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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by 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 conditions 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.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

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JAMES RIVER BASIN

National Dam Safety Program

Name of Dam: Sunken Meadow Dam (Inventory Number VA 18101)

Location: Surrey County, Commonwealth of Virginia.

Inventory Number: VA 18101

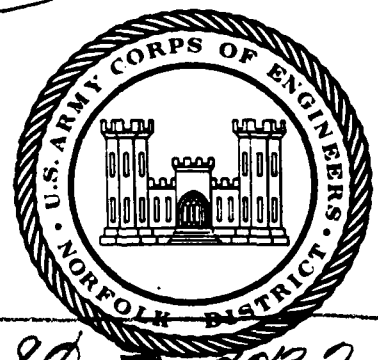
PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

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⑮ DHCW 65-80-D-0032

⑩ James A. Walsh

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September 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the 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. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

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 design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design 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

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NAME OF DAM: SUNKEN MEADOW DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Sunken Meadow Dam
State: Commonwealth of Virginia
County: Surrey
USGS 7.5 Minute Quadrangle: Claremont, VA
Stream: Sunken Meadow Creek
Date of Inspection: 10 July 1980

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BRIEF ASSESSMENT OF DAM

Sunken Meadow Dam is an earthfill embankment approximately 9.1 feet high and 930 feet long. The spillway consists of a 27 foot long broad-crested weir, a concrete well, and a triple 4 foot by 5 foot reinforced concrete box culvert under the embankment, adjacent to the left abutment. The dam is located approximately 1.7 miles east of Claremont, Virginia. The dam itself is owned by the Virginia Department of Highways and Transportation. The reservoir is owned by Mrs. Mable K. Costenbader, and is used for recreation. Sunken Meadow Dam is an 'intermediate' size - 'high' hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams.

Using the Corps of Engineers' screening criteria for the initial review of spillway adequacy, the Probable Maximum Flood (PMF) was selected as the spillway design flood (SDF). The SDF was routed through the reservoir and found to overtop the dam by a maximum depth of 5.2 feet with an average critical velocity of 10.6 f.p.s. Total duration of dam overtopping would be approximately 37.3 hours. The spillway is capable of passing up to 8 percent of the PMF without overtopping the crest of the dam. The spillway is adjudged as inadequate. The spillway was not adjudged as seriously inadequate because, although there is a high probability of loss of life due to large flows downstream of the dam, failure of the dam due to overtopping would not significantly increase the probability of loss of life.

The visual inspection and office analyses indicate no deficiencies requiring emergency attention.

A flood warning system and emergency action plan should be developed and put into operation as soon as possible.

NAME OF DAM: SUNKEN MEADOW DAM

The following measures should be undertaken as part of a regularly scheduled inspection and maintenance program:

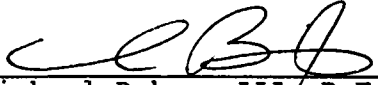
- 1) The brush and saplings on the upstream embankment slope should be cut off at ground level and a good grass cover should be established over the entire embankment.
- 2) The embankment should be mowed regularly.
- 3) The sediment should be removed from the concrete drain pipe and the concrete chute leading into the reservoir along the junction of the upstream embankment slope and left abutment.
- 4) Drain pipes should be placed under the two access roads to the private beach to allow free drainage from the ditch along the downstream toe of the embankment.
- 5) The log along the upstream edge of the spillway weir should be removed.
- 6) The slide gates in the weir should be lubricated as necessary and kept in an operable condition.
- 7) A staff gage should be installed to monitor reservoir levels above normal pool.

MICHAEL BAKER, JR., INC.

SUBMITTED:

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JAMES A. WALSH

James A. Walsh, P.E.
Chief, Design Branch


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

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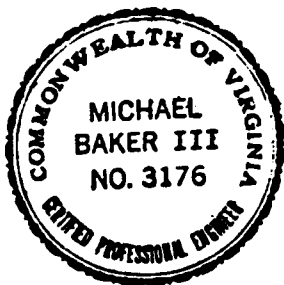
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APPROVED:

Original signed by:
Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer



Date:

SEP 9 1980

NAME OF DAM: SUNKEN MEADOW DAM



OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: SUNKEN MEADOW DAM ID# VA 18101

SECTION 1 - PROJECT INFORMATION

1.1 General

- 1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.
- 1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

- 1.2.1 Description of Dam and Appurtenances: Sunken Meadow Dam is a 9.1 foot¹ high by 930 foot long earthfill embankment. The upstream and downstream embankment slopes are both approximately 5H:1V (Horizontal to Vertical). The crest of the dam is approximately 30 feet wide; State Route 609 runs along the crest. The minimum elevation of the crest is 9.2 feet Temporary Bench Mark (T.B.M.)². There is no information available on any possible zoning of the embankment or the existence of an internal drainage system. There is no slope protection on the dam.

The spillway is located adjacent to the left³ abutment. The intake structure is a concrete, broad-crested weir, with the weir crest at elevation 6.0 feet T.B.M. The weir is 27 feet

¹Measured from the streambed at the downstream toe of dam to the lowest point on the embankment crest.

²All elevations were referenced to a Temporary Bench March (T.B.M.) and are approximately Mean Sea Level.

³Facing downstream.

NAME OF DAM: SUNKEN MEADOW DAM

long, with vertical upstream and downstream faces. Water flowing over the weir falls into a concrete well approximately 5 feet deep. It then passes under the dam through a 44 foot long, triple 4 foot by 5 foot reinforced concrete box culvert. The outlet channel is the original stream channel.

There are two 36 inch diameter slide gates in the concrete weir. Controls for the gates are located directly above the gates, on platforms above the weir, and are reached by means of catwalks extending from the upstream headwall of the spillway culvert. The inverts of the gates are at elevation 0.9 feet T.B.M.

- 1.2.2 Location: Sunken Meadow Dam is located on Sunken Meadow Creek, approximately 1.7 miles east of Claremont, Virginia. A Location Plan is included with this report (Appendix I).
- 1.2.3 Size Classification: The height of the dam is 9.1 feet. The reservoir storage capacity at the crest of the dam (elevation 9.2 feet T.B.M.) is 1056 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.
- 1.2.4 Hazard Classification: State Route 609, a two-lane asphalt highway, runs along the crest of the dam. The confluence of Sunken Meadow Creek and the James River is approximately 600 feet downstream of the dam. Between the James River and the dam there is a private beach with 30-40 mobile homes which are used as vacation homes. There is danger of loss of human life from large flows downstream of the dam. Therefore, Sunken Meadow Dam is considered in the "high" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.
- 1.2.5 Ownership: The dam is owned by the Virginia Department of Highways and Transportation. The reservoir is owned by Mrs. Mable K. Costenbader.

NAME OF DAM: SUNKEN MEADOW DAM

- 1.2.6 Purpose of Dam: The reservoir is used for recreation.
- 1.2.7 Design and Construction History: According to local residents, the original dam at this location was constructed before the Civil War. The first road on the dam was built in the early twentieth century and has been reconstructed several times since. No other information on the design and construction history was available.
- 1.2.8 Normal Operational Procedures: The reservoir is normally operated at the elevation of the spillway weir crest, 6.0 ft. T.B.M. No formal operating procedures are followed for this structure.

1.3 Pertinent Data

- 1.3.1 Drainage Area: The drainage area tributary to the dam is 7.82 square miles.
- 1.3.2 Discharge at Dam Site: The maximum discharge from the reservoir is unknown.

Spillway

Pool level at top of dam 515 c.f.s.

- 1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet T.B.M.	Area (acres)	Reservoir Capacity		Length (feet)
			Acre- feet	Watershed (inches)	
Top of Dam	9.2	281	1056	2.5	8700
Spillway Crest	6.0	172	338	0.8	6500
Streambed at Toe	0.1	-	-	-	-

NAME OF DAM: SUNKEN MEADOW DAM

SECTION 2 - ENGINEERING DATA

- 2.1 Design: The only design plans available were a set of plans for a proposed reconstruction of State Route 609, dated 25 March 1960. No other design plans, specifications, or boring logs were available for use in preparing this report. No stability analyses or hydrologic and hydraulic data were available for review.
- 2.2 Construction: Construction records, as-built plans, and inspection logs were not available for review.
- 2.3 Evaluation: No construction records or as-built plans were available to adequately assess the condition of the dam. All evaluations and assessments in this report were based upon field observations, conversations with representatives of the owner, and office analyses.

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NAME OF DAM: SUNKEN MEADOW DAM

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field inspection was conducted on 10 July 1980. At the time of the inspection, the pool elevation was 6.6 feet T.B.M. and the tailwater elevation was 1.8 feet T.B.M. The weather was cloudy and cool, with temperatures in the low 70's°F. The ground surface at the embankment and abutments was generally dry. The dam and appurtenant structures were found to be in fair to good overall condition at the time of the inspection. Deficiencies found during the inspection are not believed to indicate any major stability problems, although they will require remedial treatment. The following are brief summaries of deficiencies found during the inspection. A Field Sketch of conditions is presented as Plate 1. The complete visual inspection check list is given in Appendix III. No record was found of any previous inspections.

3.1.2 Dam: The embankment was found to be in generally fair to good condition, with no surface cracks or sloughs. No erosion was found on either the embankment or abutment slopes. There is a heavy growth of brush and saplings 10-20 feet high, on the right half of the upstream slope of the embankment. The rest of the embankment has a thick cover of high grass and weeds. The junctions of the embankment and abutments appear to be in good condition, with no evidence of erosion. Two concrete drain pipes from the left hillside discharge into a small concrete channel which leads into the reservoir along the junction of the upstream embankment slope and right abutment. There are about 4 inches of sediment in one of the drain pipes, and sediment deposits have also accumulated in the lower portion of the concrete channel leading into the reservoir. No evidence of seepage was found during the inspection.

No evidence of an internal drainage system for the dam was found during the inspection. There is a drainage ditch running along the downstream toe of the embankment. However, this ditch has been blocked in two places by

NAME OF DAM: SUNKEN MEADOW DAM

the construction of access roads to the beach downstream of the dam.

3.1.3 Appurtenant Structures: The spillway intake structure is a 27 foot long broad-crested concrete weir, with vertical upstream and downstream faces. The intake structure appears to be in good condition, with no visible cracking or spalling of the concrete. A log approximately 25 feet long has lodged or been placed along the upstream edge of the weir. Water flowing over the weir falls into a concrete well approximately 5 feet deep and then passes under the dam through a 44 foot long, triple 4 foot by 5 foot reinforced concrete box culvert. The concrete appears to be in good condition, with no visible cracking or spalling of the concrete. A section of chain-link fence has been placed across the outlet channel just downstream of the culvert. The outlet channel is a natural channel.

There are two 36 inch diameter slide gates in the concrete weir. Controls for the gates are located directly above the gates, on platforms above the weir, and are reached by means of catwalks extending from the upstream headwall of the culvert. According to the owner of the reservoir, the gates need to be lubricated.

3.1.4 Reservoir Area: The reservoir slopes range from gentle to moderate and are heavily wooded. The slopes appear to be in good condition, with no evidence of erosion. The original dam at this location was built before the Civil War, and the total amount of sedimentation is not known. The extent of sedimentation was not directly observed. However, sedimentation is not expected to be occurring at a significant rate because all of the watershed is heavily wooded. The reservoir appears to be fairly shallow. There are scattered trees within the reservoir, both dead and living, near the dam.

3.1.5 Downstream Channel: The downstream channel is a natural channel which discharges into the James River approximately 600 feet downstream of the dam. A section of chain-link fence has been placed across the channel just

NAME OF DAM: SUNKEN MEADOW DAM

downstream of the culvert under the dam. Another culvert, consisting of several corrugated metal pipes, is located approximately 150 feet downstream of the dam. There are no other obstructions in the downstream channel. There is no appreciable slope to the downstream channel, which is controlled by backwater from the James River. The stream banks are very low and there are some trees along the banks. The rest of the overbank area is a private beach.

3.1.6 Instrumentation: There is no instrumentation present at the dam.

3.2 Evaluation: In general, the dam and appurtenant structures are in fair to good condition. The brush and saplings on the upstream embankment slope should be cut off at ground level and a good grass cover should be established over the entire embankment. The embankment should be mowed regularly. The sediment should be removed from the concrete drain pipe and the concrete chute leading into the reservoir along the junction of the upstream embankment slope and left abutment. Drain pipes should be placed under the two access roads to the private beach to allow free drainage from the ditch along the downstream toe of the embankment. The log along the upstream edge of the spillway weir should be removed. The slide gates in the weir should be lubricated as necessary and kept in an operable condition. A staff gage should be installed to monitor reservoir levels above normal pool.

NAME OF DAM: SUNKEN MEADOW DAM

SECTION 4 - OPERATIONAL PROCEDURES

- 4.1 Procedures: Operation of the dam is an automatic function controlled by the spillway. Water entering the reservoir flows over the weir crest of the spillway at elevation 6.0 feet T.B.M. Drawdown of the reservoir can be accomplished by use of the two 36 inch diameter slide gates in the weir.
- 4.2 Maintenance of Dam: Maintenance of the dam is the responsibility of the Virginia Department of Highways and Transportation. The road and dam are inspected periodically by representatives of the Virginia Department of Highways and Transportation, but no formal inspection or maintenance schedule has been instituted.
- 4.3 Maintenance of Operating Facilities: The only operating facilities at the dam are the two 36 inch diameter slide gates. Maintenance of these gates is the responsibility of the owner of the reservoir, Mrs. Mabel K. Costenbader. An inspection or maintenance schedule has not been instituted.
- 4.4 Warning System: At the present time, there is no warning system or emergency action plan in operation.
- 4.5 Evaluation: Maintenance of the dam in the past has been inadequate. Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be corrected annually. A warning system and emergency action plan should be developed and put into operation.

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NAME OF DAM: SUNKEN MEADOW DAM

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

- 5.1 Design: No design data were available for use in preparing this report.
- 5.2 Hydrologic Information: No rainfall, stream gage, or reservoir stage records are maintained for this dam.
- 5.3 Flood Experience: No records were available.
- 5.4 Flood Potential: The Probable Maximum Flood (PMF) and the 1/2 Probable Maximum Flood (1/2 PMF) were developed and routed through the reservoir by use of the HEC-1 DB computer program (Reference 9, Appendix IV) and appropriate unit hydrograph, precipitation and storage-outflow data. Clark's T and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to the unit hydrograph was taken from a publication by the National Oceanic and Atmospheric Administration (Reference 17, Appendix IV). Rainfall losses for the PMF were estimated at an initial loss of 1.0 inches and a constant loss rate of 0.05 inches per hour thereafter.
- 5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, Paragraph 1.3.3.

Regulation of flow from the reservoir is automatic. Normal flows are maintained by the crest of the spillway weir at elevation 6.0 feet T.B.M.

Outlet discharge capacity was computed by hand; reservoir area was planimetered from the Claremont, Virginia, 7.5 minute USGS quadrangle; and storage capacity was computed by the HEC-1 DB program. Outlet discharge capacity and storage capacity curves were computed to elevations above the crest of the dam. All flood routings were begun with the reservoir at normal pool, elevation 6.0 feet T.B.M.

- 5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance are shown in the following table:

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NAME OF DAM: SUNKEN MEADOW DAM

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal(a)	Hydrographs	
		1/2 PMF	PMF(b)
Peak flow, c.f.s.			
Inflow	16	14,929	29,857
Outflow	16	14,155	28,841
Peak elev., ft. T.B.M.	6.6	12.6	14.4
Non-overflow section (c) (elev. 9.2 ft. T.B.M.)			
Depth of flow, ft.	-	3.4	5.2
Average velocity, f.p.s.	-	8.5	10.6
Total duration of over- topping hrs.	-	21.3	37.3
Tailwater elev., ft. T.B.M.	1.8	-	-

(a) Conditions at time of inspection.

(b) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a region.

(c) Velocity estimates were based on critical depth at control section.

5.7 Reservoir Emptying Potential: The reservoir can be drawn down by means of the two 36 inch diameter slide gates in the concrete weir. The inverts of the gates are at elevation 0.9 feet T.B.M. Neglecting inflow, the reservoir can be drawn down from normal pool in approximately 2 days. This is equivalent to an approximate drawdown rate of 2.7 feet per day, based on the hydraulic height measured from normal pool divided by the time to dewater the reservoir.

5.8 Evaluation: Sunken Meadow Dam is an "intermediate" size - "high" hazard dam requiring evaluation for a spillway design flood equal to the PMF. The PMF was routed through the reservoir and found to overtop the dam by a maximum depth of 5.2 feet with an average critical velocity of 10.6 f.p.s. Total duration of dam overtopping would be approximately 37.3 hours. The spillway is capable of passing up to 8 percent of the PMF without overtopping the crest of the dam.

Conclusions pertain to present conditions and the effect of future development on the hydrology has not been considered.

NAME OF DAM: SUNKEN MEADOW DAM

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: There is no information available on the foundation conditions. The dam is located in the Coastal Plain physiographic province of Virginia. This province has low, steep hills, with total relief less than 150 feet. The dam is located near the interface of the Yorktown and Saint Mary formations. No internal drainage system was observed during the visual inspection. It is not known how the dam is keyed into the foundation. No major deficiencies were noted during the visual inspection.

6.2 Embankment

6.2.1 Materials: There is no information available on the nature of the embankment materials, or on any possible zoning of the embankment. The visual inspection revealed that the embankment was constructed of grayish-black to grayish-yellow, sandy/silty clay.

6.2.2 Stability: There are no stability calculations available. The dam is 9.1 feet high and the crest is 30 feet wide. The upstream and downstream slopes are both approximately 5H:1V. The dam is subjected to a sudden drawdown because the approximate reservoir drawdown rate of 2.7 feet per day exceeds the critical rate of 0.5 feet per day for earth dams.

According to the guidelines presented in Design of Small Dams, by the U.S. Department of the Interior, Bureau of Reclamation, for small homogeneous dams with a stable foundation, subjected to a drawdown, and composed of low-plastic fines (CL, ML), the recommended slopes are 3.5H:1V upstream and 2.5H:1V downstream. The recommended crest width is 11 feet. Based on these guidelines, the dam has more than adequate embankment slopes and width.

6.2.3 Seismic Stability: Sunken Meadow Dam is located in Seismic Zone 1. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes, provided static stability conditions are satisfactory and conventional safety margins exist.

NAME OF DAM: SUNKEN MEADOW DAM

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. However, based on the Bureau of Reclamation guidelines, the crest and embankment slopes are more than adequate. Also, no major deficiencies were noted during the field inspection. Therefore, a stability check is not required.

The spillway is inadequate to pass the SDF (as described in Section 5 of this report) and the depth, duration, and rate of overtopping flows are considered detrimental to the embankment. Overtopping flows are relatively deep, last for 37.3 hours, and the velocity is greater than 6 f.p.s., the effective eroding velocity for a vegetated earth embankment.

NAME OF DAM: SUNKEN MEADOW DAM

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

- 7.1 Dam Assessment: The engineering data available for review were inadequate. No indication of any major stability problem was discovered during the field inspection and office analyses. A stability check of the dam is not required. The dam and appurtenant structures are generally in fair to good condition, but maintenance is considered inadequate.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the PMF was selected as the SDF for the "intermediate" size - "high" hazard classification of Sunken Meadow Dam. It has been determined that the dam would be overtopped by the SDF. The depth, duration, and rate of overtopping flows are considered detrimental to the embankment. Overtopping flows are relatively deep (5.2 feet), last 37.3 hours, and the velocity (10.6 f.p.s.) is greater than 6 f.p.s., the effective eroding velocity for a vegetated earth embankment. The spillway is capable of passing up to 8 percent of the PMF without overtopping the crest of the dam.

The spillway is adjudged as inadequate. The spillway was not adjudged as seriously inadequate because, although there is a high probability of loss of life due to large flows downstream of the dam, failure of the dam due to overtopping would not significantly increase the probability of loss of life.

There is no flood warning system or emergency action plan currently in operation.

- 7.2 Recommended Remedial Measures: A flood warning system and emergency action plan should be developed and put into operation as soon as possible. The dam should be checked during periods of heavy rainfall. If dam overtopping is imminent, warning should be issued to downstream inhabitants and local public officials. The emergency action plan should list steps to be taken to help prevent failure of the dam in an emergency.

The following measures should be undertaken as part of a regularly scheduled inspection and maintenance program.

- 1) The brush and saplings on the upstream embankment slope should be cut off at ground level and a good grass cover should be established over the entire embankment.

NAME OF DAM: SUNKEN MEADOW DAM

- 2) The embankment should be mowed regularly.
- 3) The sediment should be removed from the concrete drainpipe and the concrete chute leading into the reservoir along the junction of the upstream embankment slope and left abutment.
- 4) Drainpipes should be placed under the two access roads to the private beach to allow free drainage from the ditch along the downstream toe of the embankment.
- 5) The log along the upstream edge of the spillway weir should be removed.
- 6) The slide gates in the weir should be lubricated as necessary and kept in an operable condition.
- 7) A staff gage should be installed to monitor reservoir levels above normal pool.

NAME OF DAM: SUNKEN MEADOW DAM

APPENDIX I

PLATES

CONTENTS

Location Plan

Plate 1 - Field Sketch

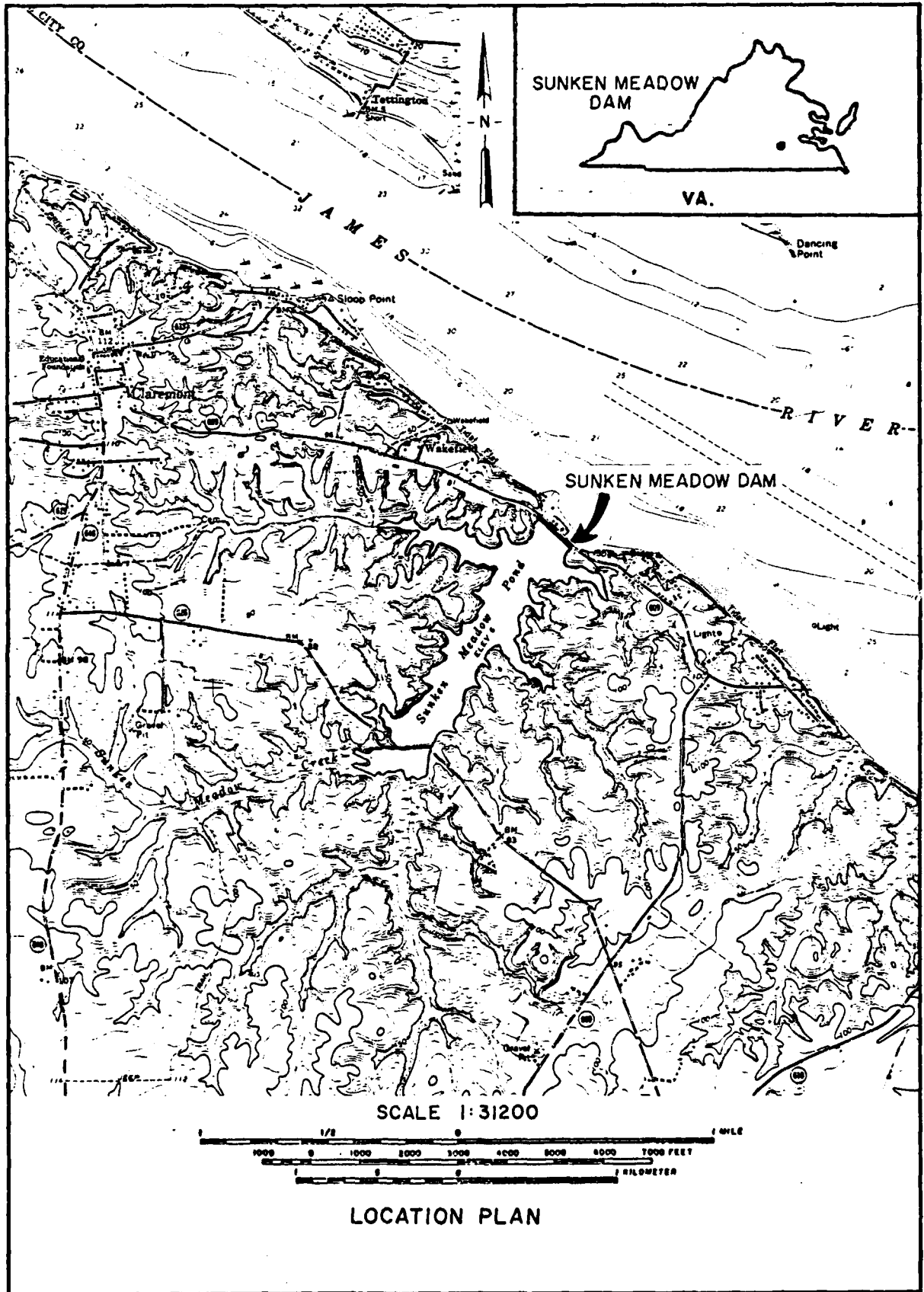
Plate 2 - Top of Dam Profile

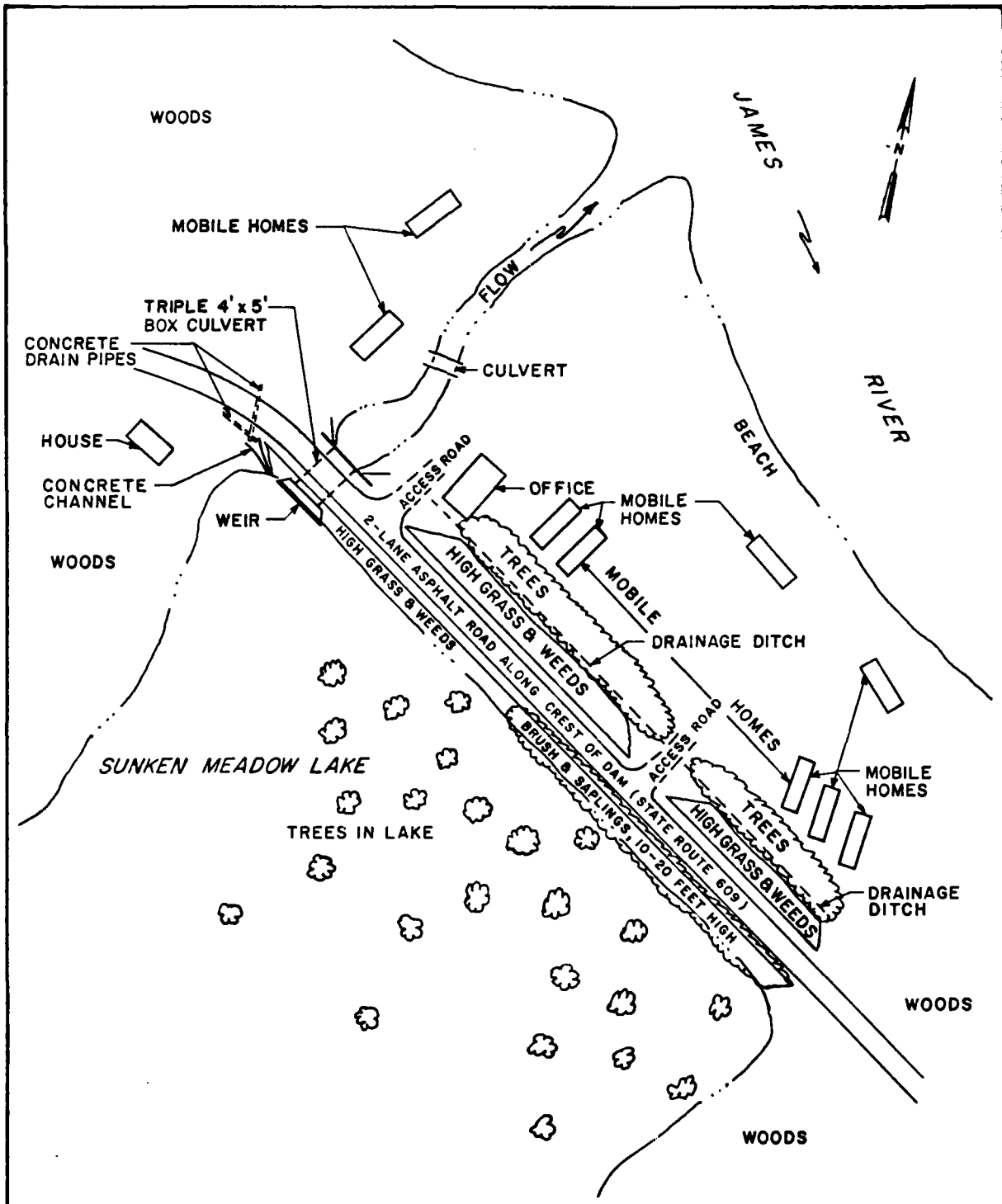
Plate 3 - Typical Cross Section

Plate 4 - Spillway Cross Section

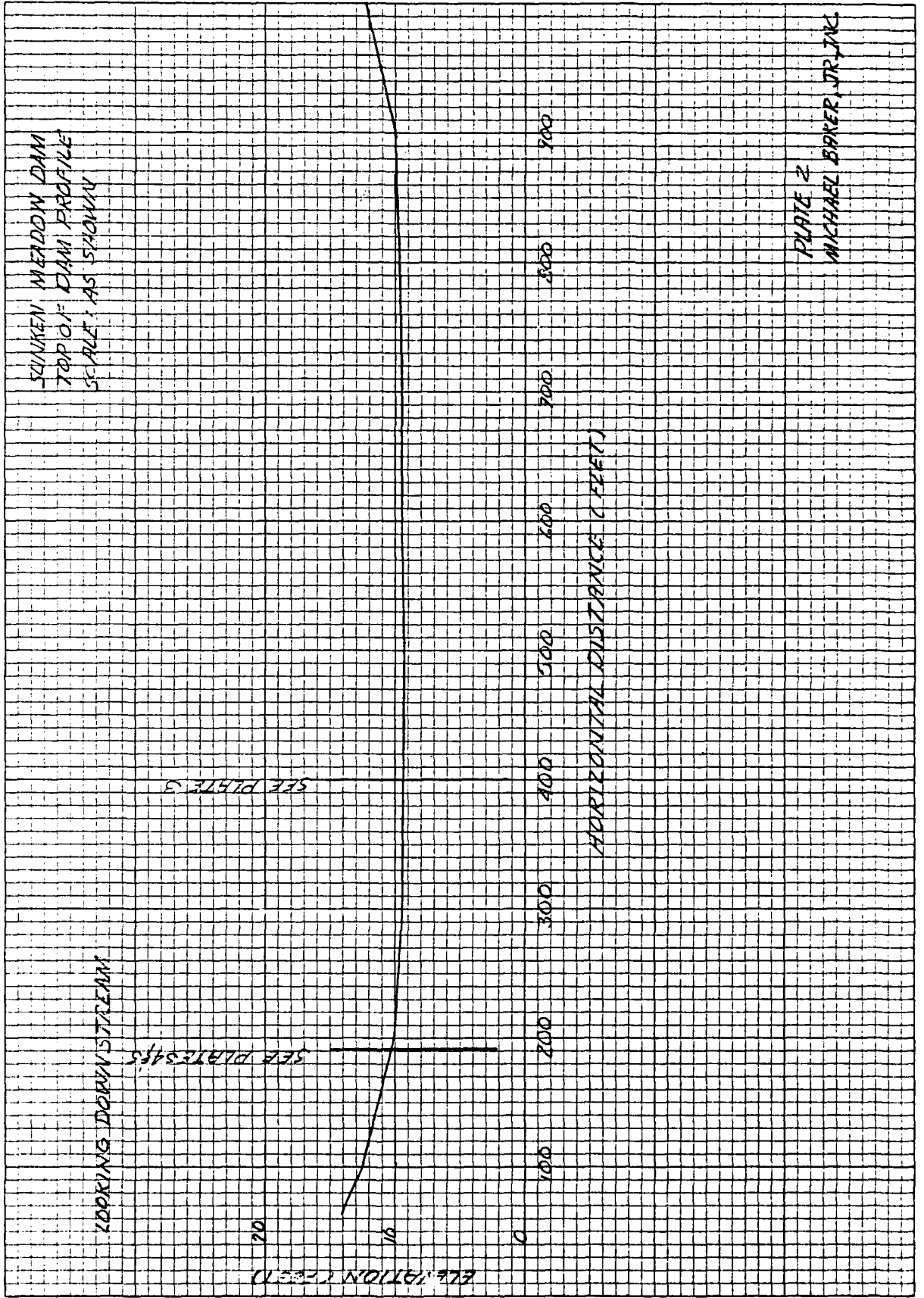
Plate 5 - Plan View of Spillway

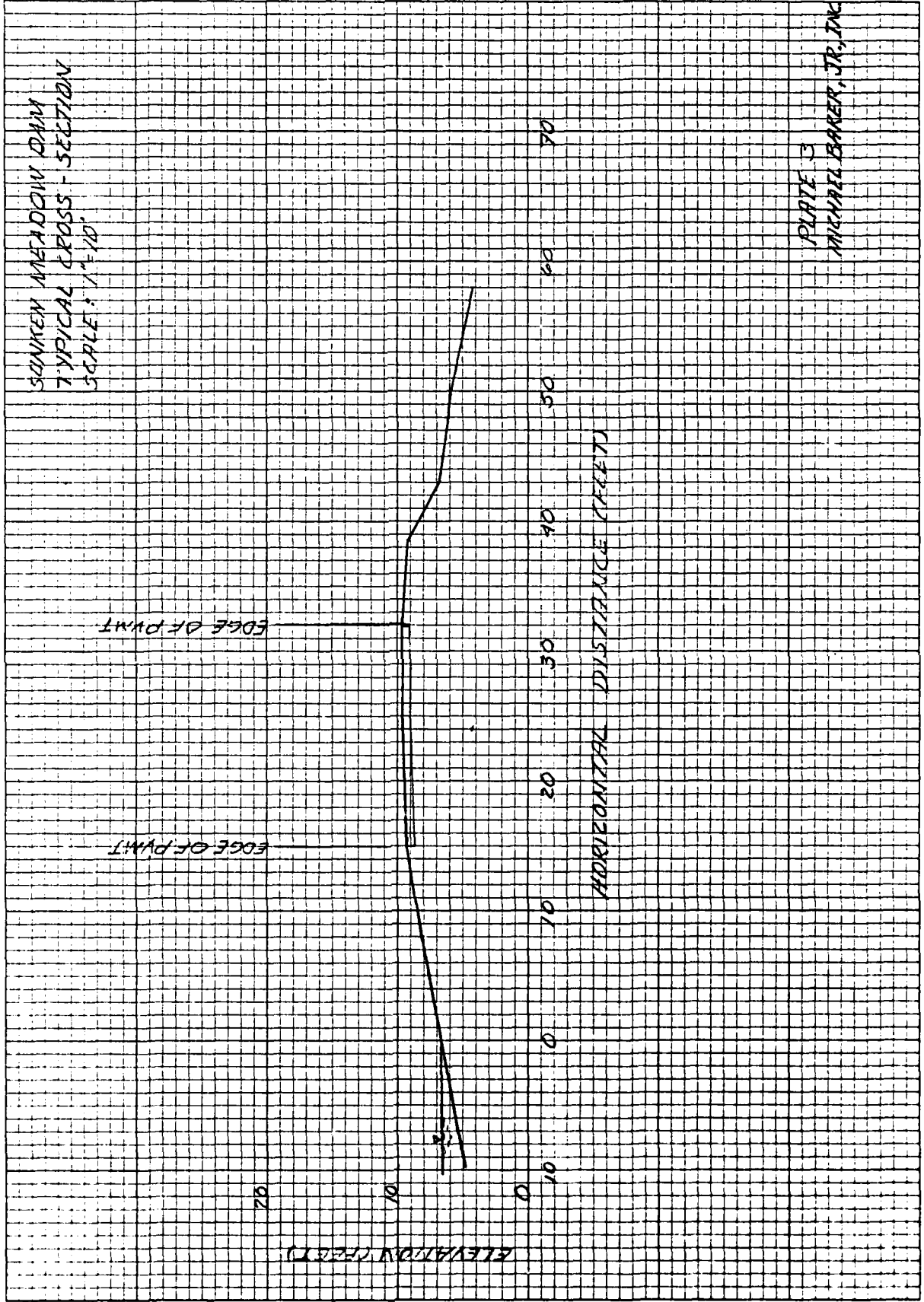
NAME OF DAM: SUNKEN MEADOW DAM





FIELD SKETCH
SUNKEN MEADOW DAM
 MICHAEL BAKER, JR., INC.
 10 JULY 1980
 PLATE I





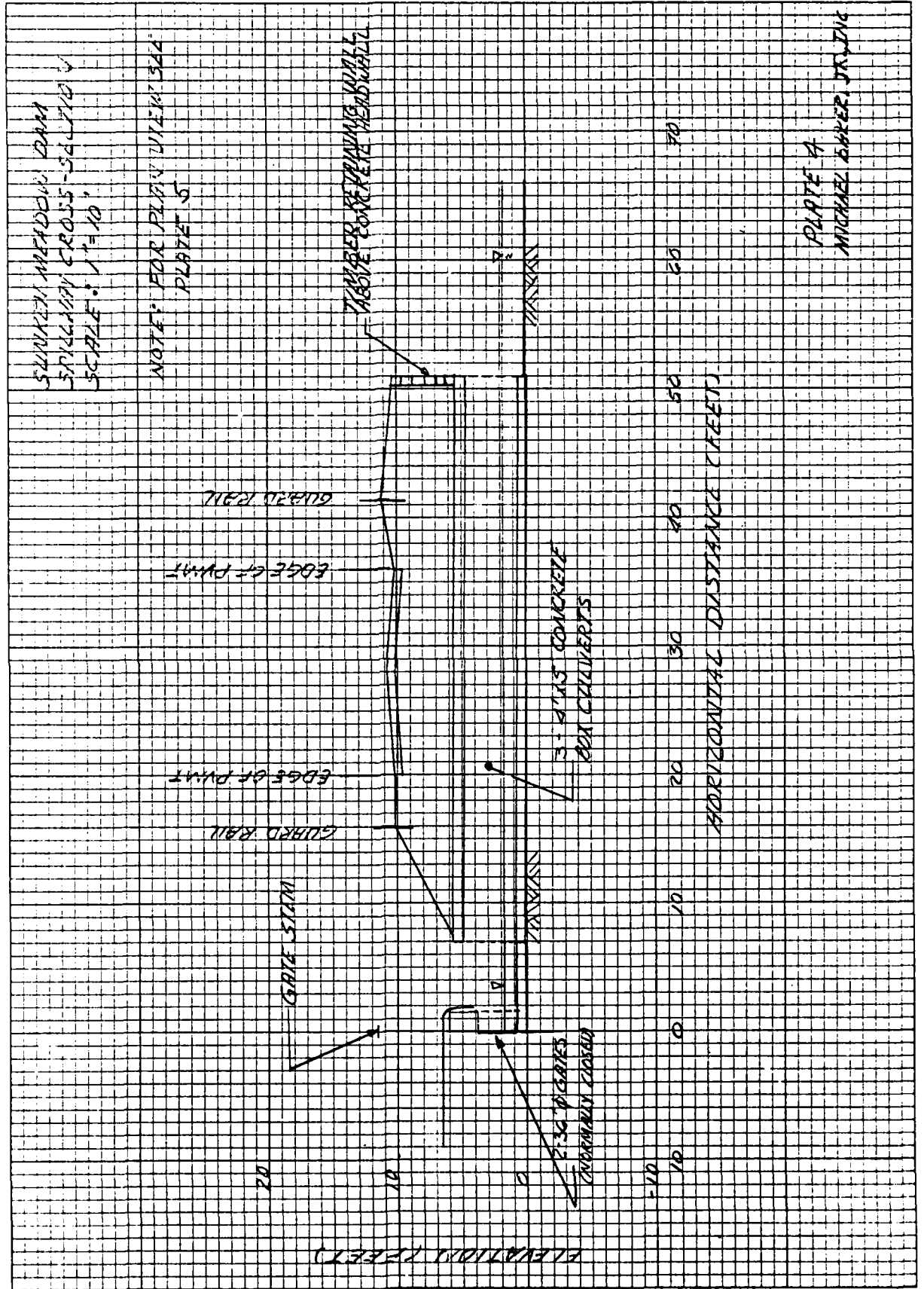
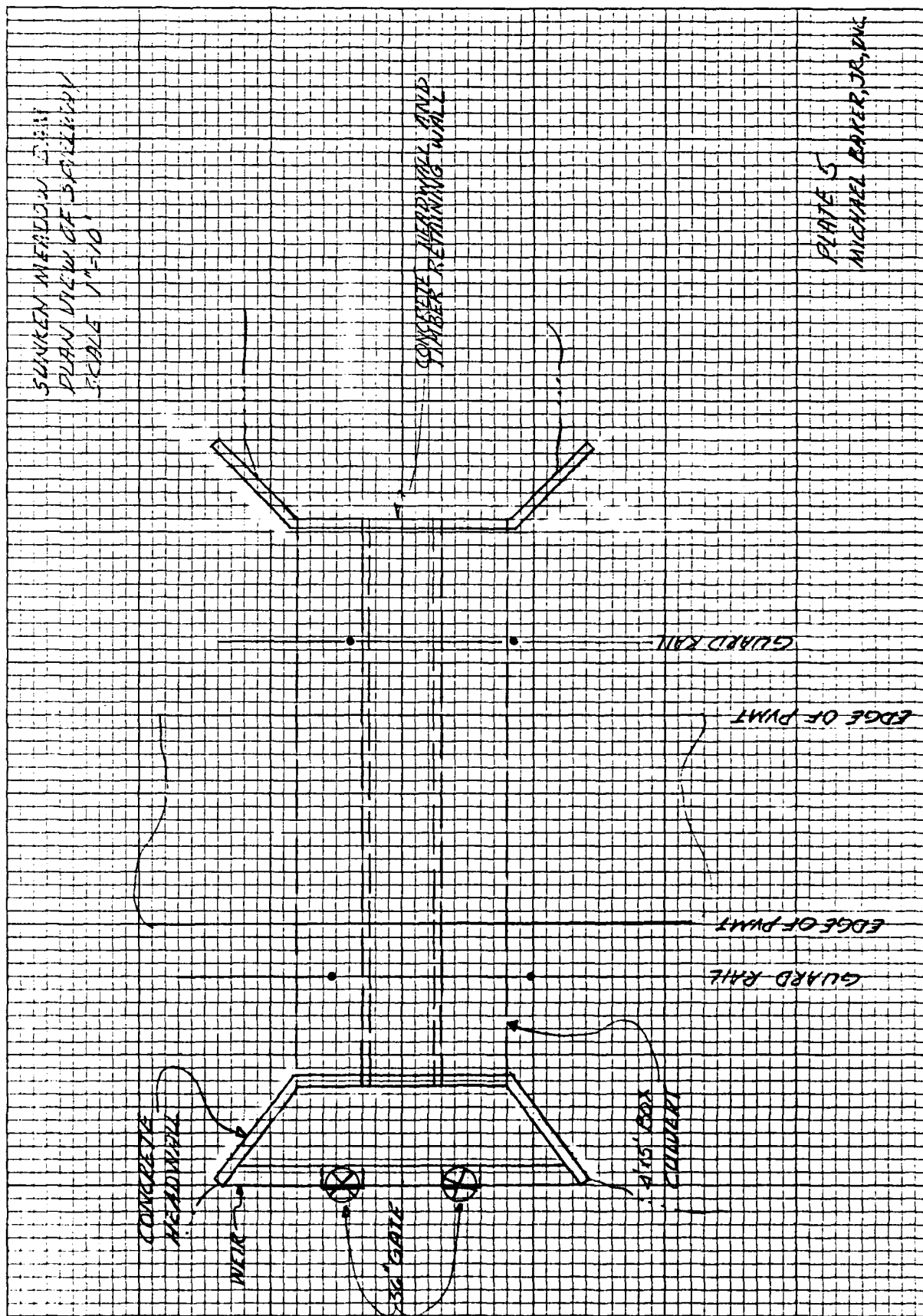


PLATE 4
MICHAEL BAYER, JR., INC.

40 U/03

1 1/2" KLEUFEL & LESSER CO. MADE IN U.S.A.



APPENDIX II

PHOTOGRAPHS

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Photo 1: Spillway Weir and Controls for Emergency Gates

Photo 2: Spillway from Downstream Channel

Photo 3: Downstream Embankment Slope

Photo 4: Reservoir from Crest of Dam

Photo 5: Downstream Channel from Crest of Dam

Photo 6: Mobile Homes in Downstream Area

Note: Photos were taken on 10 July 1980.

NAME OF DAM: SUNKEN MEADOW DAM

SUNKEN MEADOW DAM



PHOTO 1. Spillway Weir and Controls for Emergency Gates



PHOTO 2. Spillway from Downstream Channel

SUNKEN MEADOW DAM



PHOTO 3. Downstream Embankment Slope



PHOTO 4. Reservoir from Crest of Dam

SUNKEN MEADOW DAM



PHOTO 5. Downstream Channel from Crest of Dam



PHOTO 6. Mobile Homes in Downstream Area

APPENDIX III

VISUAL INSPECTION CHECK LIST

Phase 1
Visual Inspection
Check List

Name of Dam Sunken Meadow Dam County Surrey State Virginia Coordinates Lat. 3713.0
Long. 7656.0

Date of Inspection 10 July 1980 Weather Cloudy Temperature 70° F.

Pool Elevation at Time of Inspection 6.6 ft.* T.B.M. Tailwater at Time of Inspection 1.8 ft.* T.B.M.

*Elevations were referenced to a Temporary Bench Mark (T.B.M.) and are approximately M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:

John W. Lightner
Jeffrey A. Quay
P.S. Verma

Virginia State Water Control Board:

Leon Musselwhite
Thomas Modena
Mark Wawner

Owner's Representatives:

(The dam is owned by the Virginia
Department of Highways and Trans-
portation)
D.N. Simmers
F.M. Neblett

P.S. Verma Recorder

EMBANKMENT

Name of Dam SUNKEN MEADOW DAM

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

SURFACE CRACKS None observed

UNUSUAL MOVEMENT OR
CRACKING AT OR BEYOND
THE TOE None observed

SLOUGHING OR EROSION OF
EMBANKMENT AND ABUTMENT
SLOPES

No sloughing or erosion was found on either the embankment or abutment slopes. There is a heavy growth of brush and saplings, 10-20 ft. high, on the right half of the upstream slope of the embankment. The rest of the embankment has a thick cover of high grass and weeds.

The brush and saplings should be cut off at ground level and a good grass cover should be established over the entire embankment. The embankment should be mowed regularly.

EMBANKMENT

Name of Dam SUNKEN MEADOW DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical and horizontal alignment of the crest both appear to be good. A two-lane asphalt road (State Route 609) runs along the crest of the dam.	

RIPRAP FAILURES

There is no riprap on the dam.

EMBANKMENT MATERIALS

The embankment was apparently constructed of grayish-black to grayish-yellow, clayey and sandy silt. The embankment material was dry at the time of inspection.

There is no information available on any possible zoning of the embankment or on the existence of a keyway or impervious core.

EMBANKMENT

Name of Dam SUNKEN MEADOW DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENTS	<p>The junctions of the embankment and abutments appear to be in good condition, with no evidence of erosion. Two concrete drain-pipes from the left hillside discharge into a small concrete channel which leads into the reservoir along the junction of the upstream embankment and right abutment. There is about 4 in. of sediment in the lower end of one of the drain pipes, and sediment deposits have also accumulated in the lower portion of the concrete channel leading into the reservoir.</p>	<p>The sediment should be removed from the concrete drain pipe and the concrete chute leading into the reservoir.</p>
ANY NOTICEABLE SEEPAGE	No evidence of seepage was found.	
STAFF GAGE AND RECORDER	None	
DRAINS	<p>No evidence of an internal drainage system for the dam was found during the inspection. There is a drainage ditch running along the downstream toe of the embankment; however, it has been blocked in two places by the construction of access roads to the beach. The bottom of the drainage ditch was wet in some areas at the time of the inspection.</p>	<p>The wet areas in the drainage ditch were probably the result of rain the day before the inspection. Drain pipes should be placed under the two access roads to allow free drainage from the ditch.</p>

SPELLWAY

Name of Dam: SUNKEN MEADOW DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No cracking or spalling was observed. The concrete appears to be in good condition.	
INTAKE STRUCTURE	The intake structure is a broad-crested concrete weir 27 ft. long by 1.5 ft. wide with vertical upstream and downstream faces, located near the left abutment of the dam. The intake structure appears to be in good condition, with no visible cracking or spalling of the concrete. A log approximately 25 ft. long has lodged or been placed along the upstream edge of the weir.	The log should be removed.
OUTLET STRUCTURE	Water flowing over the weir falls into a concrete well approximately 5 ft. deep and then passes under the dam through a 44 ft. long, triple 4 ft. by 5 ft. reinforced concrete box culvert. The concrete appears to be in good condition. No visible cracking or spalling of the concrete was observed. A section of chain-link fence has been placed across the outlet channel just downstream of the culvert.	
OUTLET CHANNEL	The outlet channel is a natural channel which discharges into the James River approximately 600 ft. downstream of the dam.	

SPELLWAY

Name of Dam: SUNKEN MEADOW DAM

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

EMERGENCY GATES

There are two 36 in. diameter slide gates in the concrete weir. Controls for the gates are located directly above the gates, on platforms above the weir, and are reached by means of catwalks extending from the upstream headwall of the culvert. According to the owner of the reservoir, the gates need to be lubricated.

The gates should be lubricated as necessary and kept in an operable condition.

INSTRUMENTATION

Name of Dam: SUNKEN MEADOW DAM

VISUAL EXAMINATION OBSERVATIONS REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS No permanent markers were found.

OBSERVATION WELLS None

WEIRS None

PIEZOMETERS None

OTHER None

RESERVOIR

Name of Dam: SUNKEN MEADOW DAM

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

SLOPES

The reservoir slopes are heavily wooded; the slope ranges from gentle to moderate. The slopes appear to be in good condition, with no evidence of erosion.

SEDIMENTATION

The original dam at this location was built before the Civil War, and the total amount of sedimentation is unknown. The extent of sedimentation was not directly observed. However, sedimentation is not expected to be occurring at a significant rate because almost all of the watershed is heavily wooded.

LAKE

The lake appears to be fairly shallow. There are scattered trees in the reservoir, both dead and living, near the dam.

DOWNSTREAM CHANNEL

Name of Dam: SUNKEN MEADOW DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
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**CONDITION
(OBSTRUCTIONS,
DEBRIS, ETC.)**

The downstream channel is a natural channel which discharges into the James River approximately 600 ft. downstream of the dam. A section of chain-link fence has been placed across the outlet channel just downstream of the culvert under the dam. There is another culvert consisting of several C.M.P.'s approximately 150 ft. downstream of the dam. There are no other obstructions in the downstream channel.

SLOPES

There is no appreciable slope to the downstream channel, which is controlled by backwater from the James River. The stream banks are very low and there are some trees along the banks. The rest of the overbank area is a private beach.

**APPROXIMATE NO.
OF HOMES AND
POPULATION**

The downstream area is a private beach with 30-40 mobile homes. The population is estimated at 50-100 people during the summer.

APPENDIX IV

CORRESPONDENCE FROM VIRGINIA DEPARTMENT
OF HIGHWAYS AND TRANSPORTATION

HAROLD C KING, COMMISSIONER
EDWARD H. HAY, MIDDLE BRUNN DISTRICT
THOMAS S. THAYER, HUNTERDON DISTRICT
FRANK H. LEE, FREDERICKSBURG DISTRICT
DONALD W. LINDSEY, WESTMORLAND DISTRICT
WILLIAM T. BRYAN, FREDERICKSBURG DISTRICT
WILLIAM T. ROBINSON, WEST POINT FREDERICKSBURG DISTRICT
WILLIAM B. WAINWRIGHT, SPRINGFIELD CULPEPER DISTRICT
HUBERT S. LANIER, STAUNTON DISTRICT
T. RAY WASHLEY, III, CHESTERFIELD AT FARMER LEXA
CHARLES S. WOODRUFF, JR., CHESTERFIELD AT FARMER LEXA

J. S. HODGE
DISTRICT ENGINEER

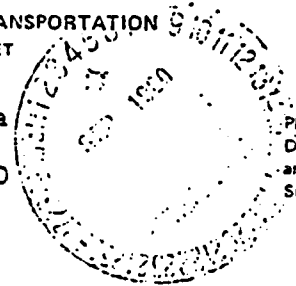


COMMONWEALTH of VIRGINIA

DEPARTMENT OF HIGHWAYS & TRANSPORTATION
1221 EAST BROAD STREET
RICHMOND, 23219

Waverly, Virginia
23890
September 3, 1980

LEO E. BUSSER, III
DEPUTY COMMISSIONER & CHIEF ENGINEER
T. ASHBY NENNY
SUPERVISOR ADMINISTRATION
J. M. WYATT, JR.
SUPERVISOR OPERATIONS
J. P. ROYER, JR.
DIRECTOR OF PLANNING
H. R. PERKINSON, JR.
DIRECTOR OF PROGRAM MANAGEMENT
W. L. BRITTON, JR.
DIRECTOR OF ENGINEERING



Please Reply To
Department of Highways
and Transportation
Suffolk, Virginia 23434

Mr. R. V. Davis
Executive Secretary
State Water Control Board
P. O. Box 11143
Richmond, Virginia 23230

Re: Sunken Meadow Dam
Inventory No. 18101

Dear Mr. Davis:

With reference to your letter of August 20, 1980 concerning the preliminary inspection report for the above noted dam, we would like to make the following comments:

1. We will cut the saplings on the upstream side of the abandoned embankment and seed the embankment with grass.
2. We will remove the log on the spillway weir and clean out the pipe and paved ditch on the upstream side of the dam.
3. We will see that the pipe culverts under the entrances to Sunken Meadow Beach are installed to facilitate the drainage on the downstream side of the dam.
4. We feel that the property owner should control the gates on the spillway; however, we will attempt to obtain keys to the locks so that we can open the gates in the event of an emergency. We also will work with the property owners to see that these gates are maintained properly.

Yours very truly,

D. N. Simmers
Resident Engineer

DNS/bh
cc: Mr. C. M. Clarke

APPENDIX V

GENERAL REFERENCES

GENERAL REFERENCES

1. Bureau of Reclamation, U.S. Department of the Interior, Design of Small Dams, A Water Resources Technical Publication, Revised Reprint, 1977.
2. Chow, Ven Te, Handbook of Applied Hydrology, McGraw - Hill Book Company, New York, 1964.
3. Chow, Ven Te, Open Channel Hydraulics, McGraw - Hill Book Company, New York, First Edition, 1959.
4. Commonwealth of Virginia, "Geologic Map of Virginia," Department of Conservation and Economic Development, and Division of Mineral Resources, 1963.
5. HR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 Hours," (1956).
6. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw - Hill Book Company, New York, 1963.
7. Soil Conservation Service, "National Engineering Handbook - Section 4, Hydrology," U.S. Department of Agriculture, 1964.
8. Soil Conservation Service, "National Engineering Handbook - Section 5, Hydraulics," U.S. Department of Agriculture.
9. U.S. Army, Hydrologic Engineering Center, "Flood Hydrograph Package (HEC-1), Dam Safety Investigations, Users Manual," Corps of Engineers, Davis, California, September 1978.
10. U.S. Army, Hydrologic Engineering Center, "HEC-2 Water Surface Profiles, Users Manual," Corps of Engineers, Davis, California, October 1973.
11. U.S. Army, "Inventory of United States Dams," Corps of Engineers, 9 September 1978.
12. U.S. Army, Office of the Chief of Engineers, "Appendix D, Recommended Guidelines for Safety Inspection of Dams," National Program of Inspection of Dams, Volume 1, Corps of Engineers, Washington, D.C., May 1975.

NAME OF DAM: SUNKEN MEADOW DAM

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13. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-163 (Draft Engineering Manual), "Spillway and Freeboard Requirements for Dams, Appendix C, Hydrometeorological Criteria and Hyetograph Estimates," (August 1975).
14. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-188, "Engineering and Design, National Program of Inspection of Non-Federal Dams," Corps of Engineers, Washington, D.C., 30 December 1977.
15. U.S. Army, Office of the Chief of Engineers, Engineer Technical Letter No. ETL 1110-2-234, "Engineering and Design, National Program of Inspection of Non-Federal Dams, Review of Spillway Adequacy," Corps of Engineers, Washington, D.C., 10 May 1978.
16. U.S. Department of Commerce, "Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years," Weather Bureau, Washington, D.C., May 1961.
17. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "Hydrometeorological Report No. 51, Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Washington, D.C., June 1978.

NAME OF DAM: SUNKEN MEADOW DAM