AD-A106 616 PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF MINE--ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. SOMETHING GREEN A DAM (MO 30720), --ETC(U)
SEP 80 R G BERGGREEN, L M KRAZYNSKI DACW43-80-C-0066

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1 OF 2
AD A

LEVEL II

MISSISSIPPI-KASKASKIA-ST. LOUIS BASIN

SOMETHING GREEN A DAM
WASHINGTON COUNTY, MISSOURI
MO 30720

AND

SOMETHING GREEN B DAM
WASHINGTON COUNTY, MISSOURI
MO 30719

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

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PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

SEPTEMBER 1980

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7. AUTHOR(s) Woodward-Clyde Consultants	8. CONTRACT OR GRANT NUMBER(s) DACW43-80-C-0066 ✓
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Dam Safety, Lake, Dam Inspection, Private Dams

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

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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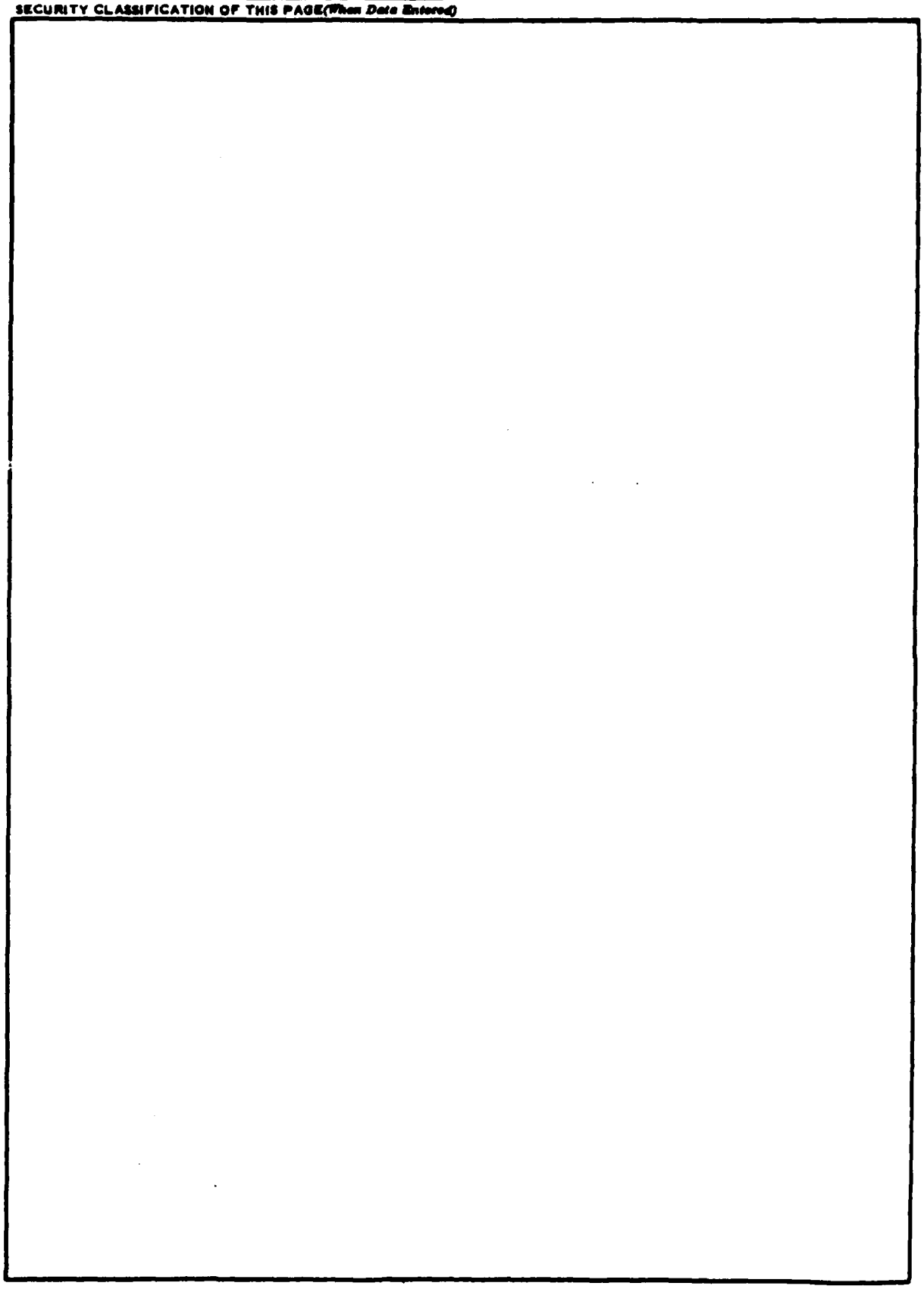

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Something Green A Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Something Green A Dam (MO 30720).

It was prepared under the National Program for Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St Louis District as a result of the application of the following criteria:

a. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division

29 SEP 1980
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

30 SEP 1980
Date

SOMETHING GREEN A DAM

County, Missouri

Missouri Inventory No. 30720

(6) **Phase I Inspection Report**

National Dam Safety Program.

Something Green A Dam (MO 30720),
Something Green B Dam (MO 30719)
Mississippi - Kaskaskia - St. Louis Basin,
Washington County, Missouri. Phase I
Inspection Report.

Prepared by

Woodward-Clyde Consultants

Chicago, Illinois

(9) Final rept.,

(15) DACW43-80-C-0066

(10) Richard G. /Berggreen
Leonard M. /Krazynski

Under Direction of

St Louis District, Corps of Engineers

(12) 116

for

Governor of Missouri

(11) Sep[redacted]80

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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 not to provide a complete evaluation of the safety of the structure nor to provide a guarantee on its future integrity. Rather the purpose of the program is to identify potentially hazardous conditions to the extent they can be identified by a visual examination. The assessment of the general condition of the dam is based upon available data (if any) and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies. In view of the limited nature of the Phase I studies no assurance can be given that all deficiencies have been identified.

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 any data which may be available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action removes the normal load on the structure, as well as the reservoir head along with seepage pressures, 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 frequent inspections can unsafe conditions be detected, so that corrective action can be taken. Likewise continued care and maintenance are necessary to minimize the possibility of development of unsafe conditions.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	Something Green A (downstream)
State Located	Missouri
County Located	Washington
Stream	Rouge Creek
Date of Inspection	17 July 1980

The Something Green A Dam (downstream-most of two existing Something Green Dams), Missouri Inventory Number 30720, was inspected by Richard Berggreen (engineering geologist), Leonard Krazynski (geotechnical engineer), John Seymour (geotechnical engineer) and Sean Tseng (hydrologist). The dam is an earthen dam.

The dam inspection was made following the guidelines presented in the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines represent a consensus of the engineering profession. They are intended to provide an expeditious identification, based on available data and a visual inspection of those dams which may pose hazards to human life or property. In view of the limited nature of the study, no assurance can be given that all deficiencies have been identified.

The St Louis District, Corps of Engineers, has classified this dam as high hazard; we concur with this classification. The estimated damage zone extends approximately four miles downstream of the dam. Within this damage zone are several dwellings and loss of life and property could be large in the event of overtopping and failure of this dam.

The dam is classified as a small size based on its 27 ft height and storage volume of 228 ac-ft. The classification for small size dam is based on a height comprised between 25 and 40 ft or a storage capacity comprised between 50 and 1000 ac-ft.

Our inspection and evaluation indicate the dam embankment is in generally good condition. Spillage over the spillway side walls has resulted in erosion of a 2 ft deep, 4 ft wide gully at the toe of the right half of the dam. This gully should be repaired and the spillway capacity increased to avoid spillage. The lateral erosion potential of the

downstream channel is considered moderate to high. Seepage occurring along the toe and on the face of the dam did not appear to constitute a hazard to the dam at present, due to the low volume of flow and lack of any soil particles in the seepage water.

Hydrologic/hydraulic analysis indicates that a 100-year flood (1 percent probability-of-occurrence event) will be contained within the reservoir with a maximum spillway discharge of 904 ft^3/sec. This analysis also indicates that any storm greater than 25 percent of the Probable Maximum Flood (PMF) will result in overtopping the embankment. The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The concrete lined spillway chute has a discharge capacity of about 340 ft^3/sec, which is representative of flows having a frequency of occurrence probability greater than 10 percent. Hence some erosion can be expected in this area for flows greater than 340 ft^3/sec.

The owner's residence and the real estate sales office are located in close proximity downstream of Something Green A Dam (see Overview photograph and also Photos 3 and 4) and would be severely inundated in the event of a potential failure of this dam. Also, the influence of a third dam upstream (currently in construction) cannot be assessed at this time. Consequently, it is recommended that the spillway of Something Green A Dam be designed to pass 100 percent of the PMF, unless additional studies discussed in Section 7.2b.1 indicate that a smaller spillway design flood can be justified.

There was no evidence of displacement of the vertical or horizontal alignment of the dam crest, and no depressions, cracks, animal burrows or sinkholes were noted during the inspection.

It is recommended that the following studies be made and the following actions be taken, under the guidance of an engineer experienced in the design and construction of dams:

1. Make an additional hydraulic/hydrologic study to determine the dam crest and spillway requirements to enable it to pass the design flood. This study should consider the effects of all three Something Green Dams (two existing, one in

construction) in order to design and construct adequate spillways for all three structures to prevent overtopping. With the information available from our limited Phase I study, it is recommended that a spillway design flood of 100 percent of the PMF be used.

2. Design and install erosion protection for the spillway area and the downstream channel.

3. Implement a maintenance program for the dam and appurtenant structures as needed and undertake a program of periodic inspections to detect increases in seepage rate, turbidity of seepage water, and spillway and discharge channel erosion. Records of inspections and maintenance should be kept.

4. Evaluate the feasibility of implementing a practical and effective warning system to alert downstream residents, should potentially hazardous conditions develop. There appears to be a good opportunity for such a system for the three Something Green Dams.

5. Make seepage and stability analyses of the dam and spillway, comparable to those required in the recommended guidelines. These analyses should be made for appropriate loading conditions, including earthquake loads.

It is recommended the owner takes action on these recommendations without undue delay.

WOODWARD-CLYDE CONSULTANTS

Richard G. Berggreen
Registered Geologist

Leonard M. Krazynski, P.E.
Vice President

OVERVIEW

SOMETHING GREEN A DAM

MISSOURI INVENTORY NO. 30720

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SOMETHING GREEN A DAM - MISSOURI INVENTORY NO. 30720

TABLE OF CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SOMETHING GREEN A DAM, MISSOURI INVENTORY NO. 30720

SECTION 1
PROJECT INFORMATION

1.1 General

a. **Authority.** The National Dam Inspection Act, Public Law 92-367, provides for a national inventory and inspection of dams throughout the United States. Pursuant to the above, an inspection was conducted of Something Green A Dam, Missouri Inventory Number 30720.

b. **Purpose of inspection.** "The primary purpose of the Phase I investigation program is to identify expeditiously those dams which may pose hazards to human life or property... The Phase I investigation will develop an assessment of the general condition with respect to safety of the project based upon available data and a visual inspection, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted" (Chapter 3, "Recommended Guidelines for Safety Inspection of Dams").

c. **Evaluation criteria.** The criteria used to evaluate the dam were established in the "Recommended Guidelines for Safety Inspection of Dams", Engineering Regulation No. 1110-2-106 and Engineering Circular No. 1110-2-188, "Engineering and Design National Program for Inspection of Non-Federal Dams", prepared by the Office of Chief of Engineers, Department of the Army, and "Hydrologic/Hydraulic Standards Phase I Safety Inspection of Non-Federal Dams" prepared by the St Louis District, Corps of Engineers (SLD). These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of Project

a. **Description of dam and appurtenances.** Something Green A Dam is an earth fill dam impounding a recreational lake in north-central Washington County, Missouri (Fig. 1). The dam is approximately 750 ft in length and retains the impoundment on the northeast (Fig. 2).

The spillway is a broad trapezoidal concrete-lined weir at the dam axis and a rectangular concrete chute upstream and downstream of the weir. The trapezoidal weir has a controlling width of approximately 48 ft (Photo 1). The low point controlling outflow is at elevation 761.1 ft, about 4.3 feet below the crest of the dam. Approximately 25 ft downstream from the crest of the spillway, discharge flows are channeled into a 2 ft deep, 21 ft wide rectangular chute which extends 55 ft downstream to about a 4 ft eroded dropoff (Photo 2). There is no cutoff at the end of the chute to protect against undercutting.

The discharge channel below the lined portion of the spillway is eroded to bedrock, exposing a pinnacled dolomite surface. The discharge channel walls are residual stoney clay that appears to be moderately erodible (Photo 7).

No low level outlets were identified at this structure. No control facilities exist in the spillway for controlling flows.

b. **Location.** Something Green A Dam is located on Rouge Creek, a tributary of Mineral Fork Creek, approximately 8 mi north of the town of Potosi in Washington County, Missouri, Section 6, T38N, R2E; (figure 1). The dam location is on the USGS 7.5 minute Richwoods SE, quadrangle sheet.

c. **Size classification.** The dam is classified small due to its 27 ft height, and storage volume of 228 ac-ft. The classification for small size dam is based on a height comprised between 25 and 40 ft or a storage capacity comprised between 50 and 1000 ac-ft.

d. **Hazard classification.** The St Louis District, Corps of Engineers, has classified this dam as high hazard; we concur with this classification. The estimated damage zone extends approximately four mi downstream of the dam. Located within this zone are more than 5 occupied structures (Photos 3 and 4) and

Missouri Highway F. The majority of these homes are within 1 mi from the dam. Loss of life and property could be high in the event of overtopping and failure of this dam.

e. **Ownership.** We understand the dam is owned by Oak Land Developments, Inc, Route 1, Potosi, Missouri, 63664. Correspondence should be addressed to the attention of Mr William Rummel.

f. **Purpose of dam.** The dam was constructed to impound a recreational lake.

g. **Design and construction history.** Information on the design and construction history of the dam was obtained from Mr William Rummel, the owner of the dam.

The dam was built by Mr Rummel in the summer of 1974, using two D-8 bulldozers and a small International scraper. A 30 ft wide key was excavated to bedrock. The cutoff trench was inspected by Mr Lutzen of the Missouri Geological Survey. A copy of reports from Mr Lutzen on the geology at the dam site is included in Appendix C. Fill for the dam consists of clay and stoney clay taken from the valley slopes. Both upstream and downstream slopes were constructed at 3(H) to 1(V). Compaction was by trackwalking with the bulldozers. No record of compaction tests was found. Mr Rummel indicated the construction was inspected periodically by personnel from the Missouri Geological Survey, but no records of site visits during construction were located.

Following completion of the dam, the reservoir filled following the first heavy rain storm.

h. **Normal operating procedures.** There are no mechanical facilities at this dam requiring operation. The lake level is allowed to rise and fall according to its drainage area runoff and the runoff and discharges from Something Green B Dam located upstream. Reservoir level is controlled by the crest elevation of the trapezoidal spillway.

1.3 Pertinent Data

a. **Drainage area.** approximately 0.46 mi^2 (measured below Something Green B Dam). Approximately 1.46 mi^2 total.

b. **Discharge of damsite.**

Maximum known flood at damsite	Unknown
Warm water outlet at pool elevation	N/A
Diversion tunnel low pool outlet at pool elevation	N/A
Diversion tunnel at pool elevation	N/A
Gated spillway capacity at pool elevation	N/A
Gated spillway capacity at maximum pool elevation	N/A
Ungated spillway capacity at maximum pool elevation	1241 ft^3/sec
Total spillway capacity of maximum pool elevation	1241 ft^3sec

c. **Elevations. (ft above MSL)**

Top of Dam	765.4 to 766.0
Maximum pool - design surcharge	N/A
Full flood control pool	N/A
Recreation pool	761.1
Spillway crest (gated)	N/A
Upstream portal invert diversion tunnel	N/A
Downstream portal invert diversion tunnel	N/A
Streambed at centerline of dam	Unknown
Maximum tailwater	N/A
Toe of dam at maximum section	738.4

d. **Reservoir.**

Length of maximum pool	Approximately 2050 ft
Length of recreation pool	Approximately 2000 ft
Length of flood control pool	N/A

e. **Storage (acre-feet).**

Recreation pool	125
Flood control pool	N/A
Design surcharge	N/A
Top of dam	228

f. **Reservoir surface (acres).**

Top of dam	28
Maximum pool	28
Flood control pool	N/A
Recreation pool	21
Spillway crest	21

g. **Dam.**

Type	Compacted earth fill
Length	Approximately 750 ft
Height	27 ft
Top width	Approximately 40 ft at maximum section
Side slopes	Upstream 3(H) to 1(V) (according to William Rummel, owner and builder) Downstream 3.5(H) to 1(V) (measured)
Zoning	None
Impervious core	None
Cutoff	30 ft wide trench to bedrock (reported)
Grout curtain	None

h. **Diversion and regulating tunnel.**

Type	None
Length	N/A

Closure	N/A
Access	N/A
Regulating facilities	N/A

i. **Spillway.**

Type	Broad-crested trapezoidal concrete weir
Length of weir (effective section flowing full)	48.1 ft
Crest elevation	761.1 ft
Gates	None
Downstream channel	Bedrock floored; approximately vertical soil walls up to 6 ft high

j. **Regulating outlets.** A draw-down riser pipe was described by the owner approximately 4 to 5 ft below the spillway elevation in the lake. This riser is connected to an 8 in. pipe which exits the toe of the dam. Outflow is controlled by a chain operated cap at the top of the riser. This control was not operated during the visual inspection.

SECTION 2
ENGINEERING DATA

2.1 Design

No design drawings or records were found for this dam. Dam location was selected with the aid of Mr Edwin Lutzen of the Missouri Geological Survey; see the attached reports by Mr Lutzen in Appendix C.

2.2 Construction

Information on the construction of Something Green A Dam was obtained through interviews with Mr William Rummel, the dam owner and builder.

The dam was constructed in 1974. A 30 ft wide (2 dozer blades) keyway/cutoff trench was excavated to bedrock. The trench was inspected by personnel of the Missouri Geological Survey, according to Mr Rummel, but no record was obtained of this visit. The fill used in the dam was the stoney residual clay stripped from the valley slopes. The fill was compacted by trackwalking with bulldozers. Both the upstream and downstream faces were placed at slopes of approximately 3(H) to 1(V). A concrete apron was built 100 ft long through and beyond the spillway. A 2 to 3 ft deep discharge channel was cut beyond the downstream end of the apron, and has been subsequently eroded an additional 2 to 4 ft to bedrock.

2.3 Operation

No operating records were available for this dam. Mr Rummel indicated the seepage that was noted on the face of the dam became obvious approximately 2 to 3 years after the dam was constructed.

2.4 Evaluation

a. **Availability.** The available engineering data is limited to the recollections of the builder and owner of the dam, Mr William Rummel. No other records of engineering or construction data were available.

b. **Adequacy.** The available information is insufficient to evaluate the design of Something Green A Dam.

Seepage and stability analyses comparable to the requirements of the guidelines are not on record. This is a deficiency which should be rectified. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record. These analyses should be performed by an engineer experienced in the design and construction of dams.

c. **Validity.** There is no reason to question the validity of the information from Mr Rummel. The information obtained appeared reasonable for the conditions observed during our inspection.

2.5 Project Geology

The dam is located on the northern flank of the Ozark structural dome. The regional dip of the bedrock is to the north. The bedrock in the vicinity of the dam is mapped on the Geologic Map of Missouri (1979) as Cambrian age Potosi and Eminence Formation (Fig. 4). Mr Edwin Lutzen of the Missouri Geological Survey describes the bedrock as Eminence Formation (Appendix C).

The Eminence Formation is principally medium to massively bedded, medium to coarse-grained light gray dolomite. The formation also contains small amounts of quartz druse and chert. Numerous large springs and some major caves have developed in the Eminence Formation. The pinnacled bedrock surface exposed in the drainage channel above and below this lake showed some evidence of small scale near-surface solutioning. The report by the Missouri Geological Survey also referred to potential solutioning in the near-surface bedrock. However, no evidence of sinkholes or karst topography was noted at the dam site during our visual inspection.

The soil at the dam site consists of a red-brown gravelly plastic residual clay, (CL-CH). This soil apparently developed as a residual soil of insoluble residue on the weathered carbonate bedrock in the area. The soil in mapped on the Missouri General Soils Map as Union-Goss-Gasconade-Peridge Association, which is described as deep to shallow, loamy and clayey upland soils with moderate to slow permeability.

The Aptus Fault Zone is mapped approximately 1 mi southwest of the dam site. The fault is approximately 15 mi long and trends in a northwest-southeast direction. This fault, like others in the Ozark area, appears confined to the Paleozoic bedrock and is likely Paleozoic in age. The area is not considered to be seismically active.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. **General.** Something Green A Dam was inspected 17 July 1980, with the owner present during the inspection. The inspection indicated the dam embankment is in generally good condition.

b. **Dam.** The dam is constructed of gravelly clay (CL-CH) excavated from the valley slopes. The downstream face slopes at approximately 3.5(H) to 1(V).

No protection against wave erosion other than a vegetation cover is provided on the upstream face of the dam.

No evidence of disruption or deformation of the horizonal or vertical alignment of the dam crest was noted in the field inspection. No excessive settlement, cracking, animal burrows or sinkhole development was noted.

A small erosion gully, approximately 2 ft deep and 4 ft wide is located at the toe of the embankment (Fig. A-1, Appendix A), running from the spillway wall (on the right abutment) to the toe of the maximum section. According to Mr Rummel, this was caused by water which overflowed the side of the spillway discharge channel during heavy flooding and ran along the toe of the dam.

A fairly broad area of seepage was noted on the face and along the toe of the dam (Fig. A-1, Appendix A). This seepage begins about 15 ft below the dam crest. At the time of inspection, seepage was minor, approximately 0.5 gal/min. Cattails and willow trees are growing in this area. Mr Rummel indicated he plans to chemically treat the area to kill the willows to prevent their growing to substantial size. The seepage reportedly began approximately 2 to 3 years after the dam was constructed. No soil particles were noted in the seepage water and the volume did not appear sufficient to threaten erosion of the dam face.

c. **Appurtenant structures.**

1. Spillway. The spillway consists of a concrete-lined trapezoidal weir and chute constructed on the right abutment. The weir section is approximately 91 ft wide at the top and 22 ft at the base. Upstream and downstream, however, is a concrete lined chute 21 ft wide, with 2 ft high vertical walls (Photo 1). It is these walls which were overtopped to produce the erosion at the toe of the dam. At the downstream end of the concrete chute, there is a vertical drop of 4.2 ft where the spillway discharge has eroded the soil to bedrock. The owner indicated he plans to increase both the height of the side walls and the downstream length of the concrete lining. The dimensions for these modifications were not given.

2. Outlet structures. The only outlet structure at this dam other than the spillway, is a vertical draw-down riser pipe in the lake, connected to horizontal pipe at the base of the dam. The vertical pipe is controlled by a chain-operated cap at the upstream end, about 4 to 5 ft below spillway elevation. There was no flow from the draw-down pipe at the time of our visual inspection.

d. **Reservoir area.** The area surrounding the reservoir is a vacation/residential development. The slopes surrounding the reservoir are typically gentle with inclinations of approximately 1(V) to 5(H) or less. No evidence of slope instability was noted during the field inspection. No significant sedimentation was noted in the tributaries entering the reservoir.

e. **Downstream channel.** The downstream channel below the spillway apron consists of a bedrock-floored, soil-walled eroded gully, approximately 6 ft deep and 8 to 10 ft wide. The exposed bedrock consists of pinnacled dolomite, Eminence Formation. The walls of the channel consist of stoney residual clay soil, which is typically moderately erodible. Substantial flows through this channel can be anticipated to cause lateral erosion of the banks of the channel. The owner plans on lining the channel for some additional downstream distance to mitigate erosion and channel migration toward the toe of the dam. Other than the pinnacled bedrock, there were no obstructions noted in the downstream channel that could result in reduced flow during flood events.

3.2 Evaluation

The earth dam embankment appears to be in generally good condition; however, there are certain features, such as discharge channel erosion, that need attention.

Remedial measures should be taken to repair the eroded gully at the toe of the right half of the dam. Efforts should be directed at preventing overtopping of the spillway wall, such as has occurred in the past at this location.

Erosion protection should also be considered for the downstream discharge channel side-walls to prevent lateral erosion toward the embankment.

Seepage at the toe and on the downstream slope of the dam should be monitored to discern any changes in rate of flow or turbidity of the water. At present, the seepage does not appear to constitute a hazard to the dam.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

There are no operational procedures for this dam. The water level is controlled by the crest of the ungated spillway.

4.2 Maintenance of Dam

No records of maintenance on this facility were available.

4.3 Maintenance of Operating Facilities

There are no facilities requiring operation at this dam.

4.4 Descriptions of Any Warning System in Effect

The inspection did not identify any warning system in effect at this facility.

4.5 Evaluation

There are apparently no formal maintenance program or operational procedures in effect. The lack of regular maintenance and periodic inspection is considered a deficiency.

The feasibility of a practical warning system should be evaluated to provide early warning to downstream residents should potentially hazardous conditions develop during periods of heavy precipitation.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features

a. **Design data.** No hydrologic or hydraulic information was available for evaluation of the dam. Pertinent dimensions of the dam and reservoir were surveyed on July 21, 1980, measured during the field inspection or estimated from the topographic maps. The topographic maps used in the analysis were the advance prints of the USGS Richwoods SW and Richwoods SE 7.5 minute quadrangle maps.

b. **Experience data.** No recorded history of rainfall, runoff, discharge or pool stage data were available for this reservoir or watershed.

c. **Visual observations.**

1. Watershed. The watershed is natural woods, heavily forested with mixed hardwoods and softwoods. The trees around the lake perimeter have been removed.

2. Reservoir. The area of the reservoir is approximately 7 percent of the approximately 0.46 square miles of watershed that drains directly into the reservoir. This does not include the additional watershed that is drained into Something Green B Lake, upstream. Total upstream watershed is approximately 1.46 mi^2. The primary use of this impoundment is for recreation.

3. Spillway. The spillway is located at the southwest end of the dam abutting the hillside (right abutment). The portion of the dam that slopes down to the spillway effectively becomes part of the spillway during high outflow. The spillway area is constrained by a rectangular, concrete-lined chute as shown in Photo 1. This chute is approximately 21 ft wide, 55 ft long,

and ends in a sharp dropoff created by erosion from spillway discharge. The steepness and geometry of the concrete channel indicate that the critical flow will occur at the spillway crest along the dam axis.

The constrained spillway does not adequately carry high outflows. This is indicated by the erosion of the discharge channel and the creation of an overflow gully on the embankment side of the concrete chute wall. The gully follows the contact between the hillside and the toe of the dam. If reservoir outflow is not confined in the spillway chute, this gully will continue to enlarge and may potentially erode the toe of the dam to a hazardous condition.

4. Seepage. The magnitude of seepage through this dam is small and not hydrologically significant to the overtopping potential.

d. **Overtopping potential.** One of the primary considerations in the evaluation of Something Green A Dam is the assessment of the potential for overtopping and consequent failure by erosion of the embankment. Since the spillway of this dam is concrete, erosion of the concreted spillway due to high-velocity discharge is not expected. The earthen portion of the facility, however, is subject to erosion at velocities exceeding approximately 5 ft/sec, as are the unlined discharge channel walls above the rock.

Also, it should be expected that prolonged heavy discharges from the spillway chute could cause further headward erosion under the spillway concrete lining with consequent loss of support.

To analyze Something Green A Dam, a more complicated approach was necessary due to the proximity of an upstream dam. Something Green B Dam (MO 30719) is approximately 3/4 mi upstream and has a drainage basin area of approximately 1.0 mi^2. To adequately account for all the area drained into Something Green B Dam, the dam was hypothetically breached for events greater than or equal to 50% of the PMF. The breach outflow and spillway outflow became direct inflow into Something Green A Dam.

The results of the hydrologic analysis indicate that a flood of greater than 25 percent of the Probable Maximum Flood (PMF) will effectively overtop the

dam. The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. A flood with 1 percent probability of occurrence (100-year flood) will be passed by the spillway without overtopping the dam.

Erosion of the dam crest is likely to occur for precipitation events greater than 50 percent of the PMF based on velocity calculations. Significant erosion of the dam crest is possible due to the length of time of overtopping and outflow.

Likewise, because of the spillway configuration its downstream concrete lined chute will not be able to confine 25 percent of the PMF. Preliminary studies indicate the discharge capacity of the concrete lined chute is approximately 340 ft^3/sec which is less than the flows expected under the 10 percent probability-of-occurrence event. Hence, it may be expected that without corrective measures there will be erosion adjacent to the spillway chute for flows in excess of 340 ft^3/sec.

A third dam and reservoir is presently under construction upstream of Something Green A and B Dams. There are no design studies or plans available to provide a basis of predicting the effects of that impoundment on Something Green A and B Dams. Additional hydrologic study should be conducted to evaluate the combined effects of all three dams and to design and construct adequate spillways for these structures.

The following data were computed for various flood events:

Precipitation Event	Max. Reservoir W.S. Elev.	Max. Depth over Dam, ft	Max. Outflow, cfs	Duration of Overtopping, hrs
25% PMF	765.4	0	1240	0
*50% PMF	766.7	1.3	3140	4.3
*100% PMF	767.5	2.1	5510	7.0

*Includes the effect of the breaching of Something Green "B" Dam upstream.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. **Visual inspection.** The visual inspection of Something Green A Dam revealed no evidence of horizontal or vertical displacement of the dam crest alignment. No cracking, excessive settlement, slides, sinkholes or other signs of slope instability were observed.

Separation and minor cracking of the concrete spillway floor was noted and is shown in Photo 5. This is a deficiency that should be corrected to prevent entry of water under the slab during heavy flows. The creation of hydrostatic pressures under the spillway lining could result in failure of the lining and subsequent erosion of the spillway.

The erosion noted at the toe of the right half of the dam, if allowed to continue, could oversteepen this part of the embankment, possibly resulting in slope failure. At present, however, this erosion does not appear to affect the structural stability of the embankment.

b. **Design and construction data.** No design or construction data relating to the structural stability of the dam were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. This is a deficiency which should be corrected to meet the recommended guidelines.

c. **Operating records.** No operating records or water levels records were available for this dam.

d. **Post-construction changes.** The lack of drawings and construction reports precludes identification of post construction changes. However, Mr Rummel did not disclose any post-construction changes during our visual inspection visit.

e. **Seismic stability.** The dam is located in Seismic Zone 2, to which the guidelines assign a moderate damage potential. Since no static stability analysis is available for review, the seismic stability cannot be evaluated. The gravelly clay character of the embankment indicates the dam should not be subject to liquefaction during a seismic event.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. **Safety.** Based on the visual inspection, Something Green A Dam is judged to be in generally good condition with the exception of some erosion problems which can be corrected. However, the hydrologic analyses indicate the spillway will not pass floods larger than 25 percent PMF without overtopping. The spillway discharge capacity is calculated at 1241 ft^3/sec.

The owner's residence and the real estate sales office are located in close proximity downstream of Something Green A Dam (see Overview photograph and also Photos 3 and 4) and would be severely inundated in the event of a potential failure of this dam. Also, the influence of a third dam upstream (currently in construction cannot be assessed at this time. Consequently, it is recommended that the spillway of Something Green A Dam be designed to pass 100 percent of the PMF, unless additional studies discussed in Section 7.2b.1 indicate that a smaller spillway design flood can be justified.

The erosion at the toe of the slope should not be allowed to progress to where it could cause damage to the embankment.

The seepage at the toe and on the face of the dam should be monitored to identify any changes in the amount of flow or turbidity of the water. At present, the seepage does not appear to constitute a hazard to the embankment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

b. **Adequacy of information.** The lack of stability and seepage analyses for this dam, as recommended in the guidelines, preclude an evaluation of the structural and seismic stability of this dam. This is a deficiency which should be rectified. These analyses should be conducted by an engineer experienced in the design and construction of earth dams.

c. **Urgency.** The deficiencies described in this report could affect the long term stability of this dam. Corrective actions should be initiated as soon as practical.

d. **Necessity for Phase II.** In accordance with the "Recommended Guidelines for Safety Inspections of Dams", the subject investigation was a minimum study. This study revealed that additional in-depth investigations are needed to complete the assessment of the safety of the dam. Those investigations which should be performed without undue delay are described in Section 7.2.b. It is our understanding from discussions with the St Louis District that any additional investigations are the responsibility of the owner.

7.2 Remedial Measures

a. **Alternatives.** There are several general options which may be selected to reduce the consequences of possible dam failure. Some of these options are:

1. Remove the dam, or breach it to prevent storage of water.

2. Increase the height of the dam and/or spillway size to pass the PMF without overtopping the dam.

3. Purchase downstream land that would be adversely impacted by dam failure and restrict human occupancy.

4. Enhance the stability of the dam to permit overtopping by the PMF without failure.

5. Provide a highly reliable flood warning system (this generally does not prevent damage but decreases chances of loss of life).

b. **Recommendations.** Based on our inspection and our preliminary hydrology study of Something Green A Dam, it is recommended that further study be conducted without undue delay under the guidance of an engineer experienced in design and construction of dams to evaluate, as a minimum, the following topics:

1. Dam crest and spillway requirements to pass 100 percent of the PMF without overtopping the embankment, unless it can be demonstrated by additional hydrologic studies, that a smaller spillway design flood can be justified. Such a study should evaluate the combined effects of all three dams in this drainage area (i.e. Something Green A, Something Green B upstream and another dam further upstream, which is currently in construction). Also, the study should evaluate the ability of the existing downstream discharge channel to carry the indicated PMF flow (i.e. approximately 5500 ft^3/sec) without inundating the downstream residences. Finally, a judgment can be made concerning a small depth of overtopping for a short period fo time, which may be deemed to not be hazardous to the stability and safety of Something Green A Dam. The results would indicate an appropriate design flood that can be justified for the spillway and discharge channel.

2. Design and installation of erosion protection for the spillway area and the downstream channel.

3. The feasibility of implementing a practical and effective warning system to alert downstream residents, should potentially hazardous conditions develop. There appears to be a good opportunity for such a system for the three Something Green Dams.

c. **Operation and maintenance procedures.** A program of periodic inspections should be implemented for the dam and appurtenant structures. This program should include inspection of the embankment for evidence of slumping or instability, and monitoring of seepage for detection of changes in the volume of flow or turbidity (soil) in this seepage water. These inspections should document any needed maintenance. Records should be kept of the inspections and necessary maintenance.

All remedial measures should be performed under the guidance of an engineer experienced in the design and construction of dams.

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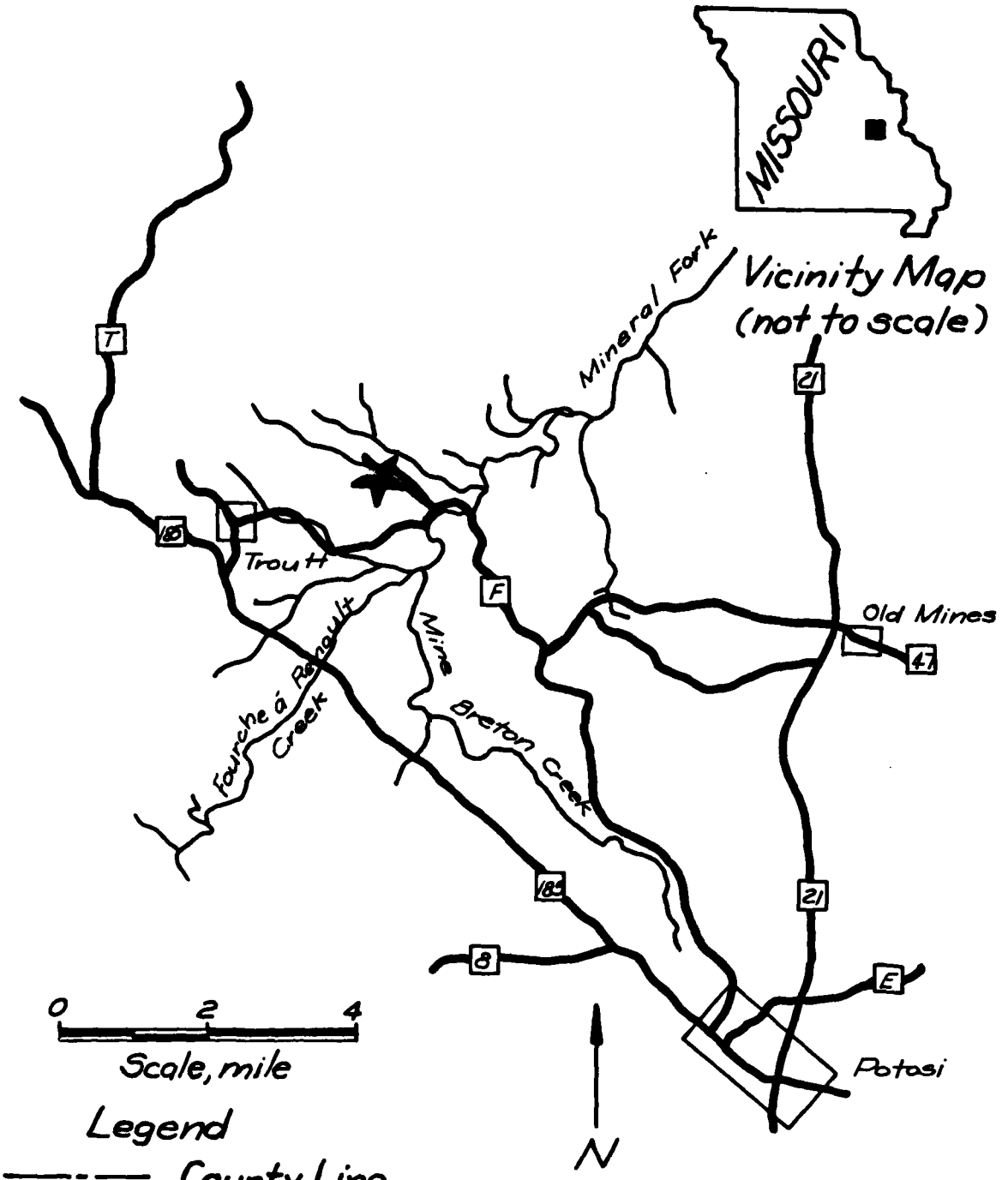
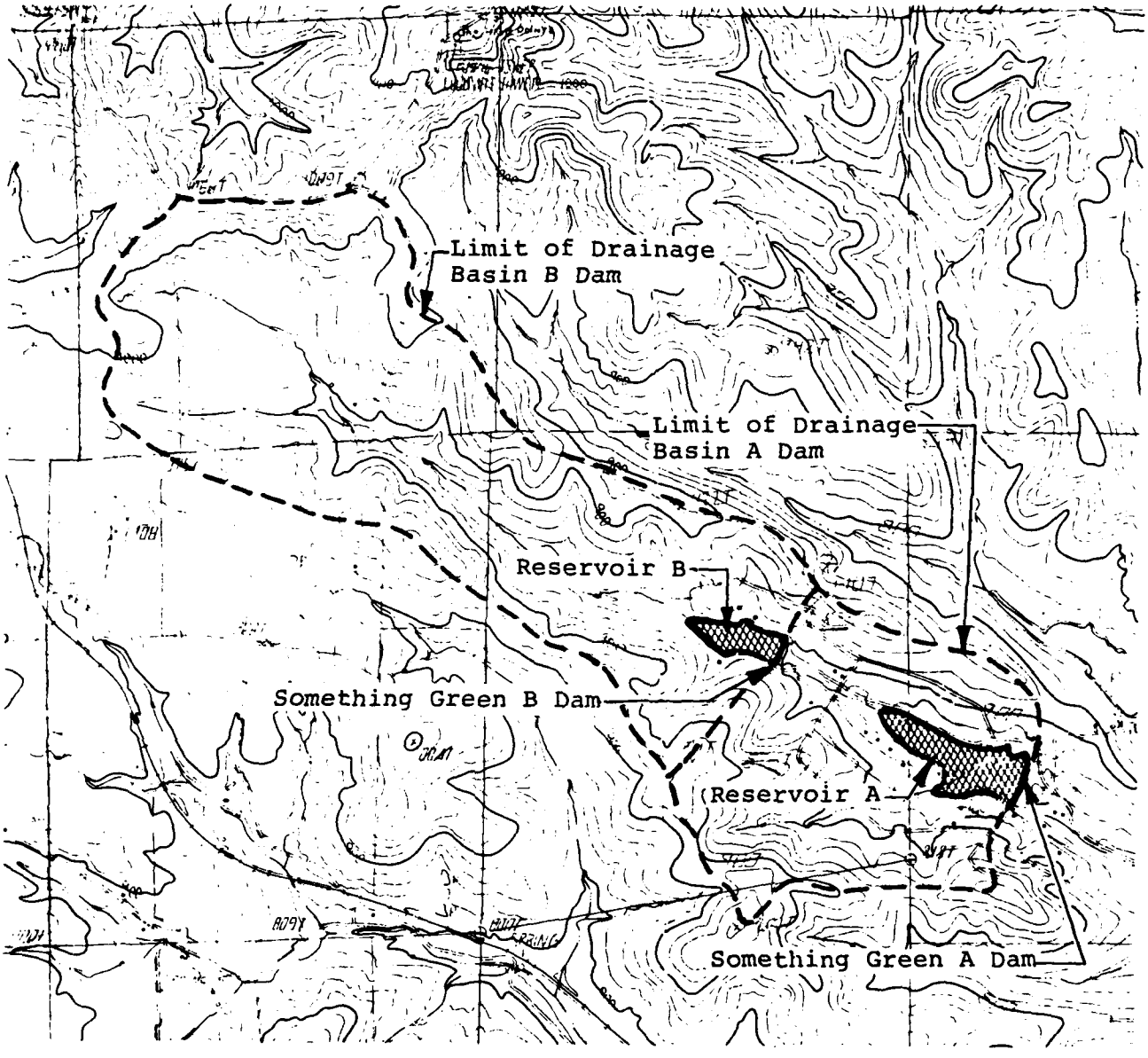


SITE LOCATION MAP	
SOMETHING GREEN A DAM	
MO 30720	Fig. 1



N

0 2000 4000

Scale, ft

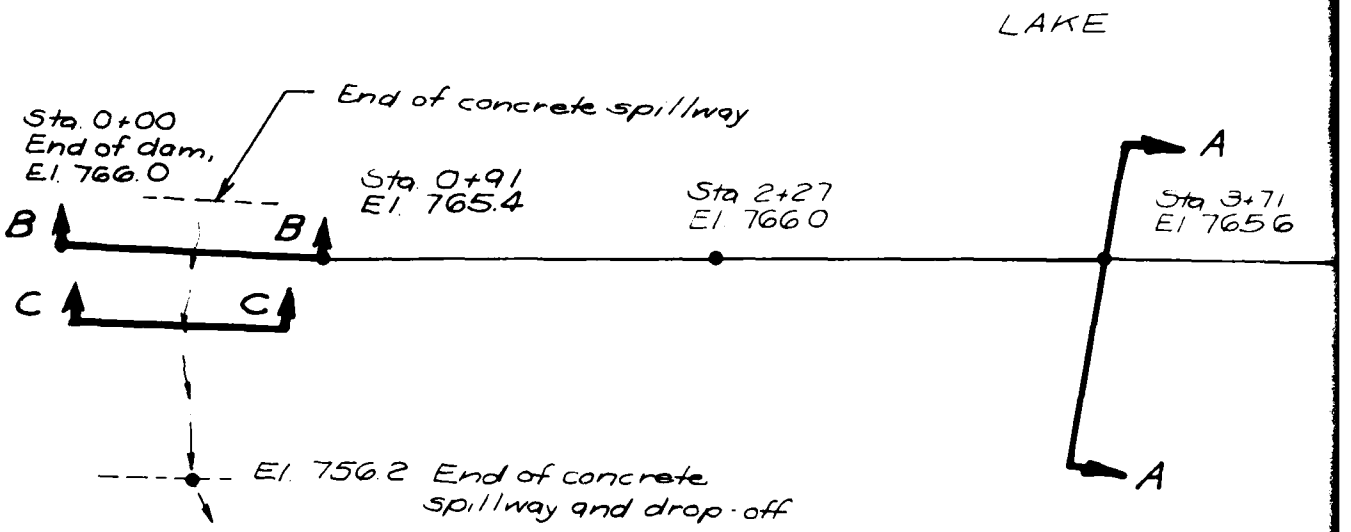
DRAINAGE BASIN AND SITE TOPOGRAPHY

SOMETHING GREEN A DAM

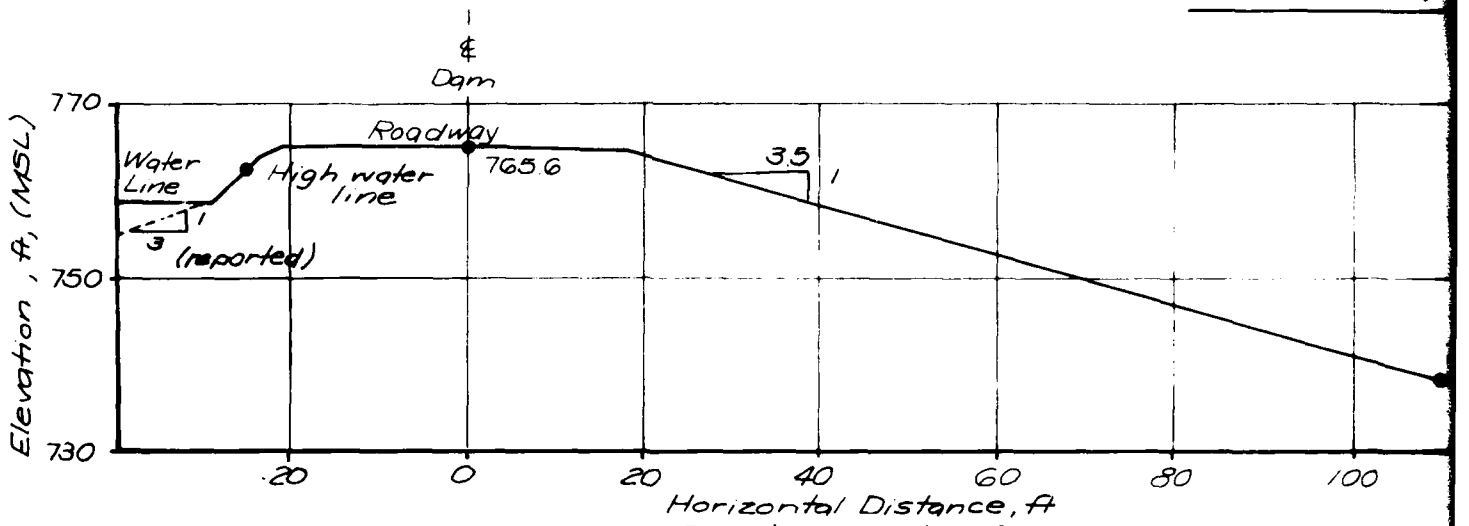
MO 30720 | Fig. 2

NOTE:

1. Topography from U.S.G.S. Richwoods SE and Richwoods SW 71/2 minute quadrangle maps.

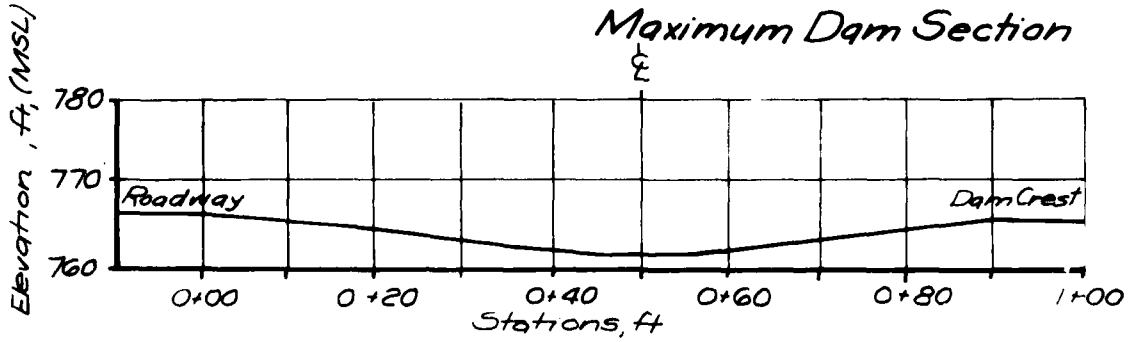


Plan of Dam



Section A-A

Maximum Dam Section



Section B-B

Concrete Spillway

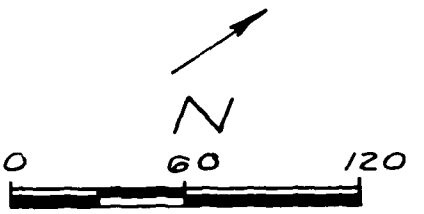
A

Sta 3+71
El 765.6

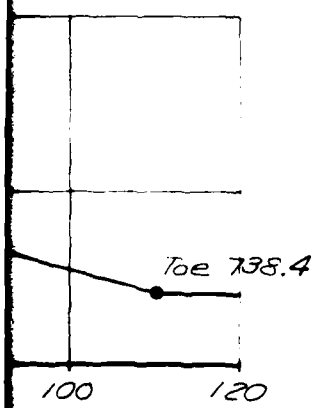
Sta 5+09
El 765.7

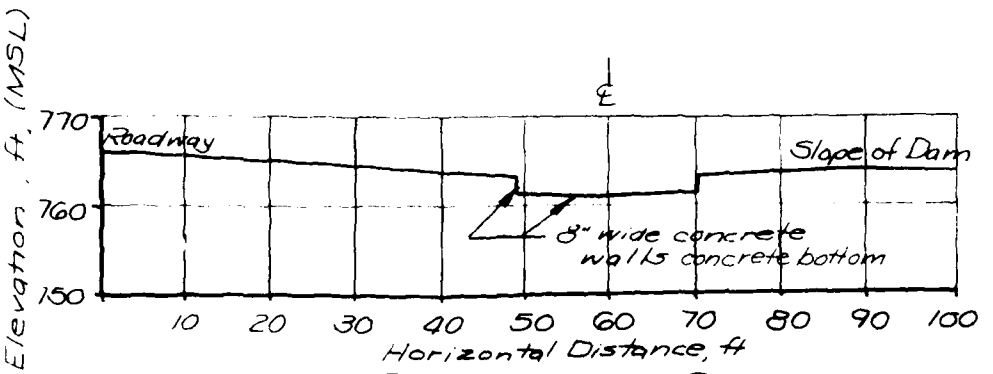
Sta. 7+77
El. 776.0

Sta. 7+50
End of dam,
El. 766.0



of Dam





Section C-C
Concrete Spillway

Legend

Discharge channel

NOTE
4.2 ft Drop at edge of spillway

PLAN AND SECTIONS OF DAM AND SPILLWAY	
SOMETHING GREEN A DAM	
MO 30720	Fig. 3

1 12.

N

0 10 20

Scale, mile

Legend

- Or — Roubidoux Formation
- Gasconade Dolomite
  - Gunter Sandstone Member
- Cep — Eminence Dolomite
- Potosi Dolomite
- Ceb — Derby-Doerun Dolomite
- Davis Formation
- Bonneterre Formation
  - Whetstone Creek Member
  - Sullivan Siltstone Member
- Reagan Sandstone
  - (subsurface, western Missouri)
- Lamotte Sandstone
- Diabase (dikes and sills)
- i — St. Francois Mountains Intrusive Suite
- St. Francois Mountains Volcanic Supergroup

REGIONAL GEOLOGIC MAP

SOMETHING GREEN A DAM

MO 30720 | Fig. 4

APPENDIX A

Photographs

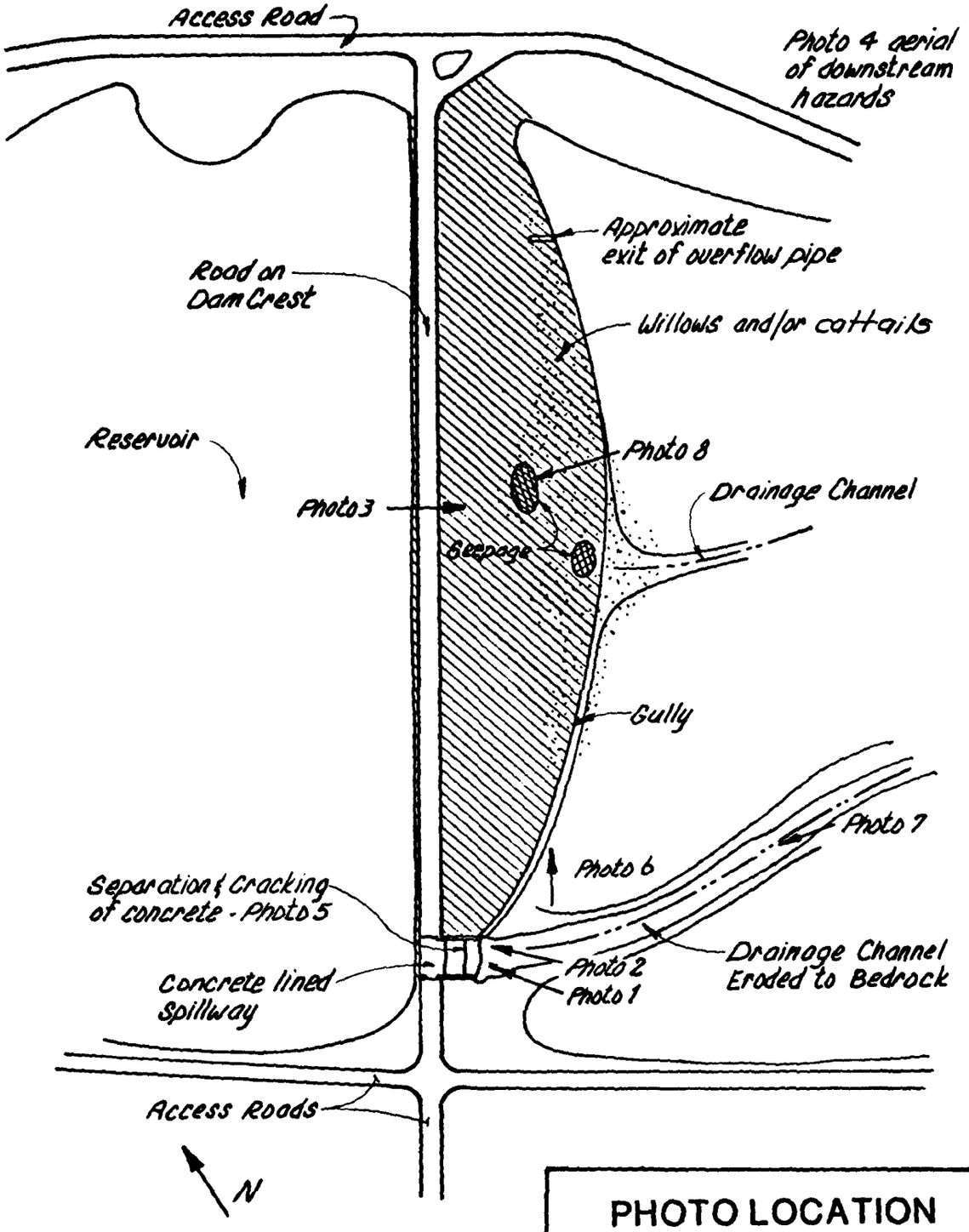


PHOTO LOCATION SKETCH

SOMETHING GREEN A DAM

MO 30720 | Fig A1

1. Trapezoidal spillway with 2 foot deep concrete lining (Note erosion at lower right); looking west-northwest.

2. Dropoff at end of concrete lining of spillway channel; looking west.

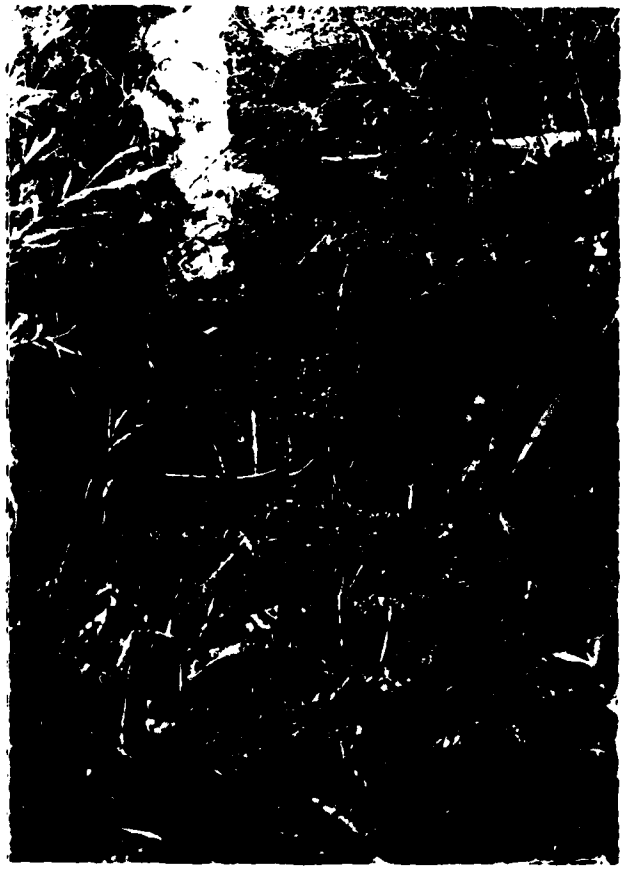
3. Downstream hazards; looking east-southeast from the crest of the dam.

4. Downstream hazards; looking west.

5. Separation of concrete construction joint and cracking of concrete in spillway lining.

6. Gully erosion along toe of south half of dam, cattail and willow vegetation indicate seepage areas; looking north-northeast.

7. Lateral erosion of downstream channel at toe of dam, note bedrock floor; looking west-southwest.



8. Seepage exiting dam face approximately at mid-height at maximum dam section. Red coloring is from algae growth.

APPENDIX B

Hydraulic/Hydrologic Data and Analyses

APPENDIX B
Hydraulic/Hydrologic Data and Analyses

B.1 Procedures

a. General. The hydraulic/hydrologic analyses were performed using the "HEC-1, Dam Safety Version (1 Apr 80)" computer program. The inflow hydrographs were developed for various precipitation events by applying them to a synthetic unit hydrograph. The inflow hydrographs were subsequently routed through the reservoir and appurtenant structures by the modified Puls reservoir routing option.

b. Precipitation events. The Probable Maximum Precipitation (PMP) and the 1 and 10 percent probability-of-occurrence events were used in the analyses. The total rainfall and corresponding distributions for the 1 and 10 percent probability events were provided by the St. Louis District, Corps of Engineers. The Probable Maximum Precipitation was determined from regional curves prepared by the US Weather Bureau (Hydrometeorological Report Number 33, 1956).

c. Unit hydrograph. The Soil Conservation Services (SCS) Dimensionless Unit Hydrograph method (National Engineering Handbook, Section 4, Hydrology, 1971) was used in the analysis. This method was selected because of its simplicity, applicability to drainage areas less than 10 mi^2, and its easy availability within the HEC-1 computer program.

The watershed lag time was computed using the SCS "curve number method" by an empirical relationship as follows:

$$L = \frac{l^{0.8}\,(s+\ell)^{0.7}}{1900\,Y^{0.5}} \quad \text{(Equation 15-4)}$$

where: L = lag in hours
ℓ = hydraulic length of the watershed in feet
$s = \frac{1000}{CN} - 10$ where CN = hydrologic soil curve number
Y = average watershed land slope in percent

This empirical relationship accounts for the soil cover, average watershed slope and hydraulic length.

With the lag time thus computed, another empirical relationship is used to compute the time of concentration as follows:

$$T_c = \frac{L}{0.6} \quad \text{(Equation 15-3)}$$

where: T_c = time of concentration in hours

L = lag in hours.

Subsequent to the computation of the time of concentration, the unit hydrograph duration was estimated utilizing the following relationship:

$$\Delta D = 0.133 T_c \qquad \text{(Equation 16-12)}$$

where: ΔD = duration of unit excess rainfall
T_c = time of concentration in hours.

The final interval was selected to provide at least three discharge ordinates prior to the peak discharge ordinate of the unit hydrograph. For this dam, a time interval of 15 minutes was used.

d. Infiltration losses. The infiltration losses were computed by the HEC-1 computer program internally using the SCS curve number method. The curve numbers were established taking into consideration the variables of: (a) antecedent moisture condition, (b) hydrologic soil group classification, (c) degree of development, (d) vegetative cover and (e) present land usage in the watershed.

Antecedent moisture condition III (AMC III) was used for the PMF estimates and AMC II was used for the 1 and 10 percent probability events, in accordance with the guidelines. The remaining variables are defined in the SCS procedure and judgements in their selection were made on the basis of visual field inspection.

e. Starting elevations. Reservoir starting water surface elevations for this dam were set as follows:

(1) 1 and 10 percent probability events - spillway crest elevation

(2) Probable Maximum Storm - spillway crest elevation

Because the low level outlet pipe is of small diameter, it was assumed it was either blocked or inoperable and did not pass any amount of the flood.

f. Spillway Rating Curve. The basic weir equation was utilized to compute the spillway rating curve. The weir equation is as follows:

$$Q = CLH^{3/2}$$

where Q = discharge in cubic feet per second
L = effective length of spillway in feet
C = coefficient of discharge (2.5 to 3.1)
H = total head over spillway in feet

B.2 Pertinent Data

a. Drainage area. 0.46 mi^2 (measured below Something Green B Dam), 1.46 mi^2 total.

b. Storm duration. A unit hydrograph was developed by the SCS method option of HEC-1 program. The design storm of 48 hours duration was divided into 15 minute intervals in order to develop the inflow hydrograph.

c. Lag time. 0.79 hrs

d. Hydrologic soil group. C

e. SCS curve numbers.

1. For PMF- AMC III - Curve Number 86
2. For 1 and 10 percent probability-of-occurrence events AMC II - Curve Number 72

f. Storage. Elevation-area data were developed by planimetering areas at various elevation contours on the USGS Richwoods SE and SW 7.5 minute quadrangle map. The data were entered on the $A and $E cards so that the HEC-1 program could compute storage volumes.

g. Outflow over dam crest. As the profile of the dam crest is irregular, flow over the crest was computed according to the "Flow Over Non-Level Dam Crest" supplement to the HEC-1 User's Manual. The crest length-elevation data and hydraulic constants were entered on the $D, $L, and $V cards.

h. Outflow capacity. The spillway elevation-discharge relationship was developed internally by the HEC-I program from the data entered on the $$ card. The final outflow relationship was computed by the HEC-1 by combining the rating curves of the spillway and the overflow over the dam crest.

i. Reservoir elevations. For the 50 and 100 percent of the PMF events, the starting reservoir elevation was 761.1 ft, the spillway crest elevation. For the 1 and 10 percent probability-of-occurrence events, the starting reservoir elevation was 761.1 ft, the spillway crest elevation.

B.3 Results

The results of the analyses as well as the input values to the HEC-1 program follow in this Appendix. Only the results summaries are included, not the intermediate output. Complete copies of the HEC-1 output are available in the project files.

```
**********  ********************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION   01 APR 80
**********************************
    1                AI      DAM NO. 30719 - SOMETHING GREEN LAKE(UPPER), WASHINGTON COUNTY, MISSOURI
    2                A2      HOWARD-CLYDE CONSULTANTS, HOUSTON JOB 790009.
    3                A3      PROBABLE MAXIMUM FLOODS (PMF) ANALYSIS.
    4                B     192       0      19       -0       -0       -0       -0       -0       -0       -0
    5                B1      9
    6                J       1       4       1
    7                J1    .25     .50     .75    1.00
    8                K       0    0-IN1                                          3       1
    9                K1  SOMETHING GREEN LAKE (UPPER) INFLOW COMPUTATION, PMF RATIO FLOODS.
   10                M       1       2    1.00                              1.0
   11                P       0      26.     102.     120.     130.     140.
   12                T                                                      -1      -85                .05
   13                M2            1.73
   14                X      -1     -.05       9
   15                K       1    DAM1                                          3       1
   16                K1  SOMETHING GREEN LAKE (UPPER) PMF FLOOD ROUTING.
   17                V                                        1       1
   18                V1      1                                                -801.6
   19                SA      0.      2.7     5.0     10.5     15.5     28.
   20                SE    787.    803.    811.6    806.1    819.     829.
   21                SS  801.6     46.      2.9      1.5
   22                SD  806.1      2.9      1.5
   23                SB   10.0      0.5     795.     1.09    801.6    806.1
   24                K       0    0-IN2                                          1
   25                K1  SOMETHING GREEN LAKE (LOWER) INFLOW COMPUTATION, PMF RATIO FLOODS.
   26                M       1       2    0.48                              1.0                1
   27                P       0      26.     102      120      130      140
   28                T                                                      -1      -85                .10
   29                M2            0.79
   30                X      -1     -.05       9
   31                K       2    0-IN2
   32                K       1    DAM2                                          1
   33                K1  SOMETHING GREEN LAKE (LOWER) PMF FLOOD ROUTING.
   34                V                                        1       1
   35                V1      1                                                -781.1
   36                SA      0.      2.7     19.6     20.5     27.5     34.
   37                SE    745.    750.     760.    761.1    765.4    770.
   38                SS  781.1     44.      2.9      1.5
   39                SD  765.4      2.7      1.5
   40                SL      0.    420.     450.     475.
   41                SV  765.4    765.     787.     788.
   42                K      99
```

Input Data
Various PMF Events
Something Green A Dam
MO 30720
B4

*UVMO

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

SUB-AREA RUNOFF COMPUTATION

SOMETHING GREEN LAKE (LOWER) INFLOW COMPUTATION, PMF RATIO FLOODS.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
Q-IN2	0	-0	-0	-0	-0	1	-0	-0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.46	-0.	.46	1.00	-0.	-0	1	-0

PRECIP DATA

SPFE	P6S	R6	R12	R24	R48	R72	R96
0.	26.00	102.00	120.00	130.00	140.00	-0.	-0.

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
-0	-0.	-0.	1.00	-0.	-0.	1.00	-1.00	-86.00	-0.	.10

CURVE NO = -86.00 WETNESS = -1.00 EFFECT CN = 86.00

UNIT HYDROGRAPH DATA

TC= -0. LAG= .79

RECESSION DATA

STRTQ= -1.00 QRCSN= -.05 RTIOR= 5.00

UNIT HYDROGRAPH 18 END OF PERIOD ORDINATES, TC= -0. HOURS, LAG= .79 VOL= 1.00

40.	135.	229.	240.	196.	126.	79.	51.	33.	21.
13.	9.	6.	4.	2.	2.	1.	0.		

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.00	.00	.00	0.	1.02	.15	97	.04	.04	.01	6.
1.01	.30	2	.00	.00	.00	0.	1.02	.30	98	.04	.04	.01	11.
1.01	.45	3	.00	.00	.00	0.	1.02	.45	99	.04	.04	.01	16.
1.01	1.00	4	.00	.00	.00	0.	1.02	1.00	100	.04	.04	.01	20.
1.01	1.15	5	.00	.00	.00	0.	1.02	1.15	101	.04	.04	.01	32.
1.01	1.30	6	.00	.00	.00	0.	1.02	1.30	102	.04	.04	.01	37.
1.01	1.45	7	.00	.00	.00	0.	1.02	1.45	103	.04	.04	.01	39.
1.01	2.00	8	.00	.00	.00	0.	1.02	2.00	104	.04	.04	.01	41.
1.01	2.15	9	.00	.00	.00	0.	1.02	2.15	105	.04	.04	.01	42.
1.01	2.30	10	.00	.00	.00	0.	1.02	2.30	106	.04	.04	.01	43.
1.01	2.45	11	.00	.00	.00	0.	1.02	2.45	107	.04	.04	.01	44.
1.01	3.00	12	.00	.00	.00	0.	1.02	3.00	108	.04	.04	.01	44.
1.01	3.15	13	.00	.00	.00	0.	1.02	3.15	109	.04	.04	.01	44.
1.01	3.30	14	.00	.00	.00	0.	1.02	3.30	110	.04	.04	.01	45.
1.01	3.45	15	.00	.00	.00	0.	1.02	3.45	111	.04	.04	.01	45.
1.01	4.00	16	.00	.00	.00	0.	1.02	4.00	112	.04	.04	.00	45.
1.01	4.15	17	.00	.00	.00	0.	1.02	4.15	113	.04	.04	.00	45.
1.01	4.30	18	.00	.00	.00	0.	1.02	4.30	114	.04	.04	.00	45.
1.01	4.45	19	.00	.00	.00	0.	1.02	4.45	115	.04	.04	.00	45.
1.01	5.00	20	.00	.00	.00	0.	1.02	5.00	116	.04	.04	.00	46.
1.01	5.15	21	.00	.00	.00	0.	1.02	5.15	117	.04	.04	.00	46.
1.01	5.30	22	.00	.00	.00	0.	1.02	5.30	118	.04	.04	.00	46.
1.01	5.45	23	.00	.00	.00	0.	1.02	5.45	119	.04	.04	.00	46.

Input Data
Various PMF Events
Something Green A Dam
MO 30720
B5

1.01	5.15	21	.00	.00	.00	0.	1.02	5.15	117	.04	.04	.00	46.
1.01	5.30	22	.00	.00	.00	0.	1.02	5.30	118	.04	.04	.00	46.
1.01	5.45	23	.00	.00	.00	0.	1.02	5.45	119	.04	.04	.00	46.
1.01	6.00	24	.00	.00	.00	0.	1.02	6.00	120	.04	.04	.00	46.
1.01	6.15	25	.02	.00	.01	0.	1.02	6.15	121	.20	.18	.02	52.
1.01	6.30	26	.02	.00	.01	1.	1.02	6.30	122	.20	.19	.02	70.
1.01	6.45	27	.02	.00	.01	1.	1.02	6.45	123	.20	.18	.02	102.
1.01	7.00	28	.02	.00	.01	1.	1.02	7.00	124	.20	.19	.01	136.
1.01	7.15	29	.02	.00	.01	1.	1.02	7.15	125	.20	.19	.01	164.
1.01	7.30	30	.02	.00	.01	2.	1.02	7.30	126	.20	.19	.01	187.
1.01	7.45	31	.02	.00	.01	2.	1.02	7.45	127	.20	.18	.01	196.
1.01	8.00	32	.02	.00	.01	2.	1.02	8.00	128	.20	.19	.01	202.
1.01	8.15	33	.02	.00	.01	2.	1.02	8.15	129	.20	.18	.01	207.
1.01	8.30	34	.02	.00	.01	2.	1.02	8.30	130	.20	.19	.01	211.
1.01	8.45	35	.02	.00	.01	2.	1.02	8.45	131	.20	.19	.01	214.
1.01	9.00	36	.02	.00	.01	2.	1.02	9.00	132	.20	.19	.01	216.
1.01	9.15	37	.02	.00	.01	2.	1.02	9.15	133	.20	.19	.01	218.
1.01	9.30	38	.02	.00	.01	2.	1.02	9.30	134	.20	.19	.01	219.
1.01	9.45	39	.02	.00	.01	2.	1.02	9.45	135	.20	.19	.01	220.
1.01	10.00	40	.02	.00	.01	2.	1.02	10.00	136	.20	.19	.01	221.
1.01	10.15	41	.02	.00	.01	2.	1.02	10.15	137	.20	.19	.01	221.
1.01	10.30	42	.02	.00	.01	2.	1.02	10.30	138	.20	.19	.01	222.
1.01	10.45	43	.02	.00	.01	2.	1.02	10.45	139	.20	.19	.01	222.
1.01	11.00	44	.02	.00	.01	2.	1.02	11.00	140	.20	.19	.01	223.
1.01	11.15	45	.02	.00	.01	2.	1.02	11.15	141	.20	.19	.01	223.
1.01	11.30	46	.02	.00	.01	2.	1.02	11.30	142	.20	.19	.01	224.
1.01	11.45	47	.02	.00	.01	3.	1.02	11.45	143	.20	.19	.01	224.
1.01	12.00	48	.02	.00	.01	3.	1.02	12.00	144	.20	.19	.01	224.
1.01	12.15	49	.05	.01	.04	3.	1.02	12.15	145	.66	.65	.02	243.
1.01	12.30	50	.05	.01	.04	5.	1.02	12.30	146	.66	.65	.01	305.
1.01	12.45	51	.05	.02	.03	7.	1.02	12.45	147	.66	.65	.01	410.
1.01	13.00	52	.05	.02	.03	11.	1.02	13.00	148	.66	.65	.01	521.
1.01	13.15	53	.06	.02	.04	14.	1.02	13.15	149	.80	.79	.01	617.
1.01	13.30	54	.06	.03	.04	17.	1.02	13.30	150	.80	.79	.01	694.
1.01	13.45	55	.06	.03	.03	21.	1.02	13.45	151	.80	.79	.01	761.
1.01	14.00	56	.06	.03	.03	24.	1.02	14.00	152	.80	.79	.01	817.
1.01	14.15	57	.08	.04	.04	28.	1.02	14.15	153	.99	.99	.01	867.
1.01	14.30	58	.08	.04	.03	32.	1.02	14.30	154	.99	.99	.01	921.
1.01	14.45	59	.08	.04	.03	36.	1.02	14.45	155	.99	.99	.01	984.
1.01	15.00	60	.08	.05	.03	41.	1.02	15.00	156	.99	.99	.01	1043.
1.01	15.15	61	.08	.05	.03	45.	1.02	15.15	157	1.01	1.00	.01	1090.
1.01	15.30	62	.16	.10	.05	51.	1.02	15.30	158	2.02	2.01	.01	1163.
1.01	15.45	63	.43	.31	.12	70.	1.02	15.45	159	5.64	5.62	.02	1467.
1.01	16.00	64	.11	.08	.03	103.	1.02	16.00	160	1.41	1.41	.00	2032.
1.01	16.15	65	.07	.06	.02	134.	1.02	16.15	161	.93	.93	.00	2520.
1.01	16.30	66	.07	.06	.01	140.	1.02	16.30	162	.93	.93	.00	2564.
1.01	16.45	67	.07	.06	.01	127.	1.02	16.45	163	.93	.93	.00	2280.
1.01	17.00	68	.07	.06	.01	107.	1.02	17.00	164	.93	.93	.00	1878.
1.01	17.15	69	.05	.05	.01	92.	1.02	17.15	165	.73	.73	.00	1580.
1.01	17.30	70	.06	.05	.01	82.	1.02	17.30	166	.73	.73	.00	1382.
1.01	17.45	71	.06	.05	.01	73.	1.02	17.45	167	.73	.73	.00	1222.
1.01	18.00	72	.06	.05	.01	67.	1.02	18.00	168	.73	.73	.00	1102.
1.01	18.15	73	.01	.00	.00	61.	1.02	18.15	169	.07	.06	.00	988.
1.01	18.30	74	.01	.00	.00	53.	1.02	18.30	170	.07	.06	.00	844.
1.01	18.45	75	.01	.00	.00	41.	1.02	18.45	171	.07	.06	.00	658.
1.01	19.00	76	.01	.00	.00	30.	1.02	19.00	172	.07	.06	.00	476.
1.01	19.15	77	.01	.00	.00	21.	1.02	19.15	173	.07	.06	.00	339.
1.01	19.30	78	.01	.00	.00	15.	1.02	19.30	174	.07	.06	.00	240.
1.01	19.45	79	.01	.00	.00	11.	1.02	19.45	175	.07	.06	.00	180.
1.01	20.00	80	.01	.00	.00	9.	1.02	20.00	176	.07	.06	.00	141.
1.01	20.15	81	.01	.00	.00	7.	1.02	20.15	177	.07	.06	.00	119.
1.01	20.30	82	.01	.00	.00	7.	1.02	20.30	178	.07	.06	.00	107.
1.01	20.45	83	.01	.00	.00	6.	1.02	20.45	179	.07	.06	.00	93.

Input Data
Various PMF Events
Something Green A Dam
MO 30720
B6

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.02	19.30	174	.07	.06	.00	240.
1.01	19.45	79	.01	.00	.00	11.	1.02	19.45	175	.07	.06	.00	190.
1.01	20.00	80	.01	.00	.00	9.	1.02	20.00	176	.07	.06	.00	141.
1.01	20.15	81	.01	.00	.00	7.	1.02	20.15	177	.07	.06	.00	119.
1.01	20.30	82	.01	.00	.00	7.	1.02	20.30	178	.07	.06	.00	102.
1.01	20.45	83	.01	.00	.00	6.	1.02	20.45	179	.07	.06	.00	93.
1.01	21.00	84	.01	.00	.00	6.	1.02	21.00	180	.07	.06	.00	87.
1.01	21.15	85	.01	.00	.00	5.	1.02	21.15	181	.07	.06	.00	83.
1.01	21.30	86	.01	.00	.00	5.	1.02	21.30	182	.07	.06	.00	80.
1.01	21.45	87	.01	.00	.00	5.	1.02	21.45	183	.07	.06	.00	79.
1.01	22.00	88	.01	.00	.00	5.	1.02	22.00	184	.07	.06	.00	78.
1.01	22.15	89	.01	.00	.00	5.	1.02	22.15	185	.07	.06	.00	77.
1.01	22.30	90	.01	.00	.00	5.	1.02	22.30	186	.07	.06	.00	77.
1.01	22.45	91	.01	.00	.00	5.	1.02	22.45	187	.07	.06	.00	77.
1.01	23.00	92	.01	.00	.00	5.	1.02	23.00	188	.07	.06	.00	77.
1.01	23.15	93	.01	.00	.00	5.	1.02	23.15	189	.07	.06	.00	77.
1.01	23.30	94	.01	.00	.00	5.	1.02	23.30	190	.07	.06	.00	77.
1.01	23.45	95	.01	.00	.00	5.	1.02	23.45	191	.07	.06	.00	77.
1.02	0.	96	.01	.00	.00	5.	1.03	0.	192	.07	.06	.00	77.
									SUM	36.40	34.71	1.69	40900.
										(925.)(	882.)(	43.)(	1158.16)

Input Data
Various PMF Events
Something Green A Dam
MO 30720
B7

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .25	RATIO 2 .50	RATIO 3 .75	RATIO 4 1.00
HYDROGRAPH AT	J-IN1	1.00	1	983.	1966.	2948.	3931.
		2.59)	(	27.83)(	55.66)(	83.49)(	111.32)(
ROUTED TO	DA01	1.00	1	963.	2536.	2931.	3906.
		2.59)	(	27.26)(	71.82)(	83.01)(	110.60)(
HYDROGRAPH AT	J-IN2	.46	1	641.	1282.	1923.	2564.
		1.19)	(	18.15)(	36.30)(	54.46)(	72.61)(
2 COMBINED	J-IN2	1.46	1	1342.	3227.	4647.	5535.
		3.78)	(	38.01)(	91.38)(	131.60)(	156.75)(
ROUTED TO	DA02	1.46	1	1236.	3142.	4455.	5509.
		3.78)	(	35.01)(	88.96)(	126.17)(	155.99)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	76 10	761.10	765.40
	STORAGE	125.	125.	228.
	OUTFLOW	0.	0.	1241.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.25	765.39	0.	228.	1236.	0.	42.00	0.
.50	766.69	1.29	269.	3142.	4.25	41.50	0.
.75	767.17	1.77	279.	4455.	6.00	40.75	0.
1.00	767.51	2.11	289.	5509.	7.00	41.00	0.

Output Summary
Various PMF Events
Something Green A Dam
MO 30720

APPENDIX C

Preliminary Engineering Geology Report
Something Green Estates

Missouri Geological Survey

PRELIMINARY ENGINEERING GEOLOGY REPORT, SOMETHIN' GREEN ESTATES, WASHINGTON COUNTY

Two reconnaisance field investigations were made of the proposed lake site development on Rouge Creek located in the E½ sec. 1, T. 38 N., R. 1 E., and the western half of sec. 6, T. 38 N., R. 2 E., Richwoods Quadrangle. The reconnaisance investigation stressed the springs and wells located on the property and to get the general idea of the soils and bedrock characteristics. The bedrock that will be encountered in this area for the dam construction will be principally of the Eminence Formation. There are local masses of reef structures that have a tendency to be a problem in dam construction. These reef structures are usually quite vuggy and transmit large volumes of water. The dams will be located in the lower portion of the formation.

The surface weathering characteristics of the Eminence Formation is quite varied from flat dense flagstone type such as is found in the bed of the stream immediately between the old barns and the log house to a very pinnacled rough irregular surface; an indication of this pinnacling is visible in the bed of the stream just below the barn above the lower spring.

For dam construction and ease of sealing off any seepage under the dam, it would be much easier and cheaper to construct the dam where these flat beds are exposed. In walking the stream the second time, two of these areas were noticed. One immediately above the log cabin and one several hundred yards upstream between the second and third crossing. The abutments would probably be a problem in construction of dams due to the apparent uneveness of the bedrock as all the loose joints will have to be cleaned, excavated, and backfilled with good clay to prevent lateral seepage around the abutments.

The soils that overlie the bedrock are highly varied from a very less, easily compacted clay with almost a impervious nature as found on the slopes of the rock. However also encountered, and overlying the rock, is a residual soil that was formed in place that has a tendency to be stony, well structured clay that has permeability equal to that of the sand even after it has been reworked and compacted by normal engineering techniques. However, it is felt that most of this material for construction of the dam can be obtained from the colluvial slopes which have a much better quality material for constructing of dams. Little or no problem should result from within the embankment after construction. Compacting at proper moisture content and density will be of a necessity.

It is believed that these the springs that will be flooded by the lower lake, are springs that are located primarily by the tight and impervious bed of dolomite that is exposed in the streambed immediately below the springs. If this is true, then these should not cause any problems in the construction of the dam.

It is recommended that some backhoe test pits be taken to bedrock at the location of each dam and along the proposed centerline, particularly within the abutment area. This is to expose the bedrock in the area to determine the nature of the bedrock and to determine the problems that would be encountered in construction of the dam. Also it would give aid in design of the core trench.

It appears possible to have three impoundments on the property. Theses tests should be taken at all three sites.

It is further recommended that a minimum of three cores be taken along the proposed centerline of the dam to determine what the rock conditions are at depth for the dams on Kings Creek. It would not be necessary to drill on the tributary to the creek. These cores should go at least 20 feet into rock so that the nature of the rock as to any openings, such as joints or vugs that would probably have to be grouted to prevent water loss within the lower horizon that can be identified. These borings should be conducted particularly if the observations of the test wells within the valley show a great deal of fluctuation with rainfall. If not and the backhoe test pits look satisfactory, the drilling could possibly be concluded, but they should be planned for and not dropped until the evaluation of the fluctuation of the water within the wells and what the nature of the materials exposed by the backhoe are thoroughly studied.

The Engineering Geology Section of the Missouri Geological Survey will be happy to be present during the digging of the backhoe test pits and make any further recommendations that would be necessary at that time.

Edwin L. Lutzen, Geologist
Engineering Geology
Missouri Geological Survey and Water Resources
October 29, 1970

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Something Green Dam 4

DB

ENGINEERING GEOLOGY OF THE SOMETHING GREEN LAKE SITE AND DEVELOPMENT
WASHINGTON COUNTY, MISSOURI

The Something Green Lake Site and Land Development, located in sec. 6, T. 38 N., R. 2 E., Washington County, is considered, geologically, a good lake site; due to the type of heavy clay soils that overlie the bedrock within this area.

The investigation of the core trench at the lower dam site indicates that there is sufficient quality of clay to prevent the infiltration of the water into the bedrock provided that the core trench is widened out to approximately two dozer blades wide to help block off the flow of water that was flowing at that time above the bedrock and below the soils. This cutoff trench will stop this type of water flow.

The septic tanks should not be considered for the housing development within this area as the soils are not conducive for septic tanks. The clays are of a tight nature that are impermeable to water. All septic tanks would fail by filling up the drainfields within a matter of use and thereby flow off onto the surface and eventually flow into the lake causing pollution, particularly of the quieter arms. It is a rule of thumb that where good lake sites can be developed because of the clay situation, such as at this particular site, that septic tanks will not work adequately. Therefore, due consideration to a central collection system ending in a lagoon downstream from the dam would be advantageous to this area. The lagoons can be constructed in such a manner and design to which the effluent would not seriously contaminate the creek flow below the dam.

The borrow material for the dam should be primarily recovered from the upper portions of the water filled valley to increase the depth and reduce the amount of vegetation that would start in the more shallow waters. It would also be advantageous to doze the existing creek channel full of material on the bank to prevent any type of seepage along the old stream channel.

Edwin E. Lutzen
Geologist
Engineering Geology
Missouri Geological Survey
September 15, 1971

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Something Green B Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Something Green B Dam (MO 30719).

It was prepared under the National Program for Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St Louis District as a result of the application of the following criteria:

a. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: _____ _____
Chief, Engineering Division Date

APPROVED BY: _____ _____
Colonel, CE, District Engineer Date

SOMETHING GREEN B DAM

Washington County, Missouri

Missouri Inventory No. 30719

Phase I Inspection Report

National Dam Safety Program

Prepared by

Woodward-Clyde Consultants

Chicago, Illinois

Under Direction of

St Louis District, Corps of Engineers

for

Governor of Missouri

September 1980

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 not to provide a complete evaluation of the safety of the structure nor to provide a guarantee on its future integrity. Rather the purpose of the program is to identify potentially hazardous conditions to the extent they can be identified by a visual examination. The assessment of the general condition of the dam is based upon available data (if any) and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies. In view of the limited nature of the Phase I studies no assurance can be given that all deficiencies have been identified.

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 any data which may be available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action removes the normal load on the structure, as well as the reservoir head along with seepage pressures, 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 frequent inspections can unsafe conditions be detected, so that corrective action can be taken. Likewise continued care and maintenance are necessary to minimize the possibility of development of unsafe conditions.

PHASE I REPORT
National Dam Safety Program

Name of Dam	Something Green B Dam (upstream)
State Located	Missouri
County Located	Washington
Stream	Rouge Creek
Date of Inspection	17 July 1980

Something Green B Dam, (the furthest upstream of the two currently existing Something Green dams) Missouri Inventory Number 30719, was inspected by Richard Berggreen (engineering geologist), Leonard Krazynski (geotechnical engineer), John Seymour (geotechnical engineer) and Sean Tseng (hydrologist).

The dam inspection was made following the guidelines presented in the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines represent a consensus of the engineering profession. They are intended to provide an expeditious identification, based on available data and a visual inspection, of those dams which may pose hazards to human life or property. In view of the limited nature of the study, no assurance can be given that all deficiencies have been identified.

The St Louis District, Corps of Engineers has classified this dam as high hazard. The estimated damage zone extends approximately 3 miles downstream of the dam. Just below the dam, there are several occupied structures and a community recreation center where loss of life and property damage could occur in the event of overtopping and of failure.

The dam is an earth dam, constructed to impound a recreational lake.

The dam, which was built in 1978, is classified as small due to its 52 ac-ft storage volume. The dam is 22 ft in height. A small dam is one which impounds 50 to 1000 ac-ft, or is 25 to 40 ft in height.

Our inspection and evaluation indicate the dam embankment is in generally good condition. No evidence of instability of the embankment in its present condition was observed. The spillway is capable of passing the 1 percent probability-of-occurrence flood event without overtopping; however, analyses indicate that a flood greater than 33 percent of the Probable Maximum Flood (PMF) will overtop the dam.

In view of the population immediately below this dam, the presence of the community recreation center which could hold a large number of persons and the likelihood of further home development in this area, it is recommended that 100 percent of the PMF be used for the design flood. Additional hydrologic studies discussed in Section 7 of this report may indicate that a spillway design flood smaller than 100 percent of the PMF can be justified.

It is recommended that the following remedial measures and additional studies be made for the Something Green B Dam.

1. Additional hydrologic study should be conducted to evaluate the effects of all three Something Green dams (two existing; one in construction) in order to design and construct adequate spillways for all three structures to prevent overtopping. With the information available from our limited Phase I study, it is recommended that a spillway design flood of 100 percent of the PMF be used.

2. Implement an inspection and maintenance program for the dam and appurtenant structures. Records of the inspections and maintenance should be kept.

3. Evaluate alternatives for a practical and effective warning system to alert downstream residents, should potentially hazardous conditions develop. All three dams should be considered in this system.

4. Conduct static and seismic stability analyses and a seepage analysis in accordance with the guidelines.

The analyses and determination of remedial measures should be performed by an engineer qualified in the design and construction of earth dams.

It is recommended the owner take action on these recommendations in the near future to preclude deterioration which could lead to the development of hazardous conditions at this facility. The action concerning the spillway capacity should be taken as soon as possible.

WOODWARD-CLYDE CONSULTANTS

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OVERVIEW

SOMETHING GREEN B DAM

MISSOURI INVENTORY NO. 30719

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SOMETHING GREEN B DAM - MISSOURI INVENTORY NO. 30719

TABLE OF CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SOMETHING GREEN B DAM, MISSOURI INVENTORY NO. 30719

SECTION 1
PROJECT INFORMATION

1.1 General

a. **Authority.** The National Dam Inspection Act, Public Law 92-367, provides for a national inventory and inspection of dams throughout the United States. Pursuant to the above, an inspection was conducted of the Something Green B Dam, Missouri Inventory Number 30719.

b. **Purpose of inspection.** "The primary purpose of the Phase I investigation program is to identify expeditiously those dams which may pose hazards to human life or property... The Phase I investigation will develop an assessment of the general condition with respect to safety of the project based upon available data and a visual inspection, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted" (Chapter 3, Recommended Guidelines for Safety Inspection of Dams).

c. **Evaluation criteria.** The criteria used to evaluate the dam were established in the "Recommended Guidelines for Safety Inspection of Dams", Engineering Regulation No. 1110-2-106 and Engineering Circular No. 1110-2-188, "Engineering and Design National Program for Inspection of Non-Federal Dams," prepared by the Office of Chief of Engineers, Department of the Army, and "Hydrologic/Hydraulic Standards Phase I Safety Inspection of Non-Federal Dams" prepared by the St Louis District, Corps of Engineers SLD. These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of Project

a. **Description of dam and appurtenances.** The Something Green B Dam is an earth fill dam impounding a recreational lake in north-central Washington County, Missouri (Fig. 1). The dam is approximately 447 ft in length and retains the impoundment on the northeast (Fig. 2). The dam is approximately 22 ft high at the maximum section. Elevations along the dam crest are nearly uniform at slightly over 806 ft MSL.

The spillway is a broad trapezoidal weir, partially lined with concrete, approximately 80 ft wide from the abutment to the crest of the dam (Photo 1). The low point controlling outflow is at elevation 801.6 ft, 4.4 feet below the crest of the dam.

The discharge channel below the lined portion of the spillway is eroded to bedrock (Photo 2). The discharge channel walls are residual stoney clay, which appears to be moderately erodible.

Two 12 in. pipes were noted at the toe of the maximum section (Photo 3). From discussions with the owner and builder of the dam, it was determined that one pipe extends through the base of the dam and was a drain for stream flow during construction. It reportedly has 3 seepage collars along its length. It was permanently capped at the time of lake filling. The second pipe is a drawdown pipe connected to a riser in the lake. The top of the riser is reported to be 4 to 5 ft below the spillway elevation. It has a chain controlled cap connected to a location pipe which extends above the lake level (Photo 7). Neither pipe was carrying water at the time of the visual inspection.

b. **Location.** The Something Green B Dam is located about 4000 ft upstream of Something Green A Dam on Rouge Creek, a tributary of the Mineral Fork Creek, approximately 8 miles north of the town of Potosi in Washington County, Missouri, Section 1, T 38N, R1E, USGS Richwoods SE 7.5 minute quadrangle (See Figs 1 and 2).

c. **Size classification.** The dam is classified small due to its storage volume of 52 ac-ft at top of dam elevation. The dam is 22 ft in height. Small dam classification includes dams impounding 50 to 1000 ac-ft or having a height of 25 to 40 ft.

d. **Hazard classification.** The St Louis District, Corps of Engineers, has classified this dam high hazard; we concur with this classification. The estimated damage zone extends approximately 3 miles downstream of the dam. Located within this zone are at least 8 occupied structures (Photos 4 and 5), a community recreation center, and Missouri Highway F. The majority of the homes are within 2 mi of the dam. As a result, the potential for loss of life and property is high.

e. **Ownership.** The dam is reportedly owned by Oak Land Developments, Inc., Route 1, Potosi, Missouri, 63664. Correspondence should be addressed to the attention of Mr William Rummel.

f. **Purpose of dam.** The dam was constructed to impound a recreational lake.

g. **Design and construction history.** The following information on the design and construction history of the dam was obtained from Mr William Rummel, the owner of the dam.

The dam was built by Mr Rummel in the summer of 1978, using bulldozers and a small International scraper. Fill for the dam consists of clay and stoney clay taken from the valley slopes. Compaction was by track-walking with the bulldozers. No record of compaction tests was found. Mr Rummel indicated the construction was inspected periodically by personnel from the Missouri Geological Survey, but no records of site visits during construction were located.

Following completion of the dam, the reservoir filled following the first heavy rain storm.

h. **Normal operating procedures.** There are no facilities at this dam requiring operation.

1.3 Pertinent Data

a. **Drainage area.** approximately 1.0 mi^2

b. **Discharge of damsite.**

Maximum known flood at damsite	No records
Warm water outlet	Not applicable (N/A)
Diversion tunnel low pool outlet	N/A
Diversion tunnel at pool elevation	N/A
Gated spillway capacity	N/A
Gated spillway capacity at maximum pool	N/A
Ungated spillway capacity at maximum pool elevation	1275 cfs
Total spillway capacity of maximum pool elevation	1275 cfs

c. **Elevations.** (ft above MSL)

Top of Dam	806.1
Maximum pool - design surcharge	N/A
Full flood control pool	N/A
Recreation pool	801.6
Spillway crest	801.6
Upstream portal invert diversion tunnel	N/A
Downstream portal invert diversion tunnel	N/A
Streambed at centerline of dam	Unknown
Maximum tailwater	N/A
Toe of dam at maximum section	784.2

d. **Reservoir.**

Length of maximum pool	Approximately 750 ft
Length of recreation pool	Approximately 650 ft
Length of flood control pool	N/A

e. **Storage (acre-feet).**

Recreation pool	18
Flood control pool	N/A
Design surcharge	N/A
Top of dam	81

f. **Reservoir surface (acres).**

Top of dam	10.5
Maximum pool	10.5
Flood control pool	N/A
Recreation pool	5.0
Spillway crest	5.0

g. **Dam.**

Type	Compacted earth fill
Length	447 ft
Height	22 ft
Top width	Approximately 18 ft at maximum section
Side slopes	Upstream unknown Downstream 3H:1V
Zoning	None
Impervious core	None
Cutoff	Unknown (reported as 30 ft wide trench to bedrock)
Grout curtain	None

h. **Diversion and regulating tunnel.**

Type	None
Length	N/A
Closure	N/A
Access	N/A
Regulating facilities	N/A

i. **Spillway.**

Type	Broad-crested trapezoidal weir, partially lined with concrete

Length of weir	79.2 ft
Crest elevation	801.6 ft (lowest point)
Gates	None
Downstream channel	Bedrock floored; near vertical soil walls

j. **Regulating outlets.** Two 12-inch horizontal pipes exiting near the toe of maximum section; no control valves on either pipe. One pipe is reported to be a capped drain for stream flow during dam construction. Second pipe is a draw-down pipe; upstream end has a riser 4 to 5 ft below spillway elevation. Chain-operated cap controls the outflow. Control was not operated during the field inspection.

SECTION 2
ENGINEERING DATA

2.1 Design

No design drawings or records were found for this dam. Dam location was selected with the aid of Mr Edwin Lutzen of the Missouri Geological Survey; see the attached reports by Mr Lutzen in Appendix C.

2.2 Construction

Information on the construction of the Something Green B Dam was obtained through interviews with Mr William Rummel, the dam owner and builder.

The dam was constructed in 1978. The fill used in the dam was the stoney residual clay stripped from the valley slopes. The fill was compacted by trackwalking with bulldozers. A concrete apron was built about 45 ft long through and beyond the spillway. A 2 to 3 ft deep discharge channel has been subsequently eroded to bedrock beyond the end of the concrete lining (Photo 2).

2.3 Operation

No operating records were available for this dam. Mr Rummel indicated the lake was filled following the first heavy rainstorm. Mr Rummel indicated the dam has not been overtopped since it was constructed.

2.4 Evaluation

a. **Availability.** The available engineering data is limited to the recollections of the builder and owner of the dam, Mr William Rummel. No other records of engineering or construction data were available during our inspection.

b. **Adequacy.** The available information is insufficient to evaluate the design of the Something Green B Dam. Seepage and stability analyses comparable to

the requirements of the guidelines are not on record. This is a deficiency which should be rectified. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record. These analyses should be performed by an engineer experienced in the design and construction of dams.

c. **Validity.** There is no reason to question the validity of the information provided by Mr Rummel, and the information appeared reasonable for the conditions observed during the inspection.

2.5 Regional Geology

The dam is located on the northern flank of the Ozark structural dome. The regional dip of the bedrock is to the north. The bedrock in the vicinity of the dam is mapped on the Geologic Map of Missouri (1979) as Cambrian age Potosi and Eminence Formations (Fig. 4). Mr Edwin Lutzen of the Missouri Geological Survey describes the bedrock as Eminence Formation (Appendix C).

The Eminence Formation is principally medium to massively bedded, medium- to coarse-grained, light gray dolomite. The formation also contains small amounts of quartz druse and chert. Numerous large springs and some major caves have developed in the Eminence Formation. The pinnacled bedrock surface exposed in the drainage channel below this lake showed some evidence of small scale near-surface solutioning. The report by the Missouri Geological Survey (Appendix C) also referred to potential solutioning in the near-surface bedrock. However, no evidence of sinkholes or karst topography was noted at the dam site during the visual inspection.

The soil at the dam site consists of a red-brown gravelly plastic residual clay, (CL-CH). This soil apparently developed as a residual soil of insoluble residue on the weathered carbonate bedrock in the area. The soil in mapped on the Missouri General Soils Map as Union-Goss-Gasconade-Peridge Association.

The Aptus Fault Zone is mapped approximately 1 mi southwest of the dam site. The fault is approximately 15 mi long and trends in a northwest-southeast direction. This fault, like others in the Ozark area, appears confined to the Paleozoic bedrock

and is likely Paleozoic in age. The area is not considered to be seismically active, and the faults are not considered to pose a significant hazard to the dam.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. **General.** The Something Green B Dam was inspected 17 July, 1980, with the owner present during the inspection. The inspection indicated the dam embankment is in generally good condition.

b. **Dam.** The dam is constructed of gravelly clay excavated from the valley slopes. The downstream face slopes at approximately 3H to 1V (Photo 6). The downstream face is grass covered and should be moderately resistant to erosion.

No evidence of disruption or deformation of the horizonal or vertical alignment of the dam was noted in the field inspection. No excessive settlement, cracking, animal burrows or sinkhole development was noted.

The upstream face is partially protected with broken concrete and stone rip rap (Photo 7). Portions of this rip rap have settled and fallen into the lake. Mr Rummel indicated it was a continuing maintenance problem to repair the rip rap.

A small area of seepage was noted at the toe of the dam (Fig A1, Appendix A). At the time of the inspection, seepage was minor, approximately 1/2 gal/min. Cattails and willow vegetation were growing in this area. Mr Rummel indicated he plans to chemically treat the area to kill the willows to prevent their growing to substantial size. No soil particles were noted in the seepage water and the volume did not appear sufficient to threaten erosion of the dam face or piping of dam materials.

c. **Appurtenant structures.**

1. Spillway. The spillway consists of a trapezoidal concrete weir and apron, partially lined with concrete and partially lined with gravelly clay, constructed on the right abutment (Photo 1). The weir section is approximately 79 ft wide at the top. A rectangular width of 46 ft was used in the analyses due to failure of the HEC-1 hydraulic/hydrologic program to analyse for trapezoidal sections. The concrete apron is approximately 45 ft long, extending from the grass-lined approach area to a 2.5 ft drop eroded to bedrock at the downstream end. The owner indicated he plans to increase the downstream length of the concrete lining, and also cut a deeper channel into the bedrock. The proposed deeper channel in the bedrock would be only for relatively minor flows through the spillway and would apparently not be of sufficient size to carry significant floods.

2. Outlet structures. The only visible evidence of an outlet structure at this dam, in addition to the ungated spillway, is a small 2 to 3 in. vertical steel pipe in the lake (Photo 7). This is reported to be a location pipe for a drawdown riser connected to one of the 12 in. pipes noted at the toe of the dam. The top of the riser is at an elevation 4 to 5 ft below the spillway crest and is controlled by a chain-operated cap. The control was not operated during the visual inspection. No water was flowing from either pipe at the time of our inspection

d. **Reservoir area.** The area surrounding the reservoir is a vacation/residential development. The slopes surrounding the reservoir are typically moderate with inclinations of approximately 5(H):1(V) or less. No evidence of slope instability was noted during the field inspection. Sedimentation in the lake was estimated by the owner at about 6 in. since the dam was constructed. Most of this is attributed to runoff from an area being graded for a third dam in this area which is being constructed upstream.

e. **Downstream channel.** The downstream channel below the spillway apron consists of a bedrock floored, soil walled, eroded gully, approximately 2 to 4 ft deep and 15 to 25 ft wide (Photo 2). The exposed bedrock consists of blocky dolomite, Eminence Formation. The owner indicated he plans on excavating

(by blasting) a deeper channel into this rock. The walls of the channel consist of stoney residual clay soil, which is moderately erodible. Large flows through this channel can be expected to cause further erosion of the banks of the channel. The owner plans on lining the channel for some unknown distance beyond the existing spillway apron to prevent erosion toward the toe of the dam. There were no obstructions noted in the downstream channel that could result in reduced flow during flood events.

3.2 Evaluation

The dam embankment appears to be in generally good condition. No cracking, excessive settlement, horizontal or vertical displacement, sinkhole development or animal burrows were noted during the visual inspection.

Erosion protection should be considered for the downstream channel banks to prevent lateral erosion which might undercut the toe of the dam. Continued maintenance is recommended of the rip rap on the upstream slope to prevent embankment erosion by wave action.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

There are no operational procedures for this dam. The water level is controlled by the crest of the ungated spillway.

4.2 Maintenance of Dam

No records of maintenance on this facility other than periodic repairs to the rip rap were available.

4.3 Maintenance of Operating Facilities

There are no facilities requiring operation at this dam.

4.4 Descriptions of Any Warning System in Effect

The inspection did not reveal any warning system in effect at this facility.

4.5 Evaluation

There apparently is no program for periodic inspection at this facility. This is considered a deficiency.

The feasibility of a practical warning system should be evaluated to alert downstream residents should potentially hazardous conditions develop during periods of heavy precipitation.

SECTION 5
HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. **Design data.** No hydrologic or hydraulic information was available for evaluation of the dam. Pertinent dimensions of the dam and spillway were surveyed on 22 July, 1980, measured during the field inspection on 17 July 1980, or estimated from available topographic maps. The topographic maps used in the analyses were the advance prints of the USGS Richwoods SW and Richwoods SE 7.5 minute quadrangle maps.

b. **Experience data.** No recorded history of rainfall, runoff, discharge or pool stage historical data were available for this reservoir or watershed.

c. **Visual observation.** The watershed above the dam is almost entirely in a natural state, heavily forested, with the exception of some open pastures near the northwest margin of the drainage basin, cleared land around the perimeter of the lake, and the area above the reservoir being prepared for construction of the third dam and reservoir.

The area of the reservoir comprises approximately 2 percent of the drainage area of about 1.0 mi^2.

The concrete-lined, trapezoidal spillway is located at the right abutment of the embankment, abutting the natural hillside. The discharge channel is lined for a distance of approximately 32 ft below the spillway crest. The geometry and slope of the discharge channel indicate the spillway crest will act as the maximum flow control section.

The magnitude of seepage through the dam is small and not hydraulically significant to the overtopping potential.

d. **Overtopping potential.** Hydrologic and hydraulic analyses (Appendix B) indicate the dam and spillway are capable of passing the 1 percent probability-of-occurrence flood event without overtopping the dam. These analyses also indicate that a flood greater than 33 percent of the Probable Maximum Flood (PMF) will effectively overtop the dam. The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in this region.

One of the primary considerations in the evaluation of overtopping of the Something Green B Dam is the assessment of erosion potential and consequent failure by rapid erosion. Since the spillway consists of concrete, no erosion of the spillway itself is anticipated. Erosion, however, will be likely in the side walls of the discharge channel which could undercut the toe of the southwest half of the embankment. Also sustained heavy spillway flows could erode headward and remove support from beneath the concrete lining and disrupt performance of the spillway.

The maximum flood, the PMF, will result in an outflow of over 3900 ft^3/sec. This would overtop the embankment by nearly 2 ft and the duration of overtopping would be approximately 6 hrs. This overtopping would likely cause sufficient erosion of the embankment to result in possible failure of the dam. Our studies further indicate that a storm of 50 percent of the PMF would also result in the overtopping of the dam by nearly 1 ft for the duration of approximately 3 hours.

The following table presents the expected severity of overtopping for various storm events:

Precipitation Event	Max. Reservoir W.S. Elev.	Max. Depth over Dam, ft	Max. Outflow, ft^3/sec	Duration of Overtopping, hrs
33% PMF	806.1	0	1275	0
50% PMF	807.0	0.9	1965	2.8
100% PMF	807.9	1.8	3930	5.8

The input data and output summaries for these analyses are presented in Appendix B, Hydraulic/Hydrologic Data and Analyses.

Overtopping and failure of this dam would pose serious hazards to the homes located in the damage zone, estimated to extend 3 miles below the dam. The nearest occupied structures are less than 1 mile below the dam.

The analyses described above are appropriate for the conditions observed during the inspection. However, a third dam is currently under construction upstream of dam "B". Our investigation reveals there are no design plans which could provide sufficient information at this time to allow calculation of that reservoir's effect on the performance of dam "B". Additional hydrologic studies should be conducted to evaluate the combined effects of all three dams and to design and construct adequate spillways for these structures.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. **Visual inspection.** The visual inspection of the Something Green B Dam revealed no evidence of horizontal or vertical displacement of the dam crest alignment. No cracking, settlement, slides, sinkholes or other signs of instability were observed. The seepage noted at the toe of the dam does not appear to pose a hazard to the stability of the embankment.

b. **Design and construction data.** No design or construction data relating to the structural stability of the dam were available.

c. **Operating records.** No operating records were available for this dam.

d. **Post-construction changes.** The lack of drawings or construction reports precludes identification of post construction changes. However, Mr Rummel did not disclose any post-construction changes during the visual inspection visit, other than a small addition in height at the crest, to compensate for reportedly small settlement.

e. **Seismic stability.** The dam is located in Seismic Zone 2, to which the guidelines assign a moderate damage potential. Since no static stability analysis is available for review, the seismic stability cannot be evaluated. The gravelly clay character of the embankment indicates the dam should not be subject to liquefaction during a severe seismic event.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. **Safety.** Based on the visual inspection, the Something Green B Dam embankment is judged to be in generally good condition. However, hydraulic/hydrologic analyses indicate the spillway is inadequate to pass 50 percent of the PMF.

Downstream is another dam, Something Green "A" Dam, and between the two dams there are several homes and a community recreation center. Also, it is likely there will be further development of homes in this area. These factors increase the risk of loss of life and indicate a need to construct a spillway capable of passing 100 percent of the PMF, unless additional studies discussed in Section 7.2.b.1. indicate that a smaller spillway design flood can be justified.

The erosion in the discharge channel should not be allowed to progress to where it could jeopardize the embankment or the spillway concrete lining.

The seepage at the toe of the dam should be monitored to identify any changes in the amount of flow or the turbidity of the water. At present, the seepage does not appear to constitute a hazard to the embankment. No seepage or stability analyses were available for this dam. These should be performed to meet the recommended guidelines.

b. **Adequacy of information.** The lack of stability and seepage analyses for this dam, as recommended in the guidelines, precludes an evaluation of the structural and seismic stability of this dam. This is a deficiency which should be rectified. These analyses should be conducted by an engineer experienced in the design and construction of earthen dams.

c. **Urgency.** The deficiencies described in this report could affect the long term stability of this dam. Corrective actions should be initiated as soon as practical.

d. **Necessity for Phase II.** In accordance with the Recommended Guidelines for Safety Inspections of Dams, the subject investigation was a minimum study. This study revealed that additional in-depth investigations are needed to complete the assessment of the safety of the dam. Those investigations which should be performed without undue delay are described in Section 7.2.b. It is our understanding from discussions with the St Louis District that any additional investigations are the responsibility of the owner.

7.2 Remedial Measures

a. **Alternatives.** There are several general options which may be considered to reduce the possibility of dam failure or to diminish the harmful consequences of such a failure. Some of these options are:

1. Remove the dam, or breach it to prevent storage of water.

2. Increase the height of the dam and/or spillway size to pass the PMF without overtopping the dam.

3. Purchase downstream land that would be adversely impacted by dam failure and restrict human occupancy.

4. Enhance the stability of the dam to permit overtopping by the PMF without failure.

5. Provide a highly reliable flood warning system. This generally does not prevent damage but avoids loss of life.

b. **Recommendations.** Based on our inspection of the Something Green B Dam, it is recommended that a further study be conducted without undue delay to evaluate, as a minimum, the following:

1. Increased spillway capacity to pass 100 percent of the PMF without overtopping the embankment, unless it can be demonstrated by additional hydrologic studies that a smaller spillway design flood can be justified. Such a study should evaluate the influence of the third dam in this area, which is

currently being constructed upstream of Something Green "B" Dam. The study should also include an analysis of the extent of an inundated area between dams "B" and "A" in the event of sudden release of the storage and storm water at dam "B". Finally, a reasoned judgment can be made concerning a small depth of overtopping for a short period of time, which may be deemed to not be hazardous to the stability and safety of dam "B". The results would indicate an appropriate spillway design flood that can be justified.

2. Potential for erosion during periods of heavy runoff in the discharge channel and at the toe of the embankment. This study should include both erosion potential and evaluation of design alternatives for erosion control.

3. Evaluate the feasibility of implementing a practical and effective warning system to alert downstream residents, should potentially hazardous conditions develop. There appears to be a good opportunity for such a system for the three Something Green dams.

c. **O & M procedures.** A program of periodic inspections should be implemented for the dam and appurtenant structures. This program should include inspection of the embankment for evidence of slumping or instability, and inspection of seepage for changes in the volume of flow or turbidity (soil) in this seepage water. The inspection should document any needed maintenance. Records should be kept of the inspections and necessary maintenance. Maintenance and repair should be continued for the rip rap erosion control on the upstream face of the embankment.

All remedial measures should be performed under the guidance of an engineer experienced in the design and construction of dams.

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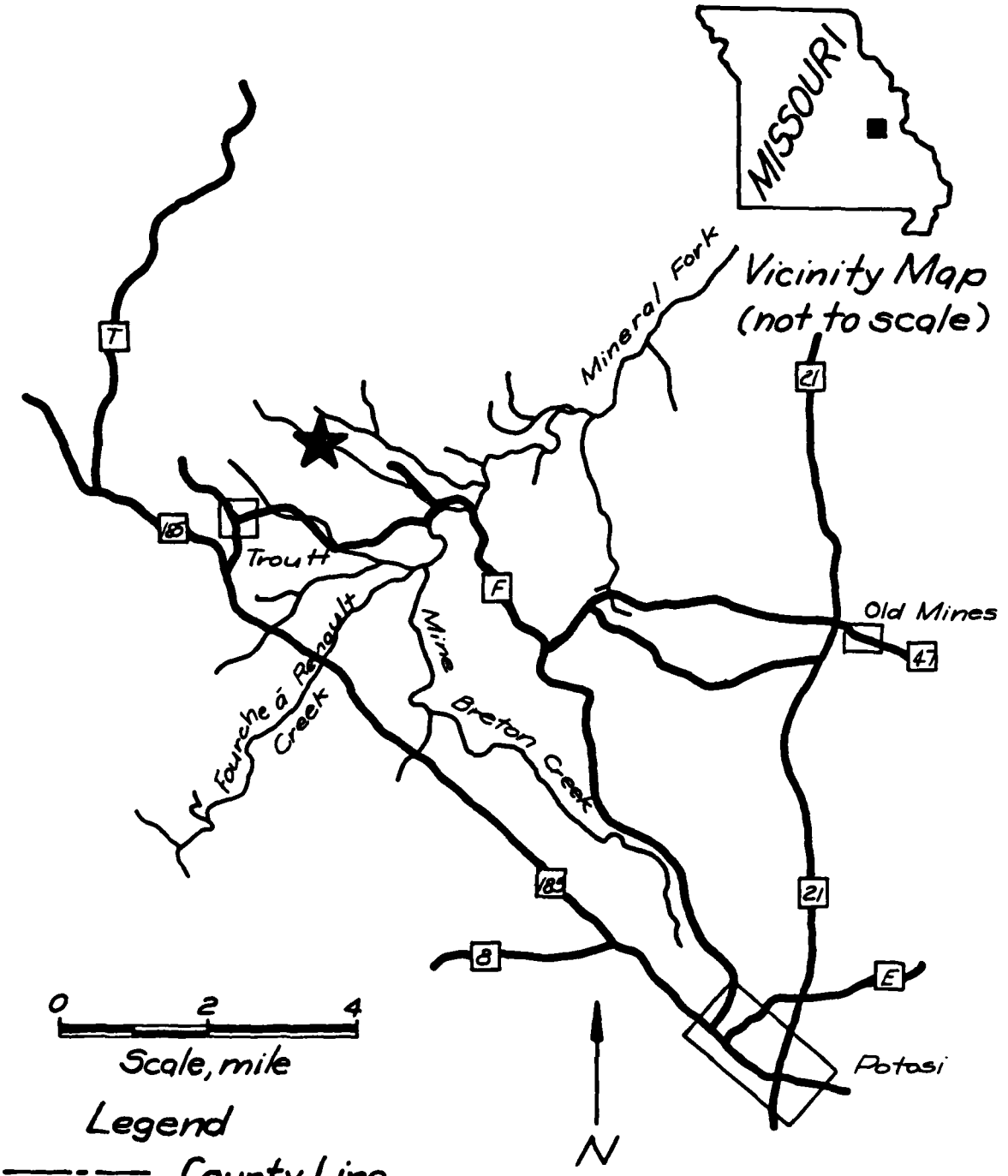
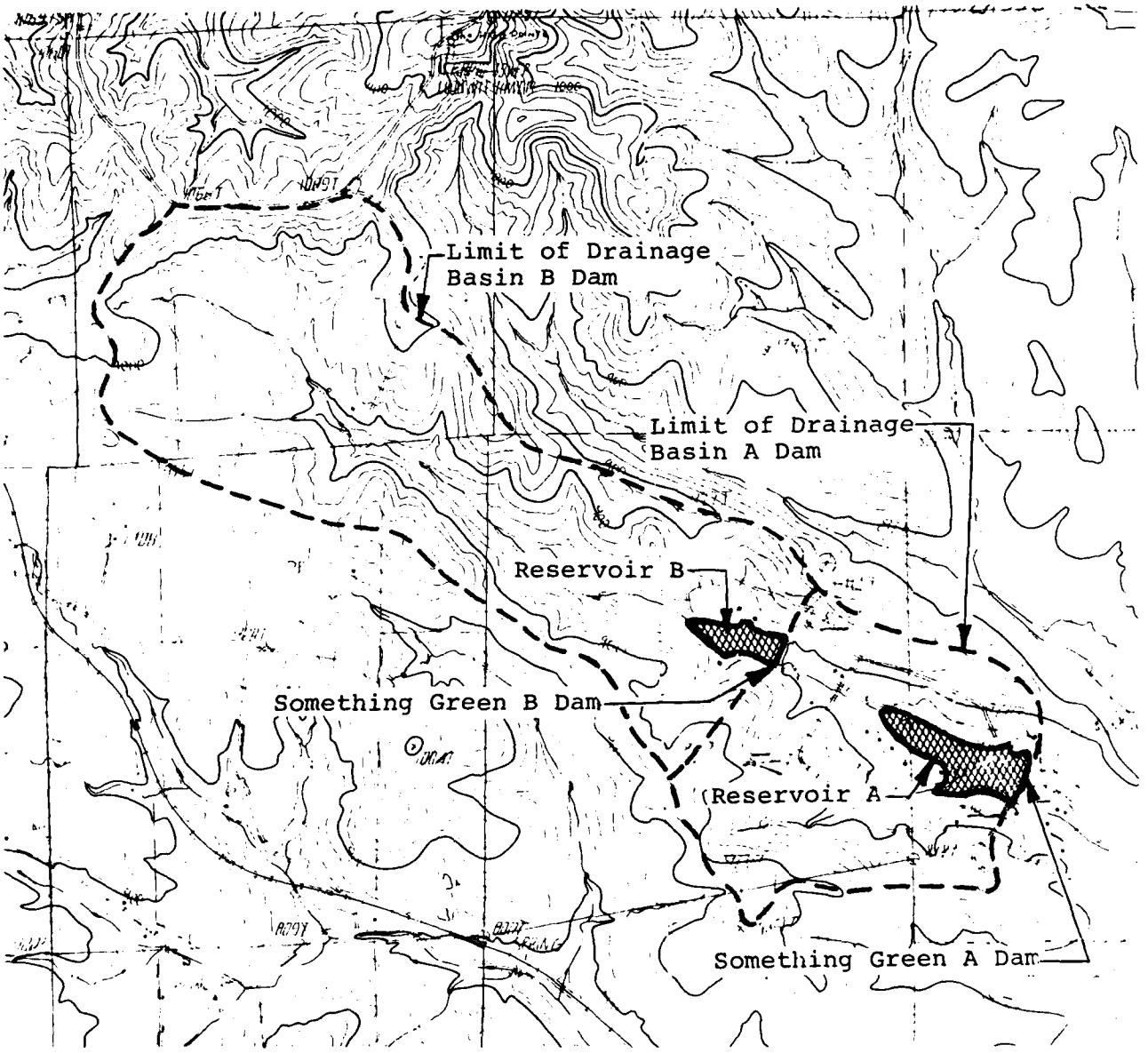


SITE LOCATION MAP	
SOMETHING GREEN 'B' DAM	
MO 30719	Fig. 1



N

0 2000 4000

Scale, ft

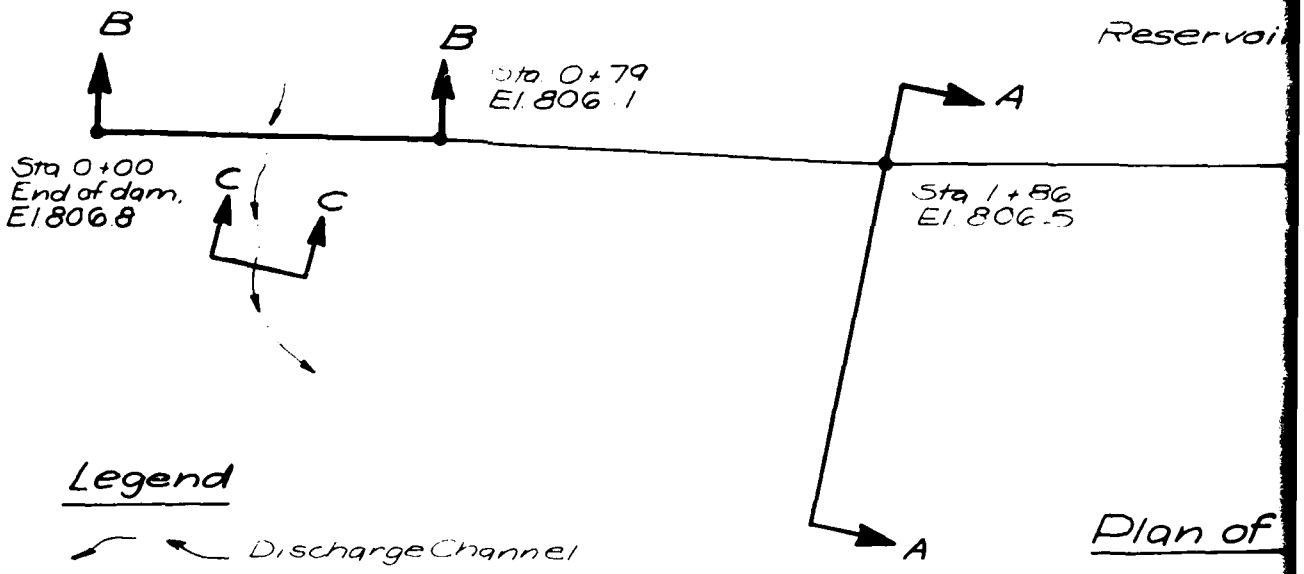
DRAINAGE BASIN AND SITE TOPOGRAPHY

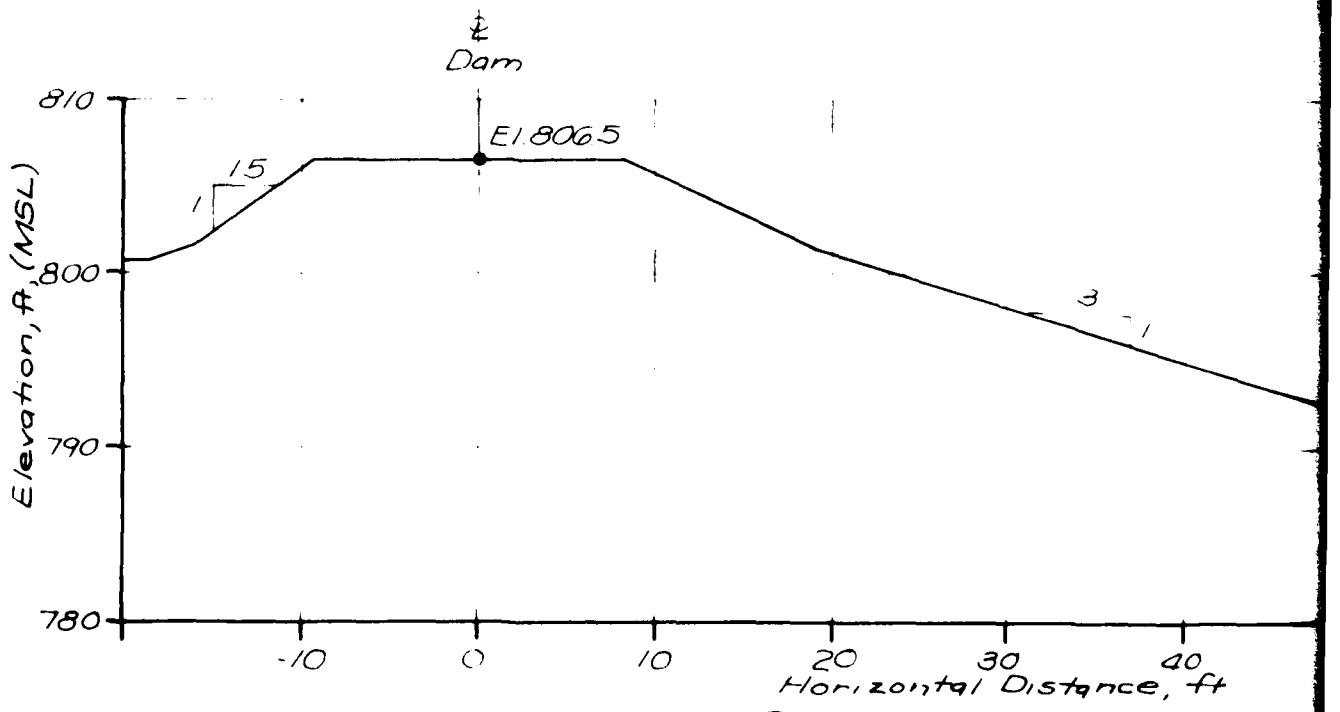
SOMETHING GREEN B DAM

MO 30719 | Fig. 2

NOTE:

1. *Topography from U.S.G.S.* Richwoods SE and Richwoods SW 71/2 minute quadrangle maps.



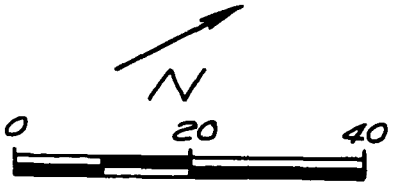


Section A-A

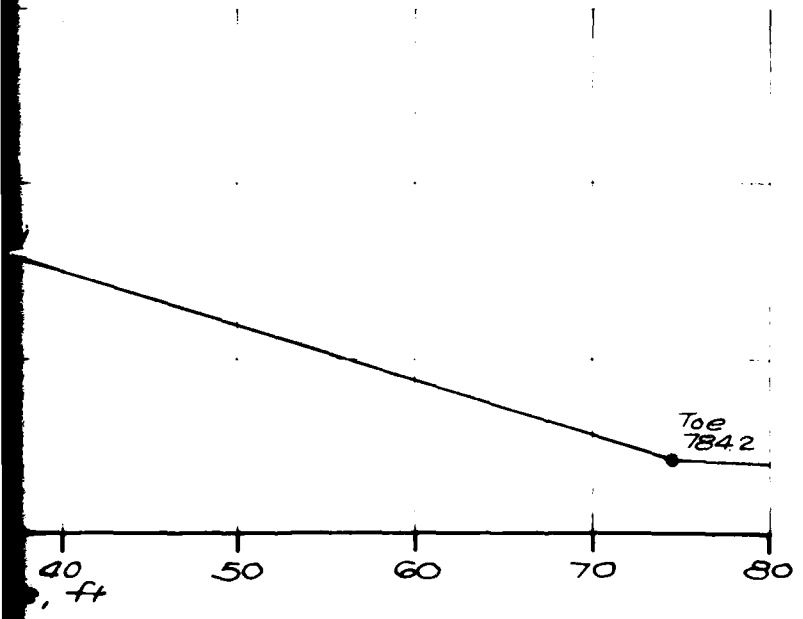
Maximum Section

Reservoir

Sta. 4+47
End of Dam,
El. 806.8

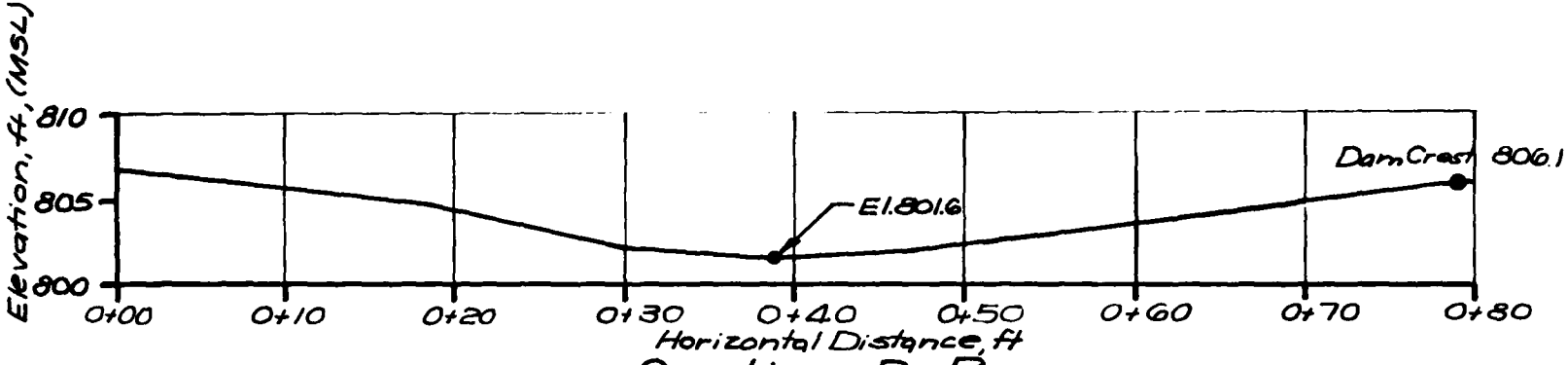


Plan of Dam



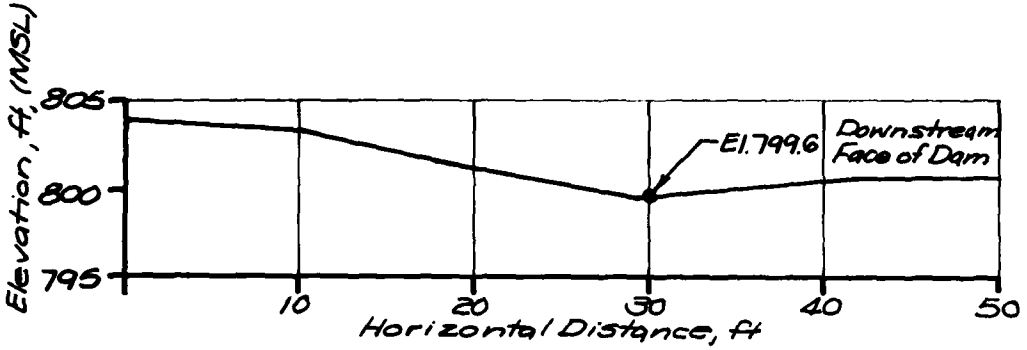
PLAN AND SECTION OF DAM	
SOMETHING GREEN B DAM	
MO. 30719	Fig. 3-A

12



Section B-B

Spillway Section



Section C-C

Discharge Channel

SECTIONS OF SPILLWAY AND DISCHARGE CHANNEL	
SOMETHING GREEN B DAM	
MO. 30719	FIG 3B

Legend

Roubidoux Formation

Gasconade Dolomite
Gunter Sandstone Member

Eminence Dolomite

Potosi Dolomite

Derby-Doerun Dolomite

Davis Formation

Bonneterre Formation
Whetstone Creek Member
Sullivan Siltstone Member

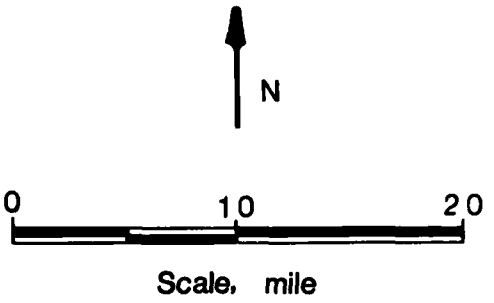
Reagan Sandstone
(subsurface, western Missouri)

Lamotte Sandstone

Diabase (dikes and sills)

St. Francois Mountains Intrusive Suite

St. Francois Mountains Volcanic Supergroup



REGIONAL GEOLOGIC MAP

SOMETHING GREEN B DAM

MO 30719 | Fig 4

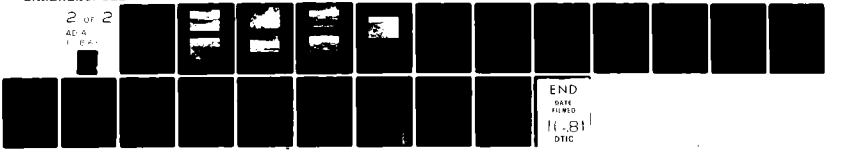
APPENDIX A

Photographs

AD-A106 616 PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF MINE--ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. SOMETHING GREEN A DAM (MO 30720), --ETC(U)
SEP 80 R G BERGGREEN, L M KRAZYNSKI DACW43-80-C-0066

UNCLASSIFIED NL

2 OF 2
AD A



END
DATE FILMED
11-81
DTIC

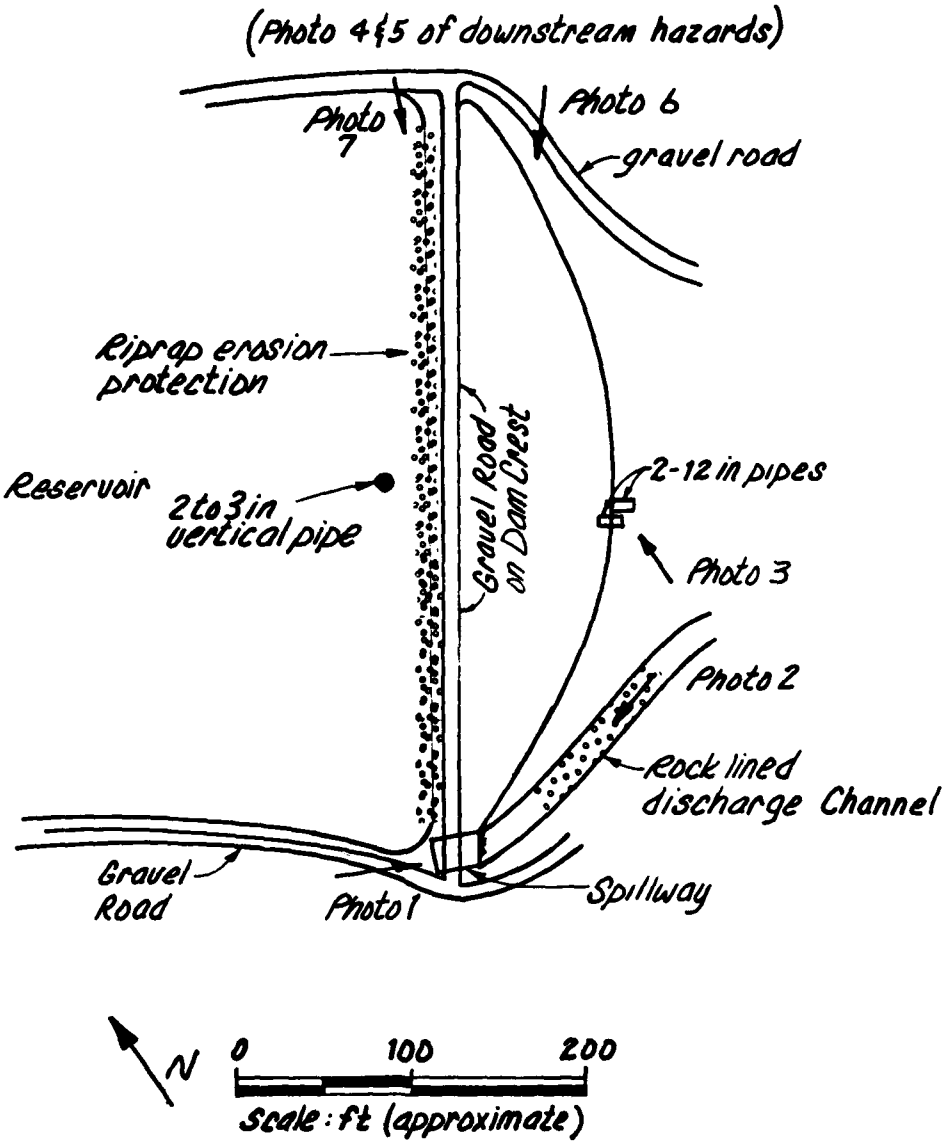


PHOTO LOCATION SKETCH	
SOMETHING GREEN B DAM	
MO 30719	Fig A1

1. Concrete lined spillway at right (southwest) abutment. Looking east-southeast, downstream.

2. Discharge channel eroded to bedrock, Eminence Dolomite. Note erosion of channel walls. Dam is to the right. Looking southwest.

3. Two 12-in pipes at toe of maximum section.

4. Occupied structure downstream of dam. Looking southeast, across drainage.

5. Community recreation center downstream of dam. Looking southeast across drainage.

6. Downstream face of dam showing vegetation cover. Looking southeast.

7. Riprap erosion protection on upstream face of dam. Looking southeast. Note small (2-3 inch) pipe standing above lake level to the right.

APPENDIX B

Hydraulic/Hydrologic Data and Analyses

APPENDIX B
Hydraulic/Hydrologic Data and Analyses

B.1 Procedures

a. General. The hydraulic/hydrologic analyses were performed using the "HEC-1, Dam Safety Version (1 Apr 80)" computer program. The inflow hydrographs were developed for various precipitation events by applying them to a synthetic unit hydrograph. The inflow hydrographs were subsequently routed through the reservoir and appurtenant structures by the modified Puls reservoir routing option.

b. Precipitation events. The Probable Maximum Precipitation (PMP) and the 1 and 10 percent probability-of-occurrence events were used in the analyses. The total rainfall and corresponding distributions for the 1 and 10 percent probability events were provided by the St. Louis District, Corps of Engineers. The Probable Maximum Precipitation was determined from regional curves prepared by the US Weather Bureau (Hydrometeorological Report Number 33, 1956).

c. Unit hydrograph. The Soil Conservation Services (SCS) Dimensionless Unit Hydrograph method (National Engineering Handbook, Section 4, Hydrology, 1971) was used in the analysis. This method was selected because of its simplicity, applicability to drainage areas less than 10 mi^2, and its easy availability within the HEC-1 computer program.

The watershed lag time was computed using the SCS "curve number method" by an empirical relationship as follows:

$$L = \frac{l^{0.8}\,(s+1)^{0.7}}{1900\,Y^{0.5}} \quad \text{(Equation 15-4)}$$

where: L = lag in hours
ℓ = hydraulic length of the watershed in feet
$s = \frac{1000}{CN} - 10$ where CN = hydrologic soil curve number
Y = average watershed land slope in percent

This empirical relationship accounts for the soil cover, average watershed slope and hydraulic length.

With the lag time thus computed, another empirical relationship is used to compute the time of concentration as follows:

$$T_c = \frac{L}{0.6} \quad \text{(Equation 15-3)}$$

where: T_c = time of concentration in hours

L = lag in hours.

Subsequent to the computation of the time of concentration, the unit hydrograph duration was estimated utilizing the following relationship:

$$\Delta D = 0.133 T_C \qquad \text{(Equation 16-12)}$$

where: ΔD = duration of unit excess rainfall
T_C = time of concentration in hours.

The final interval was selected to provide at least three discharge ordinates prior to the peak discharge ordinate of the unit hydrograph. For this dam, a time interval of 15 minutes was used.

d. Infiltration losses. The infiltration losses were computed by the HEC-1 computer program internally using the SCS curve number method. The curve numbers were established taking into consideration the variables of: (a) antecedent moisture condition, (b) hydrologic soil group classification, (c) degree of development, (d) vegetative cover and (e) present land usage in the watershed.

Antecedent moisture condition III (AMC III) was used for the PMF estimates and AMC II was used for the 1 and 10 percent probability events, in accordance with the guidelines. The remaining variables are defined in the SCS procedure and judgements in their selection were made on the basis of visual field inspection.

e. Starting elevations. Reservoir starting water surface elevations for this dam were set as follows:

(1) 1 and 10 percent probability events - high water mark

(2) Probable Maximum Storm - spillway crest elevation

Because the low level outlet pipes were either blocked or inoperable, they were assumed not to pass any amount of the flood.

f. Spillway Rating Curve. The basic weir equation was utilized to compute the spillway rating curve. The weir equation is as follows:

$$Q = CLH^{3/2}$$

where Q = discharge in cubic feet per second
L = effective length of spillway in feet
C = coefficient of discharge (2.5 to 3.1)
H = total head over spillway in feet

B.2 Pertinent Data

a. Drainage area. approximately 1.0 mi^2.

b. Storm duration. A unit hydrograph was developed by the SCS method option of HEC-1 program. The design storm of 48 hours duration was divided into 15 minute intervals in order to develop the inflow hydrograph.

c. Lag time. 1.73 hrs.

d. Hydrologic soil group. C

e. SCS curve numbers.

1. For PMF- AMC III - Curve Number 86
2. For 1 and 10 percent probability-of-occurrence events-AMC II - Curve Number 72

f. Storage. Elevation-area data were developed by planimetering areas at various elevation contours on the USGS Richwoods SE and SW 7.5 minute quadrangle maps. The data were entered on the $A and $E cards so that the HEC-1 program could compute storage volumes.

g. Outflow over dam crest. As the profile of the dam crest is irregular, flow over the crest was computed according to the "Flow Over Non-Level Dam Crest" supplement to the HEC-1 User's Manual. The crest length-elevation data and hydraulic constants were entered on the $D, $L, and $V cards.

h. Outflow capacity. The spillway rating curve was computed by the intrinsic formula within the HEC-1 program, with pertinent spillway data entered on the $$ cards.

i. Reservoir elevations. For the 50 and 100 percent of the PMF events, the starting reservoir elevation was 801.6 ft, the spillway crest elevation. For the 1 and 10 percent probability-of-occurrence events, the starting reservoir elevation was 801.4 ft, the elevation of the high water line in the reservoir area.

B.3 Results

The results of the analyses as well as the input values to the HEC-1 program follow in this Appendix. Only the results summaries are included, not the intermediate output. Complete copies of the HEC-1 output are available in the project files.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION  01 APR 80
**********
  1  A1   DAM NO. 30719 - SOMETHING GREEN LAKE(UPPER), WASHINGTON COUNTY, MISSOURI
  2  A2   WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 79CH009.
  3  A3   PROBABLE MAXIMUM FLOODS (PMF) ANALYSIS.
  4  B    192    3     15     -0     -0     -0     -0     -0     -0     -0
  5  B1    5
  6  J     1      4      1
  7  J1  .25    .50    .75   1.00
  8  K     0   Q-INI                                    1
  9  K1  SOMETHING GREEN LAKE (UPPER) INFLOW COMPUTATION, PMF RATIO FLOODS.
 10  M     1      2   1.00                         1.0
 11  P     0     20.   102.   120.   130.   140.
 12  T                                                -1    -86             .05
 13  W2          1.73
 14  X    -1   -.05      3
 15  K     1   DAM1                                    1
 16  K1  SOMETHING GREEN LAKE (UPPER) PMF FLOOD ROUTING.
 17  V                                      1      1
 18  Y1    1                                                -801.6
 19  SA    0.    2.7    5.0   10.5   15.5   20.
 20  S1  787.   800.   801.6  806.1  810.   820.
 21  S1 801.6   46.    2.9    1.5
 22  S0 806.1   2.8    1.5
 23  SL    0.   110.   370.   395.   415.   435.
 24  SV 806.1  806.5   807.   808.   809.   810.
 25  K    99
```

Input Data
Various PMF Events
Something Green B Dam
MO 30719
B4

```
**********************************
*FLOOD HYDROGRAPH PACKAGE (HEC-1)
*DAM SAFETY VERSION     JULY 1978
* LAST MODIFICATION  01 APR 80
**********************************

RUN DATE: 29 JUL 80
TIME: 09.31.17
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DAM NO. 30719 - SOMETHING GREEN LAKE(UPPER), WASHINGTON COUNTY, MISSOURI
WOODWARD-CLYDE CONSULTANTS, HOUSTON, TEXAS 77060.
PROBABLE MAXIMUM FLOODS (PMF) ANALYSIS.

JOB SPECIFICATION

NQ	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
192	15	-0	-0	-0	-0	-0	-0	-0

JOPER	NWT	LROPT	TRACE
5	-0	-0	-0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1
RTIOS= .25 .50 .75 1.00

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

SUB-AREA RUNOFF COMPUTATION

SOMETHING GREEN LAKE (UPPER) INFLOW COMPUTATION, PMF RATIO FLOODS.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
0-INL	0	-0	-0	-0	-0	1	-0	-0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	1.00	-0.	1.00	1.00	-0.	-0	-0	-0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.	26.00	102.00	120.00	130.00	140.00	-0.	-0.

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
-0	-0.	-0.	1.00	-0.	-0.	1.00	-1.00	-86.00	-0.	.05

CURVE NO = -86.00 RTIOWS = -1.00 EFFECT CN = 86.00

UNIT HYDROGRAPH DATA
TC= -0. LAG= 1.73

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 5.00

UNIT HYDROGRAPH 57 END-OF-PERIOD ORDINATES, TC= -0. HOURS, LAG= 1.73 VOL= 1.00

14.	42.	83.	142.	203.	243.	259.	259.	240.	214.
182.	141.	110.	88.	71.	58.	47.	37.	30.	24.
19.	15.	12.	10.	8.	6.	5.	4.	3.	3.
2.	2.	1.	1.	1.	0.	0.			

Input Data
Various PMF Events
Something Green B Dam
MO 30719

B5

	19.	19.	12.	10.	8.	6.	5.	4.	3.	3.			
	2.	2.	1.	1.	1.	0.	0.						

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.00	.00	.00	1.	1.02	.15	97	.04	.04	.01	13.
1.01	.30	2	.00	.00	.00	1.	1.02	.30	98	.04	.04	.01	14.
1.01	.45	3	.00	.00	.00	1.	1.02	.45	99	.04	.04	.01	16.
1.01	1.00	4	.00	.00	.00	1.	1.02	1.00	100	.04	.04	.01	20.
1.01	1.15	5	.00	.00	.00	1.	1.02	1.15	101	.04	.04	.01	27.
1.01	1.30	6	.00	.00	.00	1.	1.02	1.30	102	.04	.04	.01	35.
1.01	1.45	7	.00	.00	.00	0.	1.02	1.45	103	.04	.04	.01	43.
1.01	2.00	8	.00	.00	.00	0.	1.02	2.00	104	.04	.04	.01	51.
1.01	2.15	9	.00	.00	.00	0.	1.02	2.15	105	.04	.04	.01	59.
1.01	2.30	10	.00	.00	.00	0.	1.02	2.30	106	.04	.04	.01	66.
1.01	2.45	11	.00	.00	.00	0.	1.02	2.45	107	.04	.04	.01	72.
1.01	3.00	12	.00	.00	.00	0.	1.02	3.00	108	.04	.04	.01	77.
1.01	3.15	13	.00	.00	.00	0.	1.02	3.15	109	.04	.04	.01	81.
1.01	3.30	14	.00	.00	.00	0.	1.02	3.30	110	.04	.04	.01	84.
1.01	3.45	15	.00	.00	.00	0.	1.02	3.45	111	.04	.04	.01	86.
1.01	4.00	16	.00	.00	.00	0.	1.02	4.00	112	.04	.04	.01	89.
1.01	4.15	17	.00	.00	.00	0.	1.02	4.15	113	.04	.04	.01	90.
1.01	4.30	18	.00	.00	.00	0.	1.02	4.30	114	.04	.04	.01	92.
1.01	4.45	19	.00	.00	.00	0.	1.02	4.45	115	.04	.04	.00	93.
1.01	5.00	20	.00	.00	.00	0.	1.02	5.00	116	.04	.04	.00	94.
1.01	5.15	21	.00	.00	.00	0.	1.02	5.15	117	.04	.04	.00	95.
1.01	5.30	22	.00	.00	.00	0.	1.02	5.30	118	.04	.04	.00	96.
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1.01	6.30	26	.02	.00	.01	0.	1.02	6.30	122	.20	.18	.02	106.
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1.01	7.15	29	.02	.00	.01	1.	1.02	7.15	125	.20	.19	.01	166.
1.01	7.30	30	.02	.00	.01	1.	1.02	7.30	126	.20	.19	.01	200.
1.01	7.45	31	.02	.00	.01	1.	1.02	7.45	127	.20	.19	.01	236.
1.01	8.00	32	.02	.00	.01	1.	1.02	8.00	128	.20	.19	.01	273.
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1.01	10.15	41	.02	.00	.01	2.	1.02	10.15	137	.20	.19	.01	447.
1.01	10.30	42	.02	.00	.01	2.	1.02	10.30	138	.20	.19	.01	453.
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1.01	11.30	46	.02	.00	.01	2.	1.02	11.30	142	.20	.19	.01	471.
1.01	11.45	47	.02	.00	.01	2.	1.02	11.45	143	.20	.19	.01	474.
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1.01	12.30	50	.05	.01	.04	4.	1.02	12.30	146	.66	.65	.01	506.
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1.01	13.00	52	.05	.02	.04	7.	1.02	13.00	148	.66	.65	.01	617.
1.01	13.15	53	.06	.02	.04	9.	1.02	13.15	149	.80	.78	.01	708.
1.01	13.30	54	.06	.02	.04	12.	1.02	13.30	150	.80	.78	.01	826.
1.01	13.45	55	.06	.01	.03	17.	1.02	13.45	151	.80	.79	.01	957.
1.01	14.00	56	.26	.03	.03	21.	1.02	14.00	152	.80	.79	.01	1096.
1.01	14.15	57	.08	.04	.04	27.	1.02	14.15	153	.09	.08	.01	1237.

Input Data
Various PMF Events
Something Green B Dam
MO 30719
B6

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1.01	14.15	57	.08	.04	.04	27.	1.02	14.15	153	.99	.98	.01	1237.
1.01	14.30	58	.08	.04	.04	33.	1.02	14.30	154	.99	.99	.01	1378.
1.01	14.45	59	.08	.04	.03	39.	1.02	14.45	155	.99	.99	.01	1513.
1.01	15.00	60	.06	.04	.03	47.	1.02	15.00	156	.99	.99	.01	1642.
1.01	15.15	61	.08	.05	.03	54.	1.02	15.15	157	1.01	1.00	.01	1767.
1.01	15.30	62	.16	.10	.06	63.	1.02	15.30	158	2.02	2.00	.01	1900.
1.01	15.45	63	.43	.31	.13	76.	1.02	15.45	159	5.64	5.62	.02	2105.
1.01	16.00	64	.11	.08	.03	93.	1.02	16.00	160	1.41	1.41	.00	2581.
1.01	16.15	65	.07	.05	.02	115.	1.02	16.15	161	.93	.93	.00	2724.
1.01	16.30	66	.07	.06	.02	142.	1.02	16.30	162	.93	.93	.00	3148.
1.01	16.45	67	.07	.06	.02	169.	1.02	16.45	163	.93	.93	.00	3592.
1.01	17.00	68	.07	.06	.01	188.	1.02	17.00	164	.93	.93	.00	3821.
1.01	17.15	69	.06	.05	.01	199.	1.02	17.15	165	.73	.73	.00	3931.
1.01	17.30	70	.06	.05	.01	203.	1.02	17.30	166	.73	.73	.00	3922.
1.01	17.45	71	.06	.05	.01	201.	1.02	17.45	167	.73	.73	.00	3802.
1.01	18.00	72	.06	.05	.01	195.	1.02	18.00	168	.73	.73	.00	3616.
1.01	18.15	73	.01	.00	.00	189.	1.02	18.15	169	.07	.06	.00	3388.
1.01	18.30	74	.01	.00	.00	170.	1.02	18.30	170	.07	.06	.00	3057.
1.01	18.45	75	.01	.00	.00	156.	1.02	18.45	171	.07	.06	.00	2766.
1.01	19.00	76	.01	.00	.00	142.	1.02	19.00	172	.07	.06	.00	2487.
1.01	19.15	77	.01	.00	.00	127.	1.02	19.15	173	.07	.06	.00	2209.
1.01	19.30	78	.01	.00	.00	112.	1.02	19.30	174	.07	.06	.00	1921.
1.01	19.45	79	.01	.00	.00	96.	1.02	19.45	175	.07	.06	.00	1649.
1.01	20.00	80	.01	.00	.00	81.	1.02	20.00	176	.07	.06	.00	1384.
1.01	20.15	81	.01	.00	.00	69.	1.02	20.15	177	.07	.06	.00	1165.
1.01	20.30	82	.01	.00	.00	57.	1.02	20.30	178	.07	.06	.00	971.
1.01	20.45	83	.01	.00	.00	48.	1.02	20.45	179	.07	.06	.00	807.
1.01	21.00	84	.01	.00	.00	40.	1.02	21.00	180	.07	.06	.00	674.
1.01	21.15	85	.01	.00	.00	35.	1.02	21.15	181	.07	.06	.00	578.
1.01	21.30	86	.01	.00	.00	30.	1.02	21.30	182	.07	.06	.00	498.
1.01	21.45	87	.01	.00	.00	26.	1.02	21.45	183	.07	.06	.00	433.
1.01	22.00	88	.01	.00	.00	23.	1.02	22.00	184	.07	.06	.00	380.
1.01	22.15	89	.01	.00	.00	21.	1.02	22.15	185	.07	.06	.00	337.
1.01	22.30	90	.01	.00	.00	19.	1.02	22.30	186	.07	.06	.00	304.
1.01	22.45	91	.01	.00	.00	17.	1.02	22.45	187	.07	.06	.00	277.
1.01	23.00	92	.01	.00	.00	16.	1.02	23.00	188	.07	.06	.00	255.
1.01	23.15	93	.01	.00	.00	15.	1.02	23.15	189	.07	.06	.00	238.
1.01	23.30	94	.01	.00	.00	14.	1.02	23.30	190	.07	.06	.00	225.
1.01	23.45	95	.01	.00	.00	13.	1.02	23.45	191	.07	.06	.00	212.
1.02	0.	96	.01	.00	.00	13.	1.03	0.	192	.07	.06	.00	202.
									SUM	36.40	34.61	1.79	87771.
										(925.1(	879.1(	45.1(	2485.4(1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3491.	2591.	877.	457.	87672.
CMS	111.	72.	29.	13.	2483.
INCHES		23.73	32.63	33.98	33.98
MM		602.86	828.81	863.13	863.13
AC-FT		1269.	1739.	1811.	1811.
THOUS CU M		1561.	2145.	2234.	2234.

HYDROGRAPH AT STA O-IN1 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	1.	1.	1.
1.	2.	2.	3.	4.	5.	7.	8.	10.	12.
14.	16.	19.	23.	29.	35.	42.	47.	55.	61.

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

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS			
				RATIO 1 .32	RATIO 2 .33	RATIO 3 .34	RATIO 4 .35
HYDROGRAPH AT	U-EGL	1.00	1	1258.	1297.	1337.	1376.
		2.591	1	35.621(	36.741(	37.851(	38.961(
ROUTED TO	DAGL	1.00	1	1232.	1271.	1309.	1349.
		2.591	1	34.891(	35.981(	37.071(	38.191(

Output Summary
Overtopping Analysis
Various PMF Events
Something Green B Dam
MO 30719

88

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	801.60	801.60	806.10
	STORAGE	18.	18.	52.
	OUTFLOW	0.	0.	1273.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.32	806.00	0.	51.	1232.	0.	41.75	0.
.33	806.09	0.	52.	1271.	0.	41.75	0.
.34	806.18	.08	53.	1309.	.75	41.75	0.
.35	806.27	.17	54.	1349.	1.00	41.75	0.

Output Summary
Overtopping Analysis
Various PMF Events
Something Green B Dam
MO 30719

B9

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS			
				RATIO 1 .25	RATIO 2 .50	RATIO 3 .75	RATIO 4 1.00
HYDROGRAPH AT	B-101	1.00	1	983.	1966.	2948.	3931.
		(2.591)		(27.831)	(55.661)	(83.491)	(111.321)
ROUTED TO	BA41	1.00	1	983.	1965.	2949.	3931.
		(2.591)		(27.261)	(55.641)	(83.501)	(111.321)

Output Summary
Various PMF Events
Something Green B Dam
MO 30719
B10

89

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	STORAGE	801.60	801.60	806.10
	OUTFLOW	18.	18.	52.
		0.	0.	1273.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.25	809.33	0.	44.	963.	0.	41.75	0.
.50	806.99	.89	62.	1965.	2.75	41.50	0.
.75	807.93	1.83	68.	2949.	4.50	41.50	0.
1.00	807.95	1.85	73.	3931.	5.75	41.50	0.

Output Summary
Various PMF Events
Something Green B Dam
MO 30719

B11

B10

APPENDIX C

Preliminary Engineering Geology Report
Something Green Estates

Missouri Geological Survey

LIMINARY ENGINEERING GEOLOGY REPORT, SOMETHIN' GREEN ESTATES, WASHINGTON COUNTY

Two reconnaissance field investigations were made of the proposed lake site development on Rouge Creek located in the E½ sec. 1, T. 38 N., R. 1 E., and the western half of sec. 6, T. 38 N., R. 2 E., Richwoods Quadrangle. The reconnaissance investigation stressed the springs and wells located on the property and to get the general idea of the soils and bedrock characteristics. The bedrock that will be encountered in this area for the dam construction will be principally of the Eminence Formation. There are local masses of reef structures that have a tendency to be a problem in dam construction. These reef structures are usually quite vuggy and transmit large volumes of water. The dams will be located in the lower portion of the formation.

The surface weathering characteristics of the Eminence Formation is quite varied from flat dense flagstone type such as is found in the bed of the stream immediately between the old barns and the log house to a very pinnacled rough irregular surface; an indication of this pinnacling is visible in the bed of the stream just below the barn above the lower spring.

For dam construction and ease of sealing off any seepage under the dam, it would be much easier and cheaper to construct the dam where these flat bed areas are exposed. In walking the stream the second time, two of these areas were noticed. One immediately above the log cabin and one several hundred yards upstream between the second and third crossing. The abutments would probably be a problem in construction of dams due to the apparent unevenness of the bedrock as all the loose joints will have to be cleaned, excavated, and backfilled with good clay to prevent lateral seepage around the abutments.

The soils that overlie the bedrock are highly varied from a very less easily compacted clay with almost a impervious nature as found on the slopes of the rock. However also encountered, and overlying the rock, is a residual soil that was formed in place that has a tendency to be stony, well structured clay that has permeability equal to that of the sand even after it has been reworked and compacted by normal engineering techniques. However, it is felt that most of this material for construction of the dam can be obtained from the colluvial slopes which have a much better quality material for constructing of dams. Little or no problem should result from within the embankment after construction. Compacting at proper moisture content and density will be of a necessity.

It is believed that these the springs that will be flooded by the lower lake, are springs that are located primarily by the tight and impervious bed of dolomite that is exposed in the streambed immediately below the springs. If this is true, then these should not cause any problems in the construction of the dam.

It is recommended that some backhoe test pits be taken to bedrock at the location of each dam and along the proposed centerline, particularly within the abutment area. This is to expose the bedrock in the area to determine the nature of the bedrock and to determine the problems that would be encountered in construction of the dam. Also it would give aid in design of the core trench.

It appears possible to have three impoundments on the property. Theses tests should be taken at all three sites.

It is further recommended that a minimum of three cores be taken along the proposed centerline of the dam to determine what the rock conditions are at depth for the dams on Kings Creek. It would not be necessary to drill on the tributary to the creek. These cores should go at least 20 feet into rock so that the nature of the rock as to any openings, such as joints or vugs that would probably have to be grouted to prevent water loss within the lower horizon that can be identified. These borings should be conducted particularly if the observations of the test wells within the valley show a great deal of fluctuation with rainfall. If not and the backhoe test pits look satisfactory, the drilling could possibly be concluded, but they should be planned for and not dropped until the evaluation of the fluctuation of the water within the wells and what the nature of the materials exposed by the backhoe are thoroughly studied.

The Engineering Geology Section of the Missouri Geological Survey will be happy to be present during the digging of the backhoe test pits and make any further recommendations that would be necessary at that time.

Edwin L. Lutzen, Geologist
Engineering Geology
Missouri Geological Survey and Water Resources
October 29, 1970

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Something Green Dam A

ENGINEERING GEOLOGY OF THE SOMETHING GREEN LAKE SITE AND DEVELOPMENT WASHINGTON COUNTY, MISSOURI

The Something Green Lake Site and Land Development, located in sec. 6, T. 38 N., R. 2 E., Washington County, is considered, geologically, a good lake site; due to the type of heavy clay soils that overlie the bedrock within this area.

The investigation of the core trench at the lower dam site indicates that there is sufficient quality of clay to prevent the infiltration of the water into the bedrock provided that the core trench is widened out to approximately two dozer blades wide to help block off the flow of water that was flowing at that time above the bedrock and below the soils. This cutoff trench will stop this type of water flow.

The septic tanks should not be considered for the housing development within this area as the soils are not conducive for septic tanks. The clays are of a tight nature that are impermeable to water. All septic tanks would fail by filling up the drainfields within a matter of use and thereby flow off onto the surface and eventually flow into the lake causing pollution, particularly of the quieter arms. It is a rule of thumb that where good lake sites can be developed because of the clay situation, such as at this particular site, that septic tanks will not work adequately. Therefore, due consideration to a central collection system ending in a lagoon downstream from the dam would be advantageous to this area. The lagoons can be constructed in such a manner and design to which the effluent would not seriously contaminate the creek flow below the dam.

The borrow material for the dam should be primarily recovered from the upper portions of the water filled valley to increase the depth and reduce the amount of vegetation that would start in the more shallow waters. It would also be advantageous to doze the existing creek channel full of material on the bank to prevent any type of seepage along the old stream channel.

Edwin R. Lutzen
Geologist
Engineering Geology
Missouri Geological Survey
September 15, 1971


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