DAM

I.D. N. J. 00455

SCALE: AS SHOWN
DATE: MARCH, 1979



Legend

- AR Silt and sand with some clay and significant organic matter near the surface.
- M-23 Unconsolidated stratified silty sand and narrowly graded sand of marine origin (Kirkwood Sands).
- M-24 Dark green fine sand, silt and clay (Hornerstown Marl).

Note: Information taken from Rutgers University Soil Survey of New Jersey, Report No. 8, Ocean County and Geologic Map of New Jersey prepared by Lewis and Kummel.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

SOIL MAP

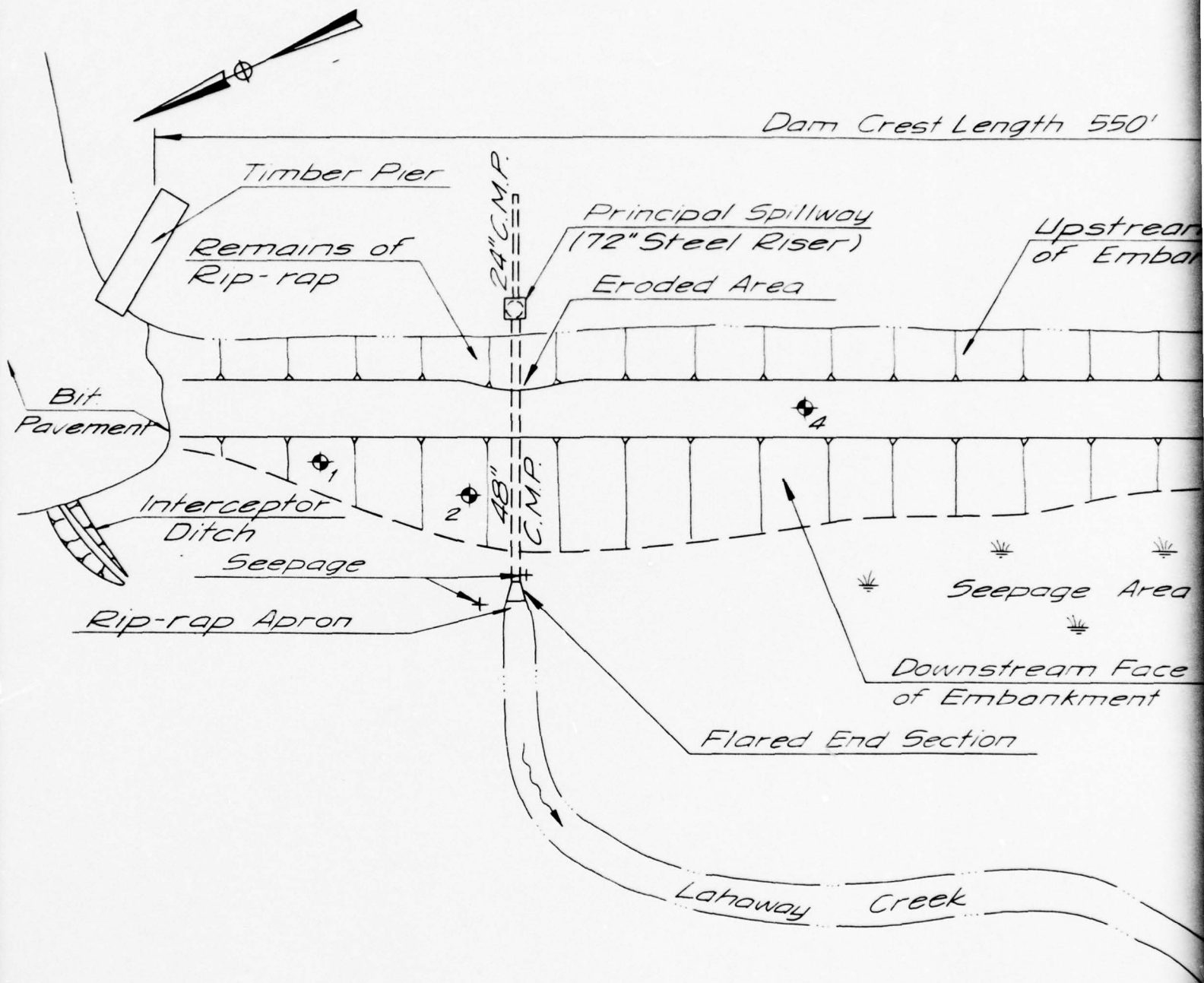
PROSPERTOWN DAM

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

I.D. N.J. 00455

SCALE: NONE

DATE: MARCH, 1979



NOTES:

1. Information taken from plans prepared by Mauzy, Morrow & Assoc. dated July 1964 and field inspections Feb. 2, 1979 & March 14, 1979
2. ♦ Soil Boring Location.

Paved Road
(Route 53)

Length 550'

Upstream Face
of Embankment

3

65'±

Seepage Area

Downstream Face
of Embankment

on

Spillway

Auxiliary

2

PLATE 4

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

GENERAL PLAN

PROSPERTOWN DAM

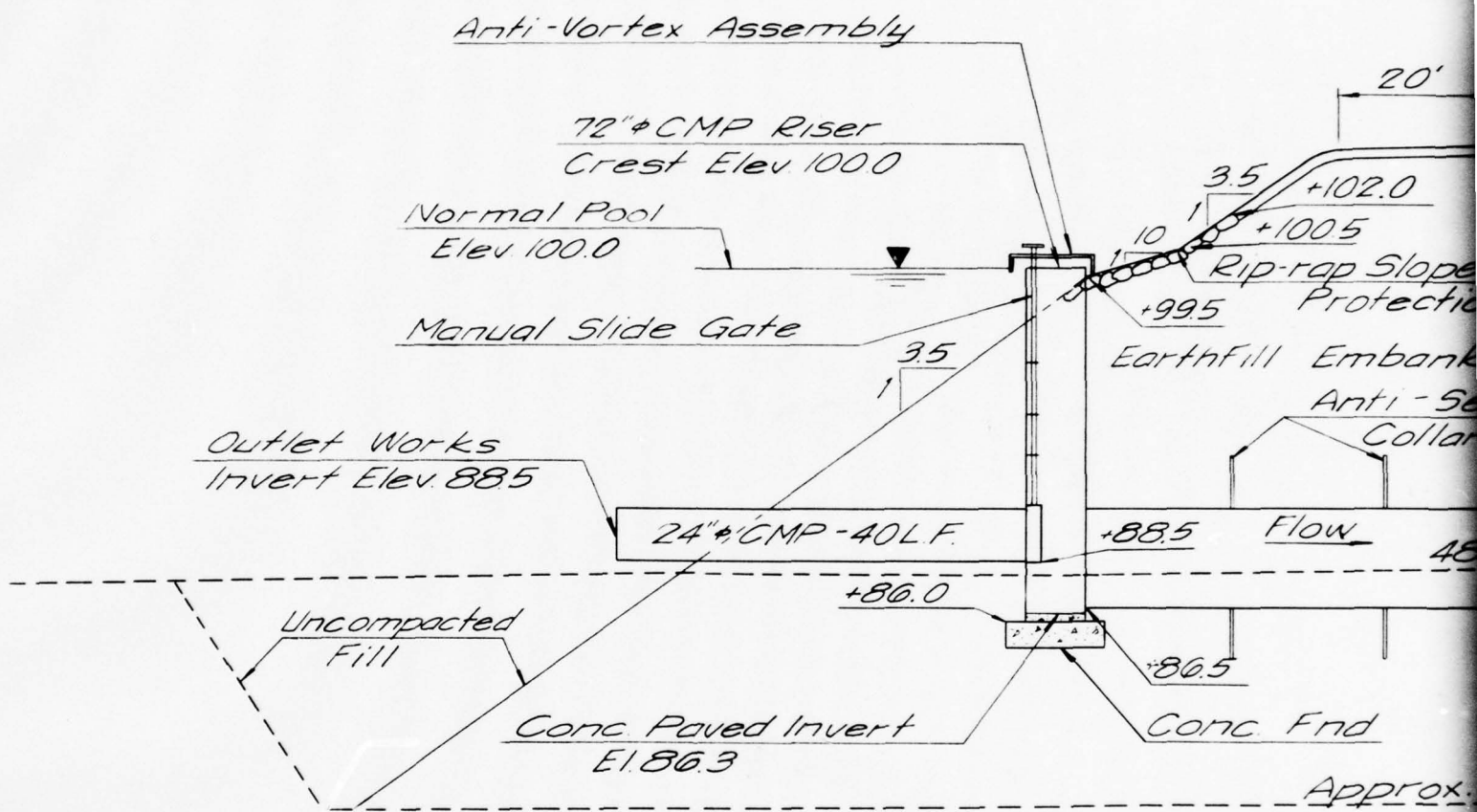
I.D. N.J. 00455

SCALE: NOT TO SCALE

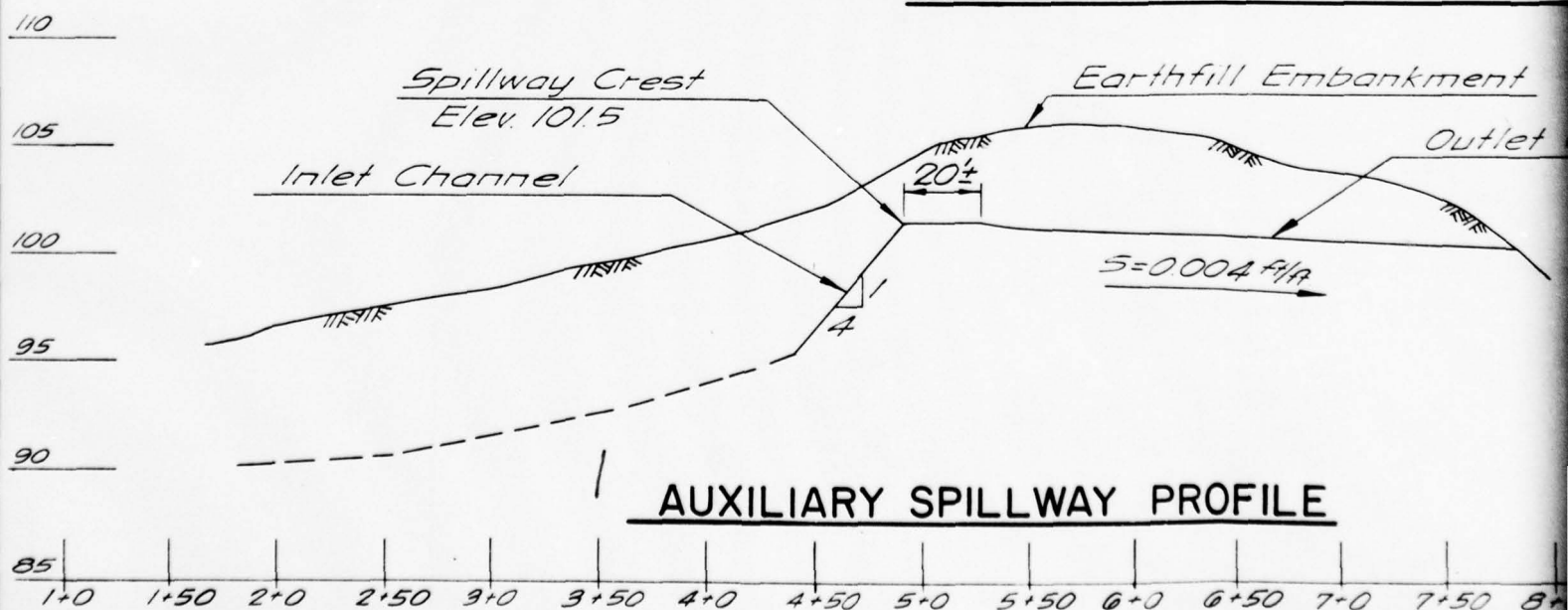
DATE: MARCH, 1979

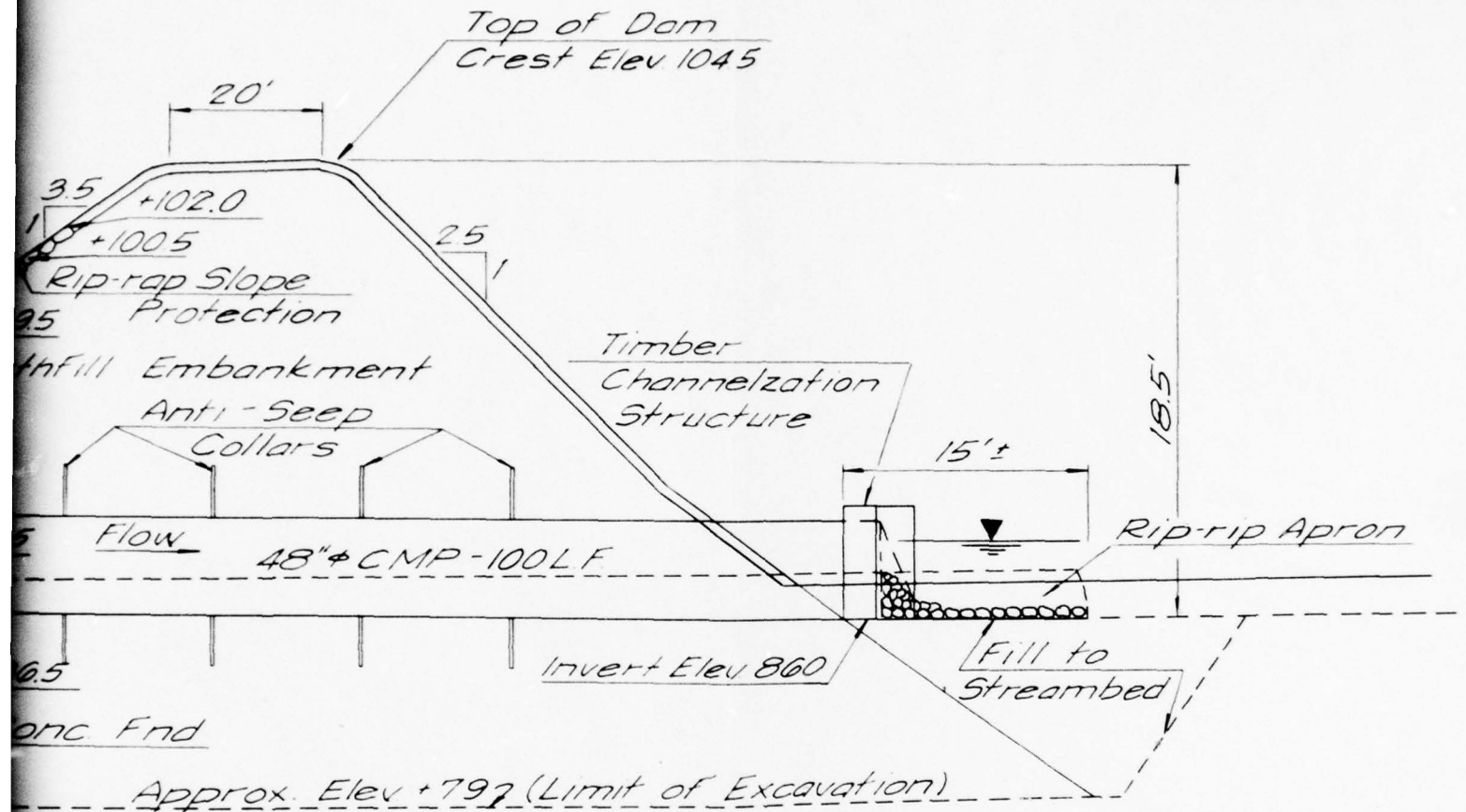
Paved Road
(Route 537)

Bridge

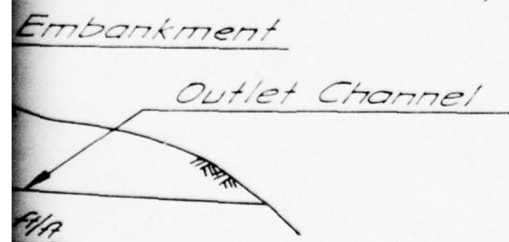


SECTION - DAM AND PRINCIPAL





DAM AND PRINCIPAL SPILLWAY



NOTE:

Information taken from "Cross Section Dam and Spillway" by Mauzy, Morrow and Associates and field inspections on February 2, 1979 and March 14, 1979.

2
PLATE 5

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS
TYPICAL SECTION
DAM AND PRINCIPAL SPILLWAY
PROSPERTOWN DAM

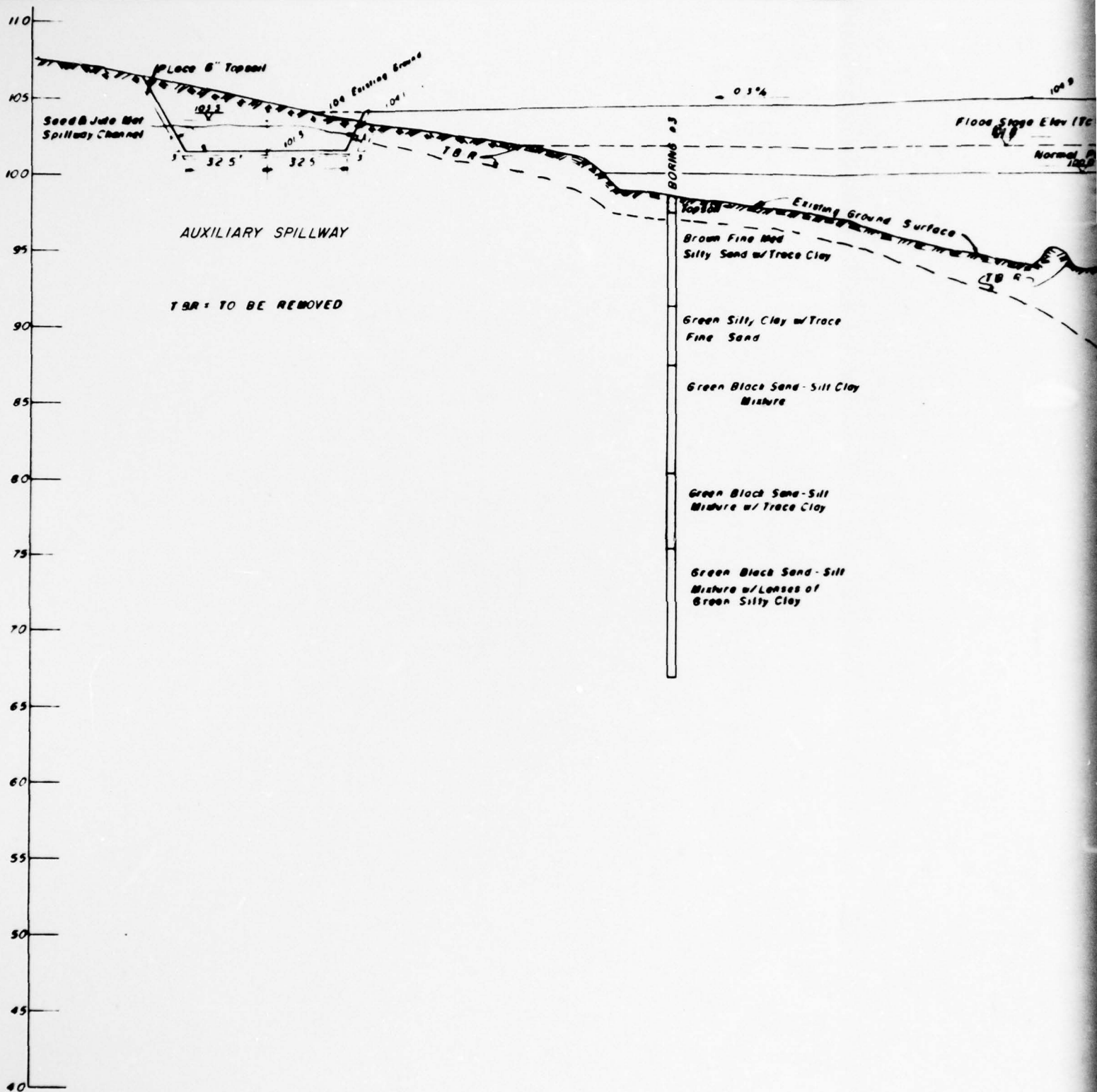
I.D. N.J. 00455

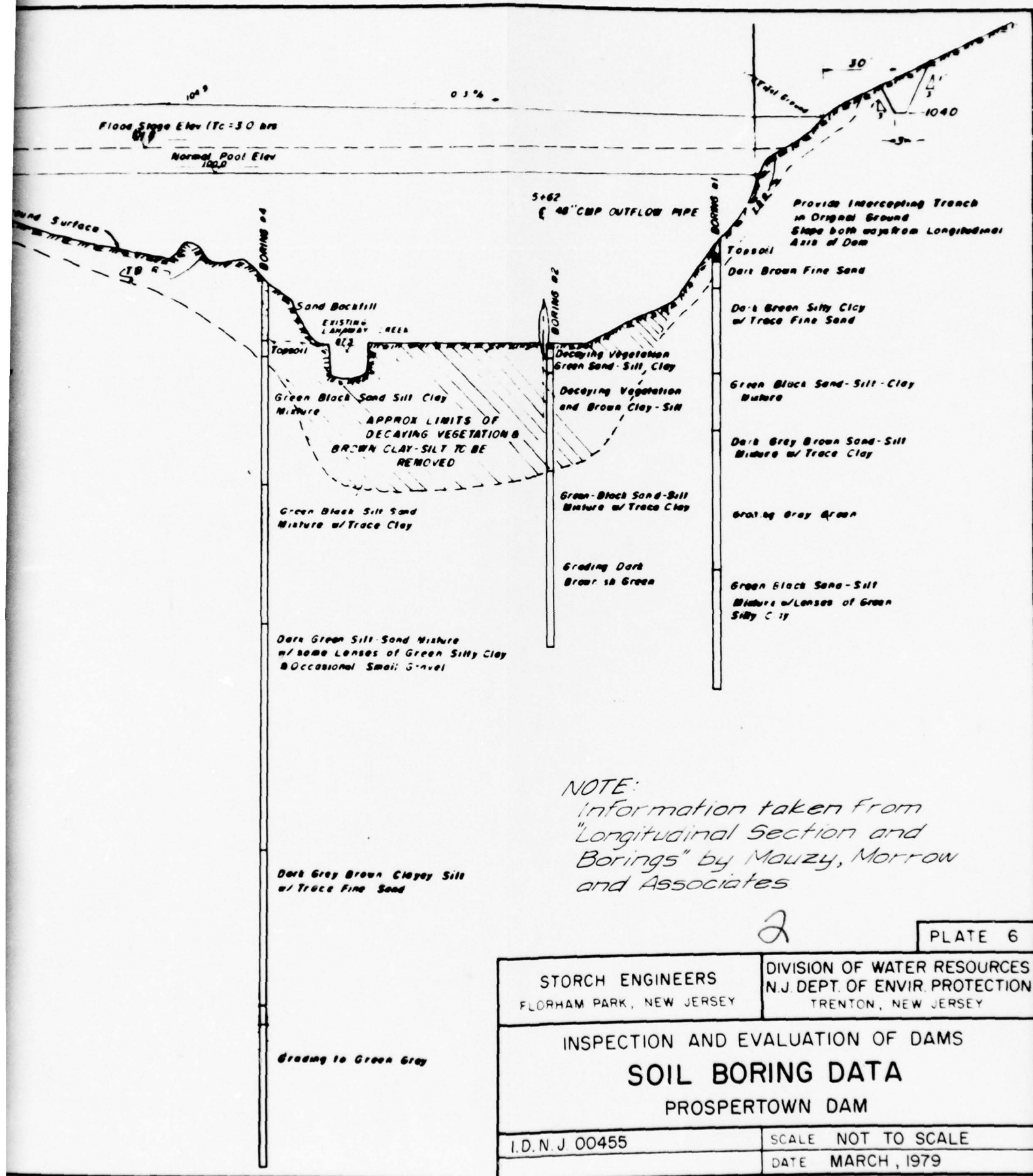
SCALE: NOT TO SCALE

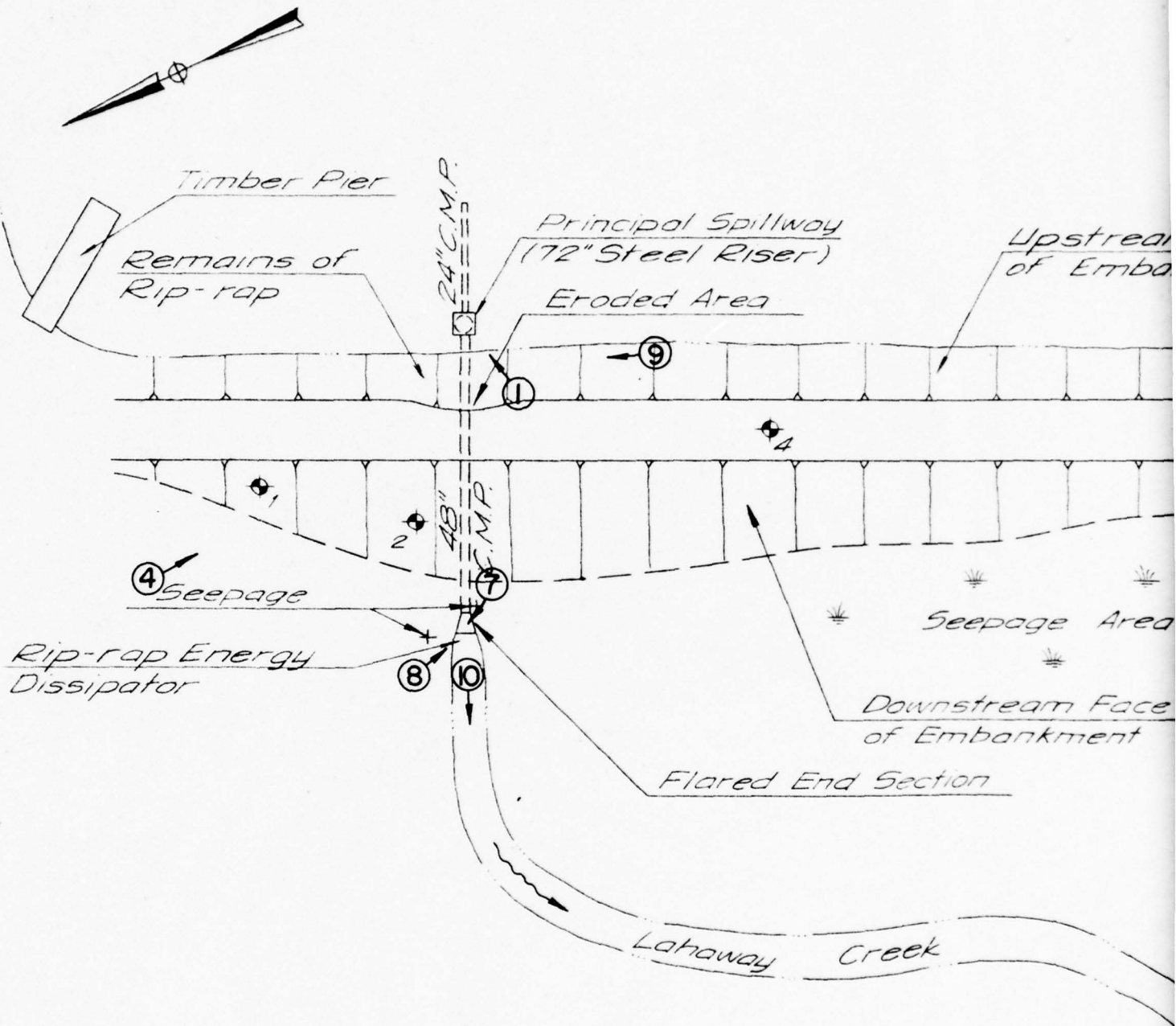
DATE: MARCH, 1979

ILE

0 7+0 7+50 8+0







NOTES:

1. Information taken from plans prepared by Mauzy, Morrow & Assoc. dated July 1964 and field inspections Feb. 2, 1979 & March 14, 1979
2. ♦ Soil Boring Location.

Paved R
(Route 53)

Upstream Face
of Embankment

ge Area

am Face
ment

Paved Road
(Route 537)

Bridge

Auxiliary

Spillway

OVERVIEW

PLATE 7

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

PROSPERTOWN DAM

I.D. N.J. 00455

SCALE: NOT TO SCALE

DATE: MARCH, 1979

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List
Visual Inspection
Phase 1

Name Dam Prosperdown Lake County Ocean State N.J. Coordinators N.J.D.E.P.

Date(s) Inspection 2/2/79 Weather Sunny Temperature 32° F
3/14/79 Cloudy 50° F

Pool Elevation at Time of Inspection 101 Assumed Datum Tailwater at Time of Inspection 89 Assumed Datum

Inspection Personnel:

<u>J. Gribbin</u>	<u>Alan Volle</u>
<u>E. A. Wiltsie</u>	<u>Ron Lai</u>
<u>R. McDermott</u>	<u>A. Volle</u>
	<u>Recorder</u>

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ADJUTENT SLOPES	Embankment crest and upstream slope eroded at principal spillway inlet. Crest width about 18 feet. Some erosion of embankment present at North End of dam due to runoff from small paved parking area. Evidence of surface runoff erosion on downstream slope as sand collected on upstream side of grass clumps.	Vehicle traffic along the dam crest has caused the side slopes of the auxiliary spillway to flatten and destroyed vegetation in this area.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - straight Vertical - generally level along entire length with crest at south end (adjacent to auxiliary spillway) slightly low, but not due to subsidence.	
RIPRAP FAILURES	Riprap along upstream slope in splash zone apparently buried as a result of settlement into saturated embankment soil and surface erosion on upstream face.	

EMBANKMENT

VISUAL EXAMINATION OF GENERAL	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ADJUTENT, SPILLWAY AND DAM	Embankment is sandy with primarily grass cover. Sand and gravel road- way present on crest of dam.	Roadway on crest of dam continues to auxiliary spillway where rutting of slopes and channel has occurred.
ANY NOTICEABLE SEEPAGE	Shallow grassed drainage gully between embankment and original ground was soft and wet. (north end of dam)	One area located adjacent to the outlet possibly seepage along culvert. Second area in embankment along north side of natural downstream channel apparently ground water.
STAFF GAGE AND RECORDER	None	
DRAINS	None observed.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAYS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N.A.	
INTAKE STRUCTURE	Submerged	
OUTLET STRUCTURE	48" comp discharge culvert with flared end sections (see principal spillway).	
OUTLET CHANNEL	Natural downstream channel (see principal spillway).	
EMERGENCY GATE	Upper portion of stem and operating mechanism observed on top of Anti-Vortex Assembly - Apparently in good condition. No gate wheel. Inaccessible.	Reportedly the gate is tested annually is in good operating condition.

UNCATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Top of 72" diameter riser could not be observed because it was enclosed by the Anti-Vortex Assembly. Slight debris collection on grate on top of assembly. Small vortex on north side of assembly indicated flow under assembly. Assembly consists of approximately 7' x 7' corrugated metal sheet structure with asphalt coating.	Remove debris from grate.
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	48" asphalt coated corrugated metal pipe with flared end section enclosed in timber channelization structure. Outflow to riprap apron. Riprap is in the discharge culvert about 2 feet high. Flows to natural winding downstream channel with dense tree and brush growth along banks.	1. Repair timber structure 2. Remove riprap from inside of discharge culvert. 3. Clear brush and small trees from downstream channel.
BRIDGE AND PIERS	Approximately 500 feet downstream from outlet of discharge culvert there is a bridge for Route 537.	

UN GATED SPILLWAY (AUXILIARY SPILLWAY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	None	
APPROACH CHANNEL	Submerged reservoir bottom.	
DISCHARGE CHANNEL	Trapezoidal grassed channel at southend of embankment. Curves to the north and outfalls into natural downstream channel via steep embankment at end. Channel slope erosion was observed in the steep natural channel embankment at the outfall of the auxiliary channel.	High grass in channel will reduce discharge capability, should be cut down.
BRIDGE AND PIERS	Same as Principal Spillway.	
GATES AND OPERATION EQUIPMENT	N.A.	

INSTRUMENTATION			REMARKS OR RECOMMENDATIONS
VISUAL EXAMINATION NONUMENTATION/SURVEYS	N.A.	OBSERVATIONS	
OBSERVATION WELLS	N.A.		
WEIRS	N.A.		
PIEZOMETERS	N.A.		
OTHER	N.A.		

RESERVOIR

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

SLOPES

Shoreline slopes up from water level at 2% to 10%. Surrounding land area is generally flat with dense vegetation, mostly pines. No observable development.

SEDIMENTATION

Could not be observed.

DOWNSTREAM CHANNEL

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Natural winding channel about 15 feet wide with steep banks about 2 feet high. Dense brush and tree growth along banks and flood plain and overhanging channel. No debris or obstructions in channel.	Clear flood plain of brush and small trees.
SLOPES	Steep banks along natural channel. Flood plain cross slopes between 20% and 50%. Stream bottom slope to bridge is less than 1%.	
APPROXIMATE NO. OF HOMES AND POPULATION	No homes or development in flood plain for at least 2 miles downstream. Route 527 bridge 500 feet downstream from dam.	Bridge would be washed out if dam were breached

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Contract Drawings, Sheet 4 of 8, "General Plan". Available from NJDEP file.
REGIONAL VICINITY MAP	Contract Drawings, Sheet 2 of 8, "Location Plan and Drainage Area". Available from NJDEP file.
CONSTRUCTION HISTORY	No reports on file with N.J.D.E.P.
TYPICAL SECTIONS OF DAM	Contract Drawings, Sheet 5 of 8, "Cross-Section Dam and Spillway". Sheet 6 of 8, "Longitudinal Section and Borings". Available from NJDEP file.
HYDROLOGIC/HYDRAULIC DATA	Contract Drawings, Sheet 3 of 8, "Dam, Lake, Surface and Flood Plain". Sheet 8 of 8, "Hydrograph of Routing". "Engineering Report on Design Criteria for Prospertown Dam and Spillway". Available from NJDEP file.
OUTLETS - PLAN	Contract Drawings, Sheet 7 of 8, "Details-Corrugated Metal Riser Pipe Assembly". Available from NJDEP file.
- DETAILS	Engineering Report (above)
-CONSTRAINTS -DISCHARGE RATINGS	None
RAINFALL/RESERVOIR RECORDS	

ITEM

REMARKS

DESIGN REPORTS

"Engineering Report on Design Criteria for Prospertown Dam Spillway" by Mauzy, Marron and Associates. Available from NJDEP file.

GEOLOGY REPORTS

Soil investigation included in Engineering Report (above)

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

Analyses relating to these areas were performed, appear to be satisfactory and are contained in the above mentioned Engineering Report.

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

4 auger borings were performed at the site with sampling intervals of 5 feet. Seive analyses, moisture contents and permeability tests were performed and data is included in the Engineering Report. Field density tests were performed during construction by Jersey Testing Laboratories of Newark, N. J. and reports are filed with N.J.D.E.P. Information available from NJDEP file.

POST-CONSTRUCTION SURVEYS OF DAM

Annual reports with general observations for the years from 1968 to 1974 are on file with the N.J.D.E.P.

BORROW SOURCES.

Fill material for the dam was excavated from the reservoir upstream from the auxiliary spillway.

ITEM

REMARKS

SPILLWAY PLAN

SECTIONS

DETAILS

Contract Drawings, Sheet 4 of 8, "General Plan"
Contract Drawings, Sheet 5 of 8, "Cross Section Dam and Spillway"
Contract Drawings, Sheet 7 of 8, "Details-Corrugated Metal Riser Pipe Assembly"
Available from NJDEP file.

OPERATING EQUIPMENT
PLANS & DETAILS

Contract Drawing, Sheet 7 of 8, "Details-Corrugated Metal Riser Pipe Assembly"
Available from NJDEP file.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Toe Drain added in 1968 to alleviate seepage on downstream slope of embankment.
HIGH POOL RECORDS	None
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

VISUAL EXAM

SURFACE CRA

UNUSUAL MOV
CRACKING AT
THE TOE

SLOUGHING O
EMBANKMENT
SLOPES

VERTICAL AN
ALIGNMENT O

RIPRAP FAIL

APPENDIX 2

Photographs

VISUAL E
GENERAL

JUNCTION
AND ADJUT
AND DAY

ANY NOTIC

STAFF GAGE

DRAINS



PHOTO 1
SPILLWAY STRUCTURE



PHOTO 2
CREST OF DAM

2 FEB. 1979

VISUAL EXAMINATION

SEE PAGE ON LEA

STRUCTURE TO
ADJUTMENT/EVEANG
JUNCTIONS

DRAINS

WATER PASSAGES

FOUNDATION



PHOTO 3

UPSTREAM FACE OF EMBANKMENT



PHOTO 4

DOWNSTREAM FACE OF EMBANKMENT

2 FEB. 1979

VISUAL EXAMIN

SURFACE CRACK
CONCRETE SURF

STRUCTURAL CR

VERTICAL AND
ALIGNMENT

MONOLITH JOIN

CONSTRUCTION



PHOTO 5
AUXILIARY SPILLWAY



PHOTO 6
AUXILIARY SPILLWAY OUTLET

2 FEB. 1979

VISUAL EXAM

CRACKING AT
CONCRETE SI
OUTLET CON

INTAKE STR

OUTLET STR

OUTLET CH

EMERGENC

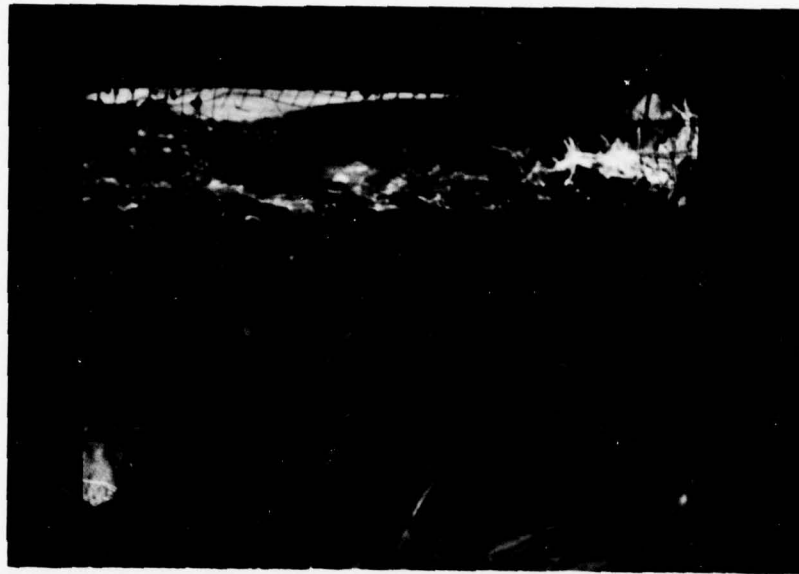


PHOTO 7

SPILLWAY DISCHARGE PIPE OUTLET



PHOTO 8

STILLING BASIN WITH RIPRAP ENERGY DISSIPATOR

VISUAL EXA

CONCRETE W

APPROACH C

DISCHARGE

BRIDGE AN



PHOTO 9

REMAINS OF RIPRAP ON UPSTREAM FACE OF EMBANKMENT



PHOTO 10

DOWNSTREAM CHANNEL

2 FEB. 1979

VISUAL E

CONCRETE

APPROACH

DISCHARGE

BRIDGE A

GATES AN
EQUIPMEN

APPENDIX 3

Engineering Data

VISUAL E
MONUMENT

OBSERVATION

WEIRS

PIEZOMETER

OTHER

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

Rolling, cross slopes 2 to 5%, several pronounced swales. Dense timber growth over most of the area with 20% pastures, grassland, unpaved roads and water surface.

DRAINAGE AREA CHARACTERISTICS: the area with 20% pastures, grassland, unpaved roads and water surface.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 100 feet (402 acre-feet)
(Assumed Datum)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 101.5 feet (515 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 104.5 feet (top of dam)

ELEVATION TOP DAM: 104.5 feet

PRINCIPAL SPILLWAY CREST: Uncontrolled sharp-crested weir

- Elevation 100.0 feet
- Type 72" diameter corrugated metal riser pipe
- Width 12 gauge
- Length 18.8 feet (Circumferential)
- Location Spillover 72" diameter riser pipe
- Number and Type of Gates None

AUXILIARY SPILLWAY CREST: Uncontrolled trapezoidal grassed channel

- Elevation 101.5
- Type trapezoidal channel
- Width Approx. 20' (Dam crest)
- Length 65 feet (Bottom Width)
- Location Spillover Steep bank along natural downstream channel
- Number and Type of Gates N.A.

OUTLET WORKS: (1) Slide gate controlled inlet pipe to discharge culvert

- a. Type 24" diameter corrugated metal pipe with manual slide gate
- b. Location Extends from upstream embankment toe to invert of riser
- c. Entrance invert 88.5 feet pipe.
- d. Exit invert 88.5 feet
- e. Emergency draindown facilities: Outlet works can be used.

HYDROMETEOROLOGICAL GAGES: None

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

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 1007 c.f.s.

APPENDIX 4

Hydrologic Computations

PROSPERTOWN DAMCLASSIFICATIONSIZE CLASSIFICATION

Total volume of water impounded } = 402 Acre-feet
@ 100.0 contour

Stream bed elevation at the } = 86
downstream toe of the dam

Elevation of the top of the dam = 104.5.

Hydraulic height of the dam = $104.5 - 86 = 18.5$ ft.

Therefore, size classification category SMALL

HAZARD POTENTIAL CLASSIFICATION

1. The dam is situated in an agricultural area.
2. Failure of the dam may damage county road bridge situated approximately 500 ft downstream of the dam.
3. Hazard to agriculture

Therefore, hazard potential classification:

SIGNIFICANT

STORCH ENGINEERS

Sheet 2 of 16

Project SE # 1132

Made By DMP Date 3/10/79

PROSPERTOWN DAM

Chkd By EAW Date 3/12/79

SPILLWAY DESIGN FLOOD

For size: Small

and hazard: Significant

Spillway Design Flood (SDF) is :-

100 yr to 1/2 PMF

HYDRAULICS

Principal Spillway Crest Elevation = 100.0

Auxiliary Spillway crest elevation = 101.5

Crest of Embankment elevation = 104.5

PRINCIPAL SPILLWAY :-

72" diameter fully coated corrugated steel riser pipe.

The discharge into the riser pipe will be calculated using the following formula,

$$Q = C (2\pi R) H_d^{3/2}$$

where Q = Discharge, CFS C = Discharge coefficient R = Radius of sharp crest Ft H_d = Head on spillway crest, Ft.

The coefficient of discharge will be calculated using Fig 283, 'Design of Small Dams'.

$$\begin{aligned} \text{Approach depth to sharp crest } P &= 100 - 88.5 \\ &= 11.5 \end{aligned}$$

$$\therefore \frac{P}{R} = \frac{11.5}{3} = 3.83$$

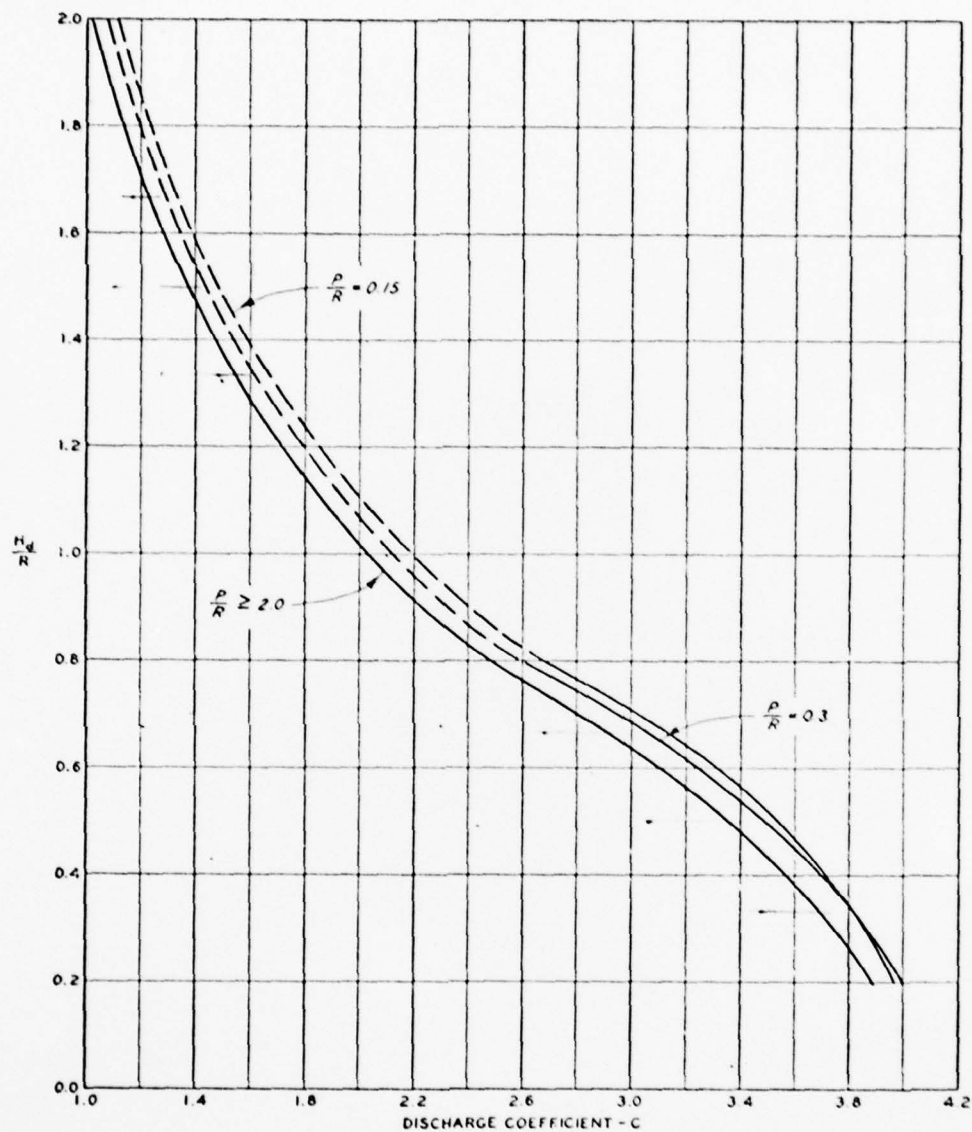
Use the curve for $\frac{P}{R} = 2.0$

Elevation	Hd	$\frac{H_d}{R}$	C	$H_d^{3/2}$	Q_1	
100	0				0	
101	1	0.33	3.70	1	70	
101.5	1.5	0.50	3.35	1.84	116	
102	2	0.67	2.90	2.83	155	
103	3	1.00	2.02	5.20	198	Control by Riser Pipe See below
104	4	1.33	1.54	8.00	220	
104.5	4.5	1.50	1.38	9.55	227	
105	5	1.67	1.23	11.18	233	control by 48" diam horizontal pipe See below
106	6	2.00	1.02	14.70	245	

Capacity of 48" Diam CMP :-

Flow will be governed by outlet control, see sheets 6 & 7 :-

Elevation	Hw	Q_1
102	15.5	195
103	16.5	208
104	17.5	220
104.5	18.0	227
105	18.5	233
106	19.5	245

EQUATION

$$Q = C(2\pi R) H_d^{3/2}$$

WHERE:

Q = DISCHARGE, CFS.
C = DISCHARGE COEFFICIENT.
R = RADIUS OF SHARP CREST, FT.
H_d = DESIGN HEAD ON SPILLWAY CREST, FT.

NOTE: CURVES ARE TAKEN FROM USBR DESIGN OF SMALL DAMS AND ARE BASED ON WAGNER'S DATA FOR FULLY AERATED FLOW OVER A SHARP-CRESTED WEIR.
DASHED CURVES ARE BASED ON EXTRAPOLATED VALUES OF H_d/R (CHART 140-1/6).
P = APPROACH DEPTH TO SHARP CREST, FT.

MORNING GLORY SPILLWAYS
DISCHARGE COEFFICIENT
DESIGN HEAD

HYDRAULIC DESIGN CHART 140-1/1

STORCH ENGINEERS

Sheet 7 of 16

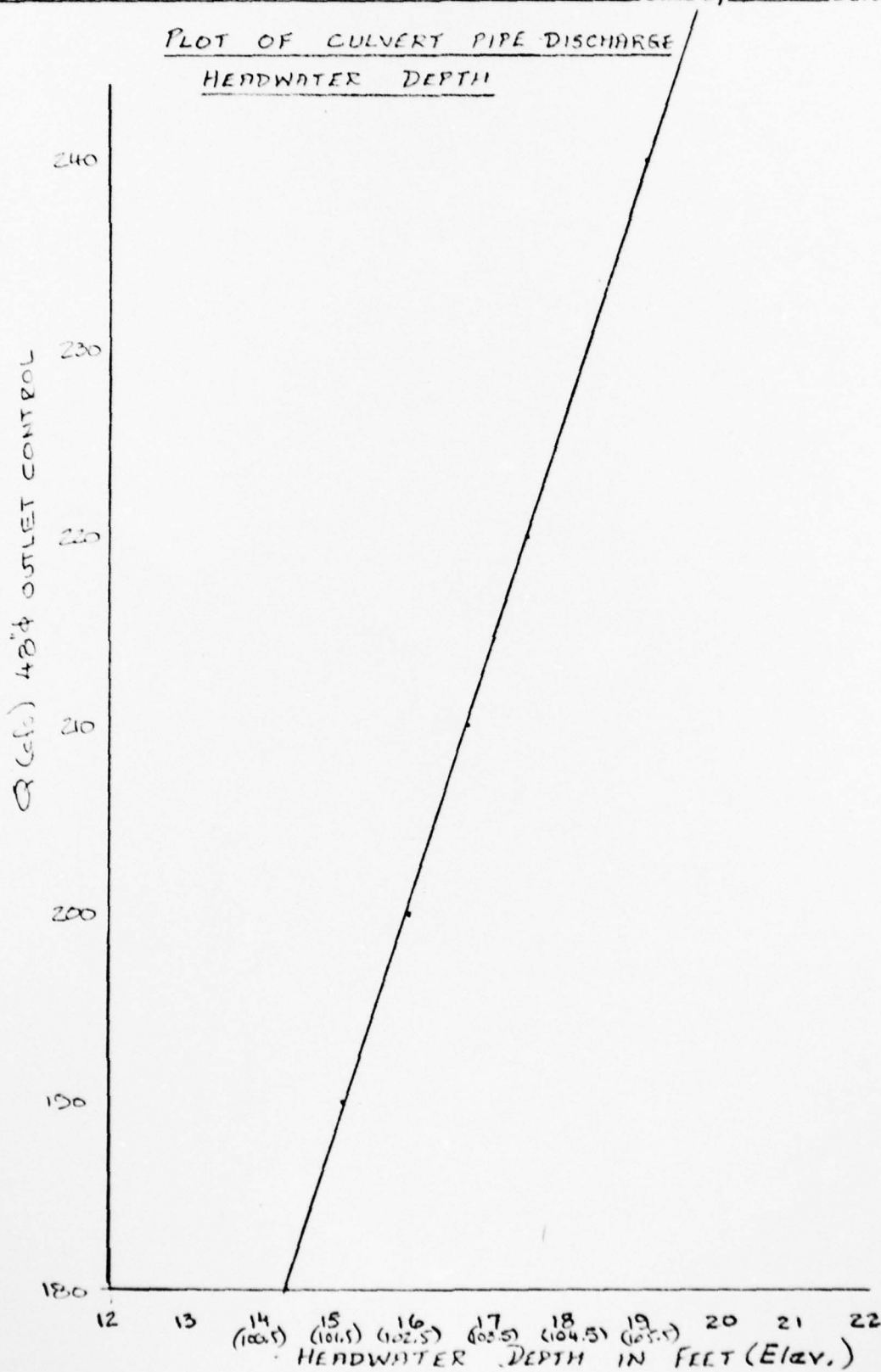
Project SE # 1132

Made By E.W. Date 5/14/79

PROSPERITY DAM

Chkd By DLF Date 5/15/79

PLOT OF CULVERT PIPE DISCHARGE
HEADWATER DEPTH



STORCH ENGINEERS

Sheet 5 of 16

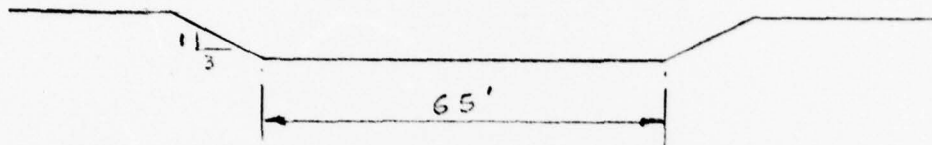
Project SE # 1152

Made By DNF Date 3/10/79

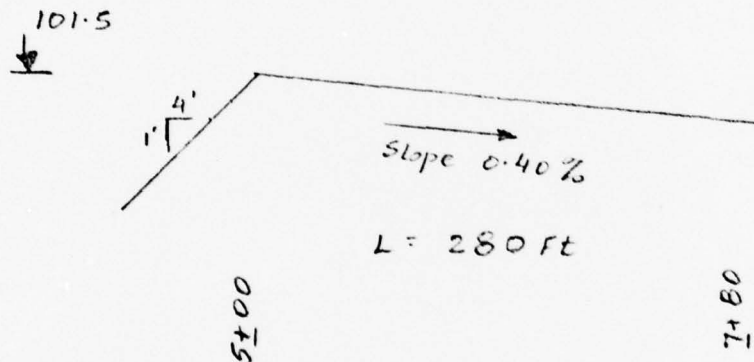
PROSPERTOWN DAM

Chkd By EAY Date 3/14/79

AUXILIARY SPILLWAY



TYPICAL SECTION



PROFILE

Ref: Handbook of Hydraulics King & Brater

From page 8-16

$$S_c = \frac{14.56 n^2}{D_m^{1/3}}$$

The auxiliary spillway is thickly overgrown with weeds

$$\therefore n = 0.04$$

Since the channel is relatively wide as compared to its depth,

$$D_m = \text{Mean Depth} = \frac{\text{Area}}{\text{Top Width}} \approx \text{Hydraulic Radius}$$

D_{flow}	$D_m^{1/3}$	S_c
0.5	0.794	0.029
1.0	1.000	0.023
1.5	1.145	0.020
2.0	1.260	0.018
2.5	1.357	0.017
3.0	1.442	0.016

$$S_o < S_c$$

Actual slope $S_o = 0.004$.

$\therefore S_c$ is greater than the actual slope.

Manning's equation:-

$$Q = (A) \frac{1.486}{n} R^{2/3} S_o^{1/2}$$

Area will be taken as $65 D_o$

n will be taken as D_o

$$\begin{aligned} \therefore Q &= 65 D_o \left(\frac{1.486}{0.04} \right) \left(D_o^{2/3} \right) \left(0.004 \right)^{1/2} \\ &= \frac{65 \times 1.486 \times 0.063}{0.04} D_o^{5/3} \\ &= 152 D_o^{5/3} \end{aligned}$$

Also

$$D_r = D_o + \frac{Q^2}{2ga^2}$$

Project SE # 1132Made By DMP Date 3/12/79PROSPERTOWN DAMChkd By EAU Date 5/14/79

$$\begin{aligned} \therefore D_2 &= D_0 + \frac{\left[152 D_0^{5/3} \right]^2}{2g D_0^2 \times 65 \times 65} \\ &= D_0 + \frac{152^2}{2g \times 65^2} D_0^{(10/3 - 2)} \\ &= D_0 + (0.085) D_0^{4/3} \end{aligned}$$

D_0	$D_0^{4/3}$	$(0.085) D_0^{4/3}$	D_2 $D_0 + (0.085) D_0^{4/3}$	Water Elevation with reservoir $101.5 + D_2$	Q $(152 D_0^{5/3})$ CFS
0.5	0.397	0.0337	0.534	102.03	48
1.0	1.0	0.085	1.085	102.59	152
1.5	1.717	0.146	1.646	103.15	299
2.0	2.520	0.214	2.214	103.71	483
2.5	3.393	0.288	2.788	104.29	700
3.0	4.327	0.368	3.368	104.87	949
3.5	5.314	0.452	3.952	105.45	1,226

STORCH ENGINEERS

Sheet 11 of 16

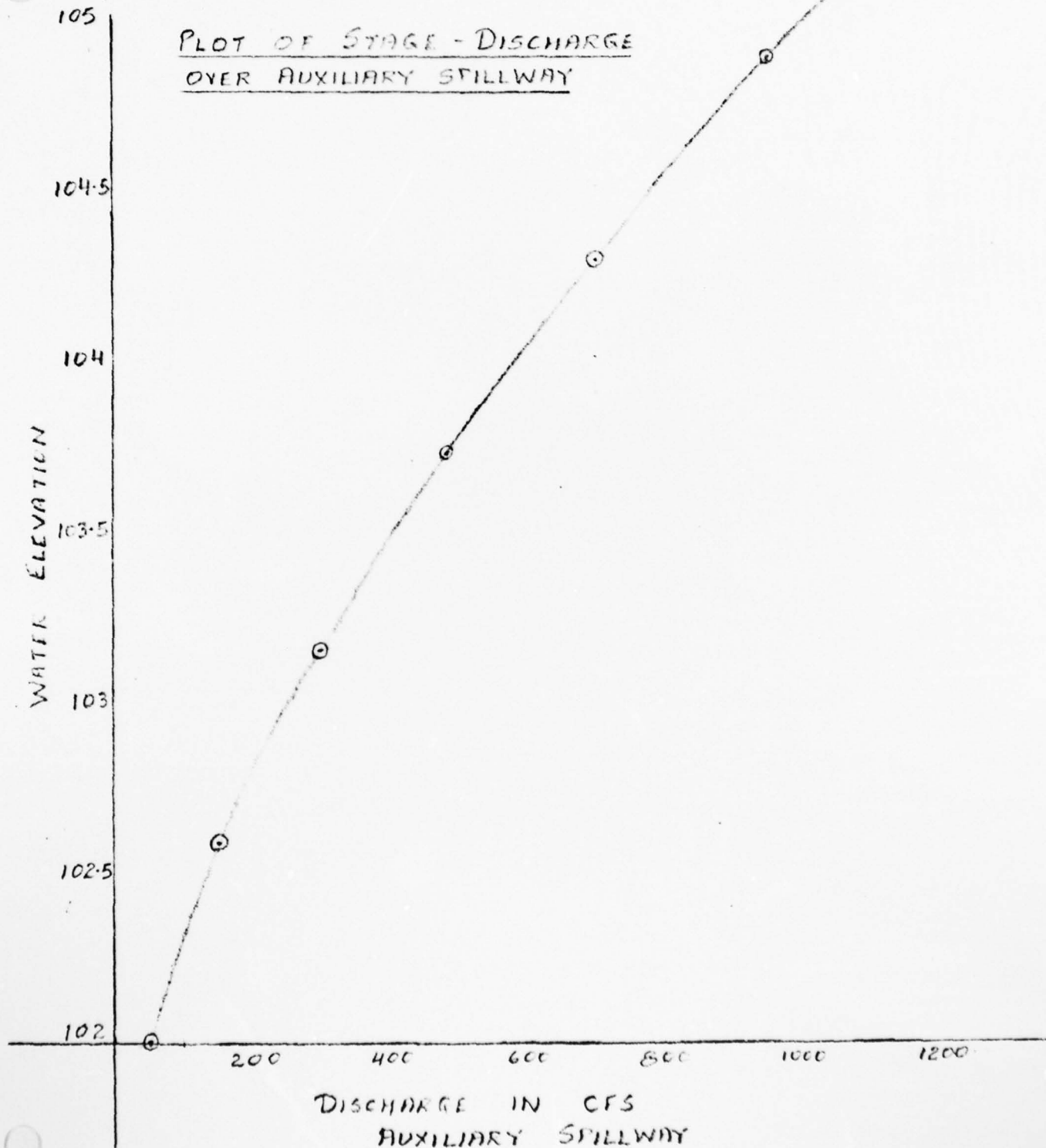
Project S.E. # 1132

Made By DMP Date 3/12/79

PROSELEIDWIN DAM

Chkd By _____ Date _____

PLOT OF STAGE - DISCHARGE
OVER AUXILIARY SPILLWAY



STORCH ENGINEERS

Sheet 12 of 16Project S.F. #1132Made By DMP Date 3/12/79PEESPERTOWN DAMChkd By EAW Date 3/14/79STAGE - DISCHARGE

Elevation	Q ₁ Principal Spillway	Q ₂ Auxiliary Spillway	Total Discharge
100	0	0	0
101	70	0	70
101.5	116	0	116
102	155	48	203
103	198	225	423
104	220	580	800
104.5	227	780	1007

Crest of
Embankment

AD-A068 645

NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. PROSPERTOWN DAM (NJ-00455), DELAWA--ETC(U)
MAY 79 R J MCDERMOTT

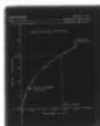
DACW61-78-C-0124

NL

UNCLASSIFIED

2 OF 2

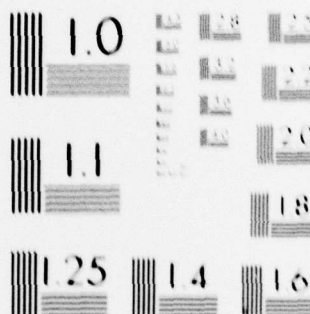
AD
A068645



END
DATE
FILMED

6-79

DDC



MICRONOMETER RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

STORCH ENGINEERS

Sheet 13 of 16

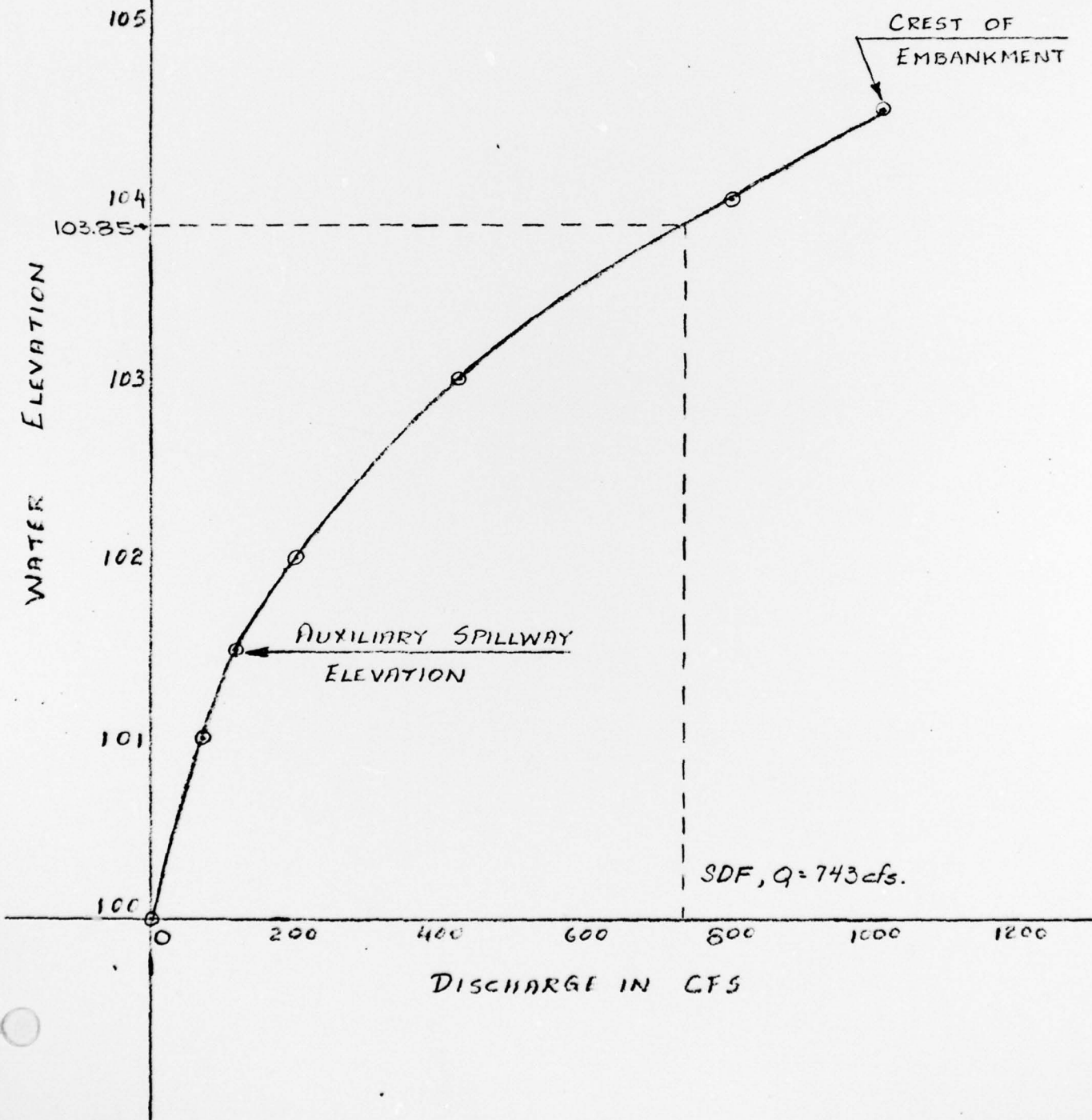
Project SE # 1132

Made By DMP Date 3/14/79

PERSEPTOWN DAM

Chkd By EAJ Date 3/20/79

PLOT OF STAGE - DISCHARGE



HYDROLOGY1 IN 100 YR. FLOOD FLOW

The 100 year flood flow will be calculated by using the following formula (from Special Report #38):

$$Q_{100} = 136 A^{0.84} S^{0.26} S_d^{-0.51} I^{0.14}$$

$$1 \text{ Area of contributing drainage area } \left\{ \begin{array}{l} \\ \end{array} \right. = 3.3 \text{ Sq. Mi}$$

2. Main Channel Slope (S):

$$\left. \begin{array}{l} \text{Length from the selected site} \\ \text{to the basin divide} \end{array} \right\} = 3.5 \text{ Miles}$$

$$85\% \text{ of the stream length} = 3.0 \text{ Miles}$$

$$\text{Elevation at 85\% of stream length} = 140$$

$$10\% \text{ of the total stream length} = 0.35 \text{ Mile}$$

$$\text{Elevation at 10\% of stream length} = 95$$

$$\text{Main channel slope} = \frac{140 - 95}{3.5 - 0.35} = \frac{45}{3.15} = 14.3 \text{ Ft/Mile}$$

3. Surface Storage Index :-

$$\text{Area of lake \# 1} = 0.035 \times 10 \times \frac{2000 \times 2000}{5280 \times 5280} = 0.05 \text{ Sq. Mile}$$

$$\left. \begin{array}{l} \text{Area of Prosperstown dam} \\ \text{at 102.0 Elevation} \end{array} \right\} = \frac{86.5}{640} = 0.135 \text{ Sq. Mi}$$

$$\therefore S_L = \left(\frac{0.05 + 0.135}{3.3} \right) 100 + 1$$

$$= 6.61\%$$

4 Manmade-impervious-cover index :-

Impervious cover index say 1%

5 100 year Flood flow :-

$$Q_{100} = 136 \overset{0.84}{(3.3)} \overset{0.26}{(14.3)} \overset{-0.51}{(6.61)} \overset{0.14}{(1)}$$

$$= 136 (2.73) (2.00) (0.382) (1)$$

$$= 284 \text{ CFS}$$

Assuming $S_L = 1\%$

$$Q_{100} = 136 (2.73) (2.00) (1) (1)$$

$$= \underline{\underline{743 \text{ CFS}}}$$

STORCH ENGINEERS

Sheet 16 of 16

Project SE # 1132

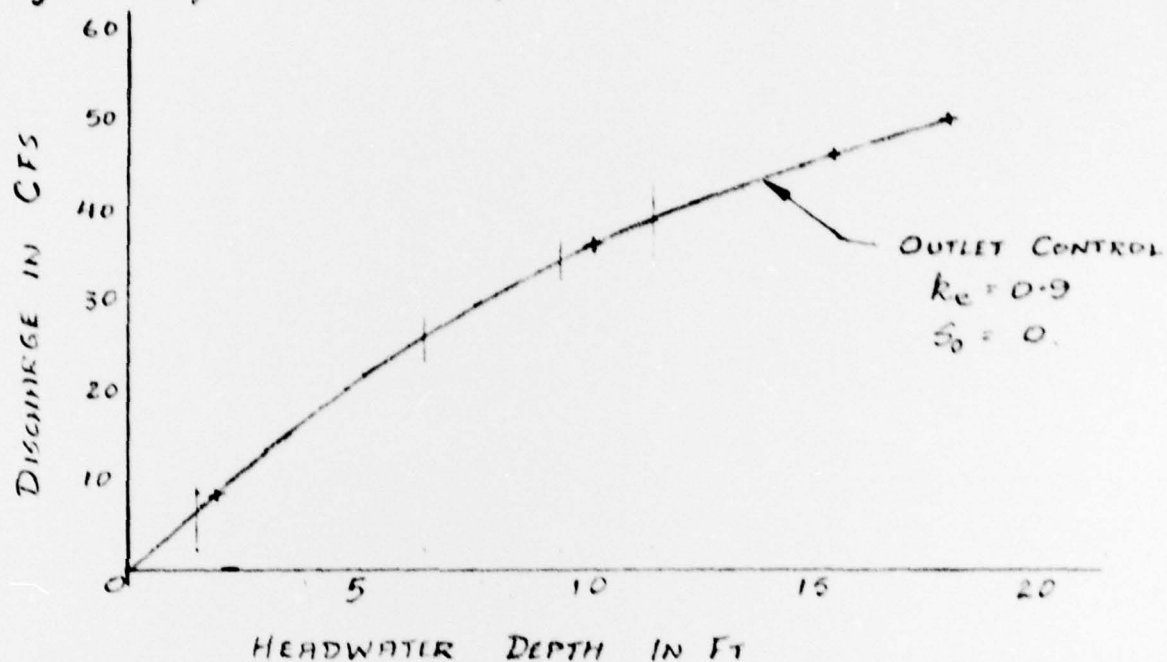
Made By DMP Date 3/14/72

PROSPERITY DAM

Chkd By EAW Date 3/16/72

DRAWDOWN CALCULATION

Diameter of outlet pipe 24" CMP
 Length of outlet pipe 40 ft



Elevation	Volume acre-feet	Headwater Hw ft	Q CFS	Avg Q CFS	Avg Q ac ft/day	Days
88.5	14.5	0	0	3.2	6.35	2.28
90.0	115.5	1.5	6.4	16.2	32.13	3.59
95.0	145.2	6.5	26	30.0	59.51	2.44
98.0	126.8	9.5	34	36.5	72.40	1.75
100.0		11.5	39			

Total 10 Days.

APPENDIX 5

Bibliography

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D. C. 20314.
2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, 1973.
3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of New Jersey, Report No. 8, Ocean County, Rutgers University, New Brunswick, N. J. 1953.
4. "Geologic Map of New Jersey" prepared by J. Volney Lewis and Henry B. Kummel, dated 1910 - 1912.
5. Stankowski, Stephen J., Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization, Special Report 38, State of New Jersey Department of Environmental Protection, Division of Water Resources, 1974.
6. Herr, Lester A., Hydraulic Charts for the Selection of Highway Culverts, U.S. Department of Transportation, Federal Highway Administration, 1965.
7. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, American Society of Civil Engineers, 1974.
8. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw-Hill Book Company, 1963.
9. Davis, Calvin Victor, (Ed.), Handbook of Applied Hydraulics, Second Edition, McGraw-Hill Book Company, 1952.

10. Clark, C.O., "Storage and The Unit Hydrograph" Paper No. 2261, Transactions, American Society of Civil Engineers, 1945.

11. Plans titled:

Location Plan and Drainage Area

Dam, Lake Surface & Flood Plain

General Plan

Cross Section Dam and Spillway

Longitudinal Section and Borings

Details - Corrugated Metal Riser Pipe Assembly

Hydrograph Routing

Prepared by Mauzy, Morrow and Associates, July 1964.

12. Engineering Report titled "Engineering Report on Design Criteria for Prospectown Dam and Spillway", Prepared by Mauzy, Morrow and Associates, (no date).