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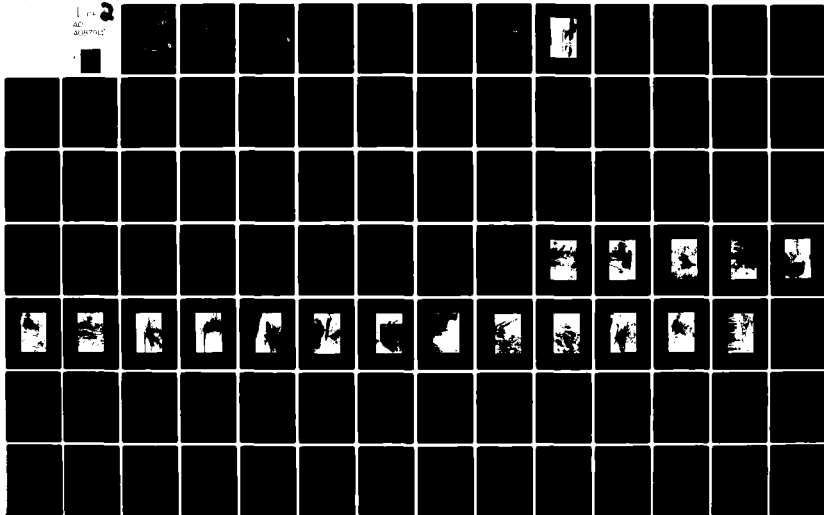
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POTOMAC RIVER BASIN
TOMS CREEK, ADAMS COUNTY

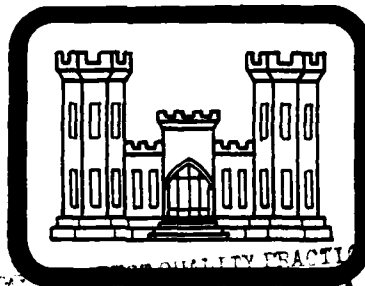
PENNSYLVANIA
NDS ID PA. 01135
DER ID 1-86

LEVEL II

SECTION F DAM

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

✓ WOODWARD-CLYDE CONSULTANTS
✓ DACW31-80-C-0018



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⑥ National Dam Inspection
Program Section F Dam

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POTOMAC RIVER BASIN

Toms Creek,

SECTION F-DEM, ADAMS COUNTY
PENNSYLVANIA

(NDE)
NATIONAL I.D. NO. PA 01135,
DER I.D. NO. 1-86

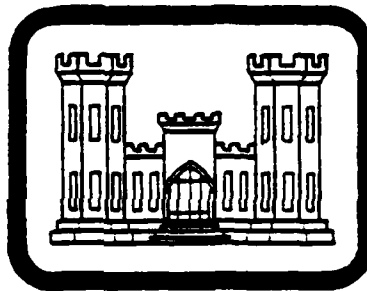
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PHASE I INSPECTION REPORT
~~NATIONAL DAM INSPECTION PROGRAM~~

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Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
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Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to expeditiously identify those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed 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 reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

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

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Section F Dam
County Located:	Adams County
State Located:	Pennsylvania
Stream:	Off-stream pond adjacent to Toms Creek
Coordinates:	Latitude 39° 44.5' Longitude 77° 22.3'
Date of Inspection:	April 21, 1980

Section F Dam and reservoir are used for recreational purposes. The embankment and dike forming the impoundment are owned by six individuals, with a seventh owning a portion of the reservoir. Visual inspection indicates that the spillway of Section F Dam is in good condition, that the embankment and dike are in poor condition as a result of lack of maintenance, and that a serious threat to the integrity of the dike and the embankment is presented by the adjacent Toms Creek. Therefore, the overall rating of this dam is poor.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Small" size dam and "High" hazard potential classification is one-half to the full Probable Maximum Flood (PMF). Based on the small total capacity of the reservoir and the topography of the area, the one-half PMF has been selected as the spillway design flood.

Hydrologic and hydraulic computations presented in Appendix D indicate that the spillway structure is capable of discharging about 0.43 PMF without overtopping. The one-half PMF is estimated to overtop the embankment by about 0.4 foot for less than three hours. It is further assessed that, neglecting the effects of the adjacent Toms Creek, the embankment is not likely to fail during one-half the PMF. Therefore, the structure is considered to have an "Inadequate" but not "Seriously Inadequate" spillway classification.

A far more serious threat to the stability of the embankment and dike is the migration of Toms Creek towards the toe of the reservoir. Streambed migration is a natural phenomenon which, in this case, is accelerated by the exposed bedrock in the streambed which dips towards the embankment. Even in areas where the low flow streambed is not immediately

SECTION F DAM, NDS I.D. No. PA 01135

adjacent to the toe, high flows in the creek flowing over the floodplain have started erosion immediately adjacent to the toe.

It is recommended that the following measures be taken as specified. Items (1) and (3) should be performed under the supervision of a registered professional engineer experienced in the design and construction of dams.

- (1) A hydrologic/hydraulic study should be made to determine the best method of increasing the spillway capacity to meet current hydrologic/hydraulic criteria. In addition, a detailed hydrologic/hydraulic investigation should be made of Toms Creek channel and its contributing watershed to more accurately determine their influence on Section F embankment and dike.
- (2) Further migration of Toms Creek channel towards the toe of the embankment must be prevented. This may be accomplished by a proper design of erosion resistant materials on the right bank of the channel.
- (3) All brush and trees should be removed from the dam and dike and the embankment returned to its original condition.
- (4) A formal agreement should be entered into by the owners of the embankment and reservoir areas. The purpose of the agreement would be to provide for the implementation of the above recommendations and to provide routine maintenance of the embankment, dike and spillway.

The following items are of a routine maintenance nature and should be done as soon as practical.

- (5) The pond drain should be fitted at the upstream end with an operational control, and the downstream gate valve should be exercised and lubricated as necessary to insure its proper functioning.
- (6) All burrowing animals must be removed and their burrows filled.

Because of the potential for property damage and loss of life in the event of failure, a formal procedure of

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observation and warning during periods of high precipitation should be developed and implemented for this facility. An operation and maintenance procedure, including a checklist of items to be inspected regularly, should be formalized and implemented to insure that all items are inspected on a regular basis and the embankment and dike are maintained in the best possible condition.

Mary F. Beck

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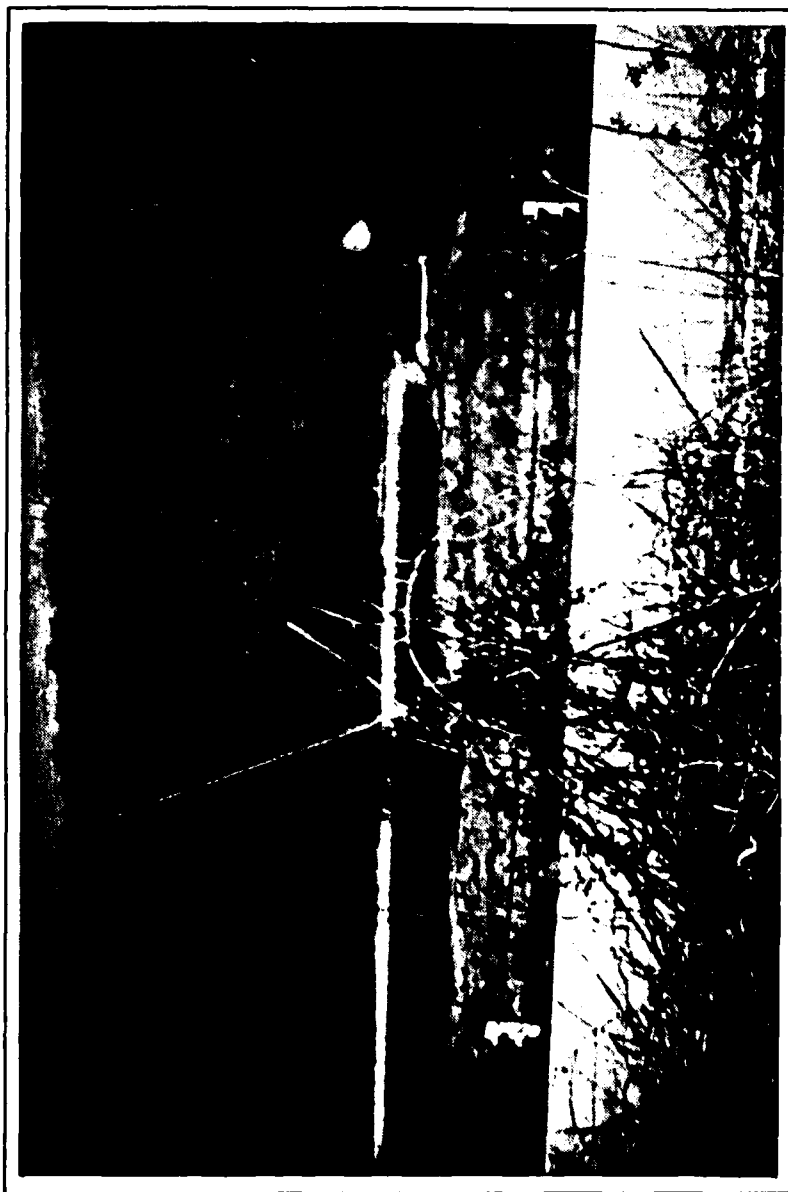
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APPROVED BY:

James E. Beck

31 July 1980
Date



OVERVIEW
SECTION F DAM, LIBERTY TOWNSHIP, ADAMS COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
SECTION F DAM
NATIONAL ID NO. PA 01135
DER NO. 1-86

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Section F Dam is an earthen embankment approximately 22 feet high and 2,800 feet long. For purposes of this report, the embankment is considered divided into two portions: the dam from Station 0+00 to about 13+00, and a dike from Station 13+00 to 28+00. The reservoir was constructed as an off-channel pond, and a major portion of the embankment, about 2,550 feet, parallels Toms Creek. It is believed that the dike upstream of Station 19+50 is natural ground, excavated on one side for the relocated Toms Creek channel and on the other side for the reservoir. The downstream end of the embankment deflects slightly upstream at about Station 8+00 and deflects away from the stream channel at Station 3+00 so that the portion of the embankment containing the spillway is aligned approximately perpendicular to the stream. The upstream slope above the waterline ranges from about 1.4H:1V to 1.7H:1V. About 1,000 feet of the embankment, including the maximum section, is protected with riprap on the upstream slope. The crest generally averages about 14 to 16 feet wide and is grass covered. The downstream embankment slope ranges from about 1.7H:1V to 2.0H:1V. Most of the downstream embankment is covered with trees and underbrush.

A concrete chute spillway is located through the maximum section. The spillway is 11 feet wide with a 17 foot

wide entrance, about four feet below the underside of a bridge crossing the spillway, and contains a fish ladder in the center of the chute. The entrance to the chute spillway is at elevation 502. The single lane bridge crosses the spillway with no piers. The chute discharges at about elevation 489.1, approximately five feet above the discharge channel bed.

A pond drain is located through the embankment where the embankment deflects away from Toms Creek. The drain consists of a ten inch cast iron pipe which is controlled by a gate valve at the downstream end. The intake is completely underwater.

Water is diverted from Toms Creek into the reservoir through a 20 inch cast iron pipe located at the upstream end of the embankment. Flow through the 20 inch pipe can be closed off on the creek side by means of a plate. The plate pivots on a bolt at its upper corner. The reservoir is also filled by surface runoff from the 0.3 square mile drainage area on the upstream side of the dam.

b. Location. Section F Dam is located in the Borough of Carroll Valley, Liberty Township, Adams County, Pennsylvania. The dam is located approximately 2,300 feet north of the intersection of Pennsylvania Routes 116 and 16. The reservoir is shown on the USGS Quadrangles entitled "Emmitsburg, Maryland-Pennsylvania" and "Blue Ridge Summit, Maryland-Pennsylvania" at coordinates N 39° 44.5' W 77° 22.3'. A regional location plan of Section F Dam and reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as a "Small" size structure by virtue of its estimated 231 acre-foot total storage capacity and less than 40 foot height.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive property damage and loss of life downstream along Toms Creek.

e. Ownership. Information received from the Adams County Tax Office indicates that six individuals own portions of the embankment. One other individual owns property which extends into the reservoir. The names and addresses of the owners are included as Appendix G. Mr. Shu Sing Chang has owned the portion of the embankment containing the maximum section, spillway and pond drain since fall 1979.

f. Purpose of Dam. The reservoir is used for recreational purposes.

g. Design and Construction History. In 1963, Mr. Charles G. Rist, deceased, approached the local USDA Soil Conservation Service office for assistance in developing an off-channel pond on property that he owned. On April 9, 1964, Mr. Rist submitted an application to the state for a permit to construct a water impoundment or pond along Toms Creek and to relocate a section of the creek. As the watershed above the creek was less than one square mile, a permit was not required to construct the dam, but only to relocate the creek. On May 7, 1964, the state prepared a "Report Upon the Application of Mr. Rist" to relocate the channel. The report indicates that the relocated channel bed was to be 60 feet wide with side slopes of 2H:1V. The off-channel pond was to be approximately 130 feet to the right of the proposed channel and to receive its water through a six inch supply line located 550 feet above the new channel. The elevation of the top of the bank of the pond was to be six feet above the elevation of the stream bed of the new channel. On May 12, 1964, a permit for the stream relocation was issued by the Water & Power Resources Board, with an expiration date of December 31, 1965. In October 1965, the Board wrote to Mr. Rist reminding him that the permit was to expire by the end of the year. Mr. Rist replied on stationery of Charnita, Inc., that the idea of building a lake as originally planned had been abandoned. No changes had been made to Toms Creek channel, and therefore an extension of the permit was unnecessary. The only subsequent records in the state files are three photographs taken not earlier than June 1967.

Construction drawings for the concrete chute spillway are dated May 31, 1967. Conversations with the engineer, Mr. G. Yachine, indicate that the embankment was designed prior to the spillway. Subsequently, the developer declared bankruptcy prior to 1975.

h. Normal Operating Procedures. Under normal conditions, water enters the reservoir from Toms Creek through the 20 inch pipe at the upper end. All flow is discharged through the concrete chute spillway at the maximum section. No minimum downstream flow is required by the state.

1.3 Pertinent Data.

A summary of pertinent data for Section F Dam is presented as follows.

- | | | |
|----|------------------------------|---------|
| a. | Drainage Area (square miles) | 0.3 |
| b. | Discharge at Dam Site (cfs) | |
| | Maximum Known Flood | Unknown |
| | At Minimum Embankment Crest | 263 |

c.	Elevation (feet above MSL) ⁽¹⁾	
	Top of Dam	506.3
	Spillway Crest	502.0
	Intake Conduit from Stream	
	Inlet Invert	502.5
	Outlet Invert	502.3
	Downstream Toe	486.8
	Discharge Channel Bed At	
	Spillway	484.3
	Pond Drain Outlet Invert	485.5±
d.	Reservoir (feet)	
	Length at Normal Pool	2,400
	Length at Maximum Pool (est)	2,400
e.	Storage (acre-feet)	
	Normal Pool (est)	125
	At Minimum Embankment Crest (est)	231
f.	Reservoir Surface (acres)	
	Normal Pool	23.5
g.	Dam Data	
	Type	Earth
	Length	2,850 feet
	Height (above discharge channel bed)	22± feet
	Crest Width	14 feet
	Upstream Slope	1.4H:1V to 1.7H:1V
	Downstream Slope	1.7H:1V to 2.0H:1V
	Volume	51,000 cubic yards
	Cutoff	Unknown
	Grout Curtain	Unknown
h.	Spillway	
	Type	Concrete channel, chute & plunge pool
	Elevation	502.0 feet
	Width	11 feet
i.	Pond Drain	
	Type	Cast iron pipe w/ 10 inch gate valve at downstream end
	Length	Unknown
	Inlet Invert Elevation	Unknown
	Outlet Invert Elevation	485.5±

(1) All elevations are relative to the spillway crest, shown to be elevation 502.0 on the design drawing (Appendix E).

SECTION 2 ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data available is presented in the checklist attached as Appendix B. As noted in this appendix, there were no original design data available. The only design drawings available were two sheets containing the design of the concrete chute spillway. The only records contained in Department of Environmental Resources (DER) files pertain to the application and permit for Toms Creek channel relocation. There was no construction documentation available.

b. Design Features. The principal design features are illustrated on the plan, profile and spillway plates enclosed in Appendix E. Information was obtained from the available drawings and from measurements taken during the usual inspection. A summary of the pertinent features is included in Section 1.3.

2.2 Construction.

There are no available construction data for this dam.

2.3 Operational Data.

No water level or rainfall measurements are maintained by the owners.

2.4 Evaluation.

a. Availability. All information presented herein was obtained from limited records located in the Department of Environmental Resources files in Harrisburg, Pennsylvania, from conversations with Mr. Aylwyn Williams, Carroll Valley Borough Manager, Geo-Technical Services (design of concrete spillway), and from Mr. Chang who owns most of the dam.

b. Adequacy. The available data were not adequate to evaluate the engineering aspects of this dam and appurtenant structures.

c. Validity. It was reported by the Soil Conservation Service District Conservationist for Adams County that the original site proposed by Mr. Rist for the pond was located north of the present site. Therefore, plan drawings located in DER files apparently were not developed for the present structure.

SECTION 3 VISUAL INSPECTION

3.1 Findings.

a. General. Observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix A, and are summarized and evaluated in the following subsections. For purposes of this report, the embankment is divided into two portions; the dam containing the concrete spillway and pond drain, extending from Stations 0+00 to 13+00; and a dike, extending from Station 13+00 to 28+00. In general, the appearance of the facility indicates that the dam and dike are in poor condition.

b. Dam and Dike. The vertical alignment of the dam and dike was checked, and a profile is shown on Plate 3, Appendix E. No discernible horizontal displacement or bulging was noted along the crest. The crest itself is protected with grass. The grass is worn and the crest slightly rutted as a result of vehicle traffic to about Station 2+50. Shallow desiccation cracks were noted along the crest at the maximum section.

The upstream slope ranges from about 1.4H:1V to 1.7H:1V. The upstream slope of the embankment from Station 0+00 to 10+00 is protected with riprap, as shown in Photograph 9. The riprap appears to be recently placed (subsequent to construction), although trees are gaining foothold, as shown in the photograph. There is erosion around both upstream sides of the concrete chute spillway, as shown in Photograph 14, resulting from foot traffic.

The junction between the right abutment and the downstream slope was in good condition with no erosion apparent. Nearly the entire downstream embankment was covered with trees and brush, as shown in Photograph 7, with poor ground cover. There were several footpaths worn through the embankment, as shown in Photograph 15. Foot traffic has caused erosion along both sides of the concrete chute spillway. The slope of the downstream embankment ranges from about 1.7H:1V to 2.0H:1V. Erosion/foot traffic has damaged the downstream slope at the corner of the embankment (see sheet 5B, Appendix A) so that the slope near the downstream edge of the crest is about 1.5H:1V, and the entire embankment slope is uneven. There was an animal burrow in the embankment to the right of the spillway.

A marshy area with cattails was noted beyond the downstream toe of the dam and in the right abutment area above the reservoir level. Very slight seepage through the embankment was noted, as shown on sheet 5B of 11, Appendix A.

An apparent slide has occurred on the upstream side of the dike at the location shown on sheet 5B, Appendix A, about Station 26+50, reducing the crest width from an average of 14 to 16 feet wide to a minimum width of seven feet. Erosion has occurred on the upstream side of the dike in the vicinity of Station 25+50. The upstream slopes between approximately Station 25+00 to about 26+50 are particularly steep, approaching 1H:1V. However, the water level in the reservoir is lower than the adjacent stream at this location. A stump at the waterline near the upper end of the reservoir and a large tree on the embankment crest appear to predate construction. The tree, at about Station 20+00, appears to be on natural ground with no fill. Brush and trees were growing on the upstream dike near the upper end of the reservoir. There was evidence of muskrats or similar burrowing animals on the upstream slope and under the water level.

Approximately 2,550 feet of the embankment parallels Toms Creek. As the bedrock of Toms Creek dips towards and under the embankment, the stream is migrating towards the embankment toe. The erosion scarp, shown in Photographs 16 and 17, is about seven feet high. At the time of the inspection, the creek had not eroded any compacted embankment fill, although erosion has reached a point that it is directly below the toe of the downstream slope. Even in areas where the low flow streambed is not immediately adjacent to the toe, high flows in the creek flowing over the floodplain have started erosion immediately adjacent to the toe; see sheet 5A, Appendix A.

c. Appurtenant Structures.

1. Spillway. The concrete spillway is composed of a channel through the dam, a chute and a shallow plunge pool at the downstream toe. The spillway is shown in Photographs 1 and 2. A one lane bridge crosses the channel, as shown in Photograph 8. All exposed concrete appears to be in good condition with no spalling, significant cracking or other deterioration noted. There were no changes in chute wall alignment that would have resulted from settlement or rotation of the walls. Differences between the design drawings and the constructed spillway are that the inlet is about 17 feet wide, tapering to 11 feet at a point 3.83 feet downstream of the inlet edge, instead of a constant width of 11 feet, and the vertical distance between the chute floor and underside of the bridge is 4.0 feet instead of 4.5 feet.

The design drawings enclosed in Appendix E indicate that four inch perforated drain tile is to collect and convey seepage through both the left and the right downstream end walls. The outlet end of the right drain was visible and dry. Seepage at the rate of about two gallons per minute was exiting the left spillway downstream head wall from an irregular opening, shown in Photograph 13, at the point where the perforated drain tile is shown on the drawing. A ruler could be inserted sixteen inches into the opening. A tree, as shown in Photograph 12, is growing at the junction of the spillway chute and left downstream end wall. The root mass of this tree is visible where the seepage is exiting the end wall, shown in Photograph 13. There was no evidence of turbidity in the seepage.

The design drawings indicate that the spillway chute was constructed over a bed of fine sand. The spillway was designed to have a five foot deep cutoff wall at the upstream edge and a cutoff wall under the dam centerline extending two feet below the chute slab. The design drawings also indicate that a downstream cutoff wall is founded a minimum of six inches into rock, and the normal stream bed elevation would be one-half foot below the elevation of the chute floor. At the time of the inspection, however, the tail water was approximately four feet below the chute floor and the pool was about 12 inches deep. Probing the pool floor indicated that it was rock, and probing under the spillway disclosed no undermining of the spillway structure.

2. Outlet Works. As shown in Photograph 4, a ten inch gate valve is located in Toms Creek floodplain at the downstream corner of the embankment. A cast iron pipe apparently extends through the embankment into the reservoir. There was no visible sign of an intake structure either above or below the reservoir water level. The gate valve is rusted and the invert is silted over. Standing water was observed in a hole below ground level adjacent to the conduit. The gate valve was not operated during the inspection, and its existence was unknown to the Carroll Valley Borough authorities.

d. Reservoir. The reservoir slopes adjacent to the water are moderate and vegetated to the water's edge with trees, brush and grass. No debris was noted. No sediment was noted at the upstream end of the reservoir.

e. Downstream Channel. Section F Dam was built in the floodplain of Toms Creek, which flows along a major length of the embankment, about 2,550 feet. The drainage area contributing to the creek runoff is about 13.5 square miles. The lower end of the dam is built where the valley narrows and

both side slopes are steep, about 28 and 50 percent as measured from USGS maps. The creek channel varies from 44 feet wide at a point 700 feet upstream of the dam, to 30 feet wide at about Station 12+80 (location of rapids), and to about 50 feet wide 500 feet downstream of the dam. The channel below the spillway, shown in Photograph 3, joins with Toms Creek about 250 feet below the dam. The floodplain below the dam remains fairly narrow for about 2,500 feet where, at the intersection of Pennsylvania Routes 116 and 16, it opens up somewhat. Just below the highway intersection is a horse barn subject to damage in the event of failure of Section F Dam. Farther downstream, a housing development has been planned in the floodplain area and roads have been constructed. Between 1.0 and 1.3 miles below the dam, at least four houses have been constructed in the floodplain, one of which is shown in Photograph 18. These homes are subject to flooding in the event of large flows in Toms Creek or Friends Creek, which joins with Toms Creek 1.3 miles below the dam.

3.2 Evaluation.

Inspection of the dam and appurtenant facilities disclosed no evidence of apparent past or present movement that would indicate existing instability of the embankment, spillway or outlet structure. The old slip surface on the upstream side of the dike indicates an embankment instability not related to foot traffic or erosion. Damage to the embankment and dike has resulted from foot traffic, erosion and burrowing animals. The presence of the tree stump at the waterline on the upstream side of the dike indicates that point is natural ground and that clearing and grubbing was not done prior to dike construction. The old tree at Station 20+00 indicates that point of the dike is also natural ground. These items, together with the slip surface, strongly suggest that the dike, from about Station 19+50, is original ground excavated on one side for Toms Creek channel relocation, and on the other side for the reservoir. From about Station 19+50, the elevation of the downstream toe of this dike is above the normal reservoir level.

All trees and brush should be removed from the upstream and downstream slopes of the embankment and dike, and the slopes restored to their original condition. All burrowing animals should be removed and their burrows repaired. Damage to the downstream embankment resulting from foot traffic and erosion should be repaired.

The current USGS map indicates about 3,000 feet of Toms Creek channel has been relocated, from a point just downstream of the dam to a point upstream of the dike. The original channel bed was likely toward the center of the reservoir. The dipping bedrock of Toms Creek channel bed has caused migration of the creek towards the embankment toe, which must be halted and the embankment and dike protected from erosion resulting from normal and high flows in Toms Creek. If remained unchecked, erosion and bank undercutting by Toms Creek will undermine the embankment and cause failure. The brush on the channel banks should be cut to reduce resistance to large flows in Toms Creek.

Seepage downstream of the dam is considered to be essentially hillside seepage. Seepage through the embankment, as shown on sheet 5B, is considered to be minor, requiring only monitoring for increases in amount or signs of turbidity.

The concrete chute spillway was observed to be in good condition, with no signs of excessive scour or undermining at the outlet. A considerable amount of seepage was exiting from behind the left downstream end wall. The trees growing behind the headwall should be removed, including the root mass, and the area backfilled according to the original design drawings. The gate valve at the outlet of the pond drain should be checked and maintained to insure that it is operational.

In conclusion, although showing the effects of lack of routine maintenance, the spillway and embankment appear to be well constructed. The quality of dike construction may have been less rigorous, but is generally adequate as the upstream portion of the dike serves primarily to contain flow in Toms Creek. The principle danger to dike stability appears to be erosion from high flows (and velocities) in Toms Creek, as discussed in Section 5.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Procedures.

Operation of the dam does not require a dam tender. Under normal conditions, water enters the upper end of the reservoir through the 20 inch pipe, and all flow is discharged over the concrete spillway.

4.2 Maintenance of the Dam.

No routine maintenance has been provided for this structure, except for a small portion near the upstream end by one of the owners.

4.3 Maintenance of Operating Facilities.

No routine maintenance has been provided for the operating facilities of this dam.

4.4 Warning Systems In Effect.

There are no warning systems in effect for this dam.

4.5 Evaluation.

It is judged that the current operating procedure, which does not require a dam tender, is a realistic means of operating the relatively simple control facilities of Section F Dam. A formal agreement should be entered into by the various owners concerning the maintenance and operation of Section F Dam. It is noted that formal operational, maintenance and warning procedures should be developed and implemented. Maintenance procedures should include an inspection checklist with a listing of items to be checked during each inspection and repaired as necessary to insure proper performance of this structure.

SECTION 5 HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design/Evaluation Data. There are no original design or subsequent evaluation data available for this dam. It was reported by the engineer who designed the spillway structure for the dam that no hydrologic/hydraulic analyses were performed. The watershed is roughly triangular in shape, with the reservoir forming the base of the triangle. The base of the triangle is about 2,800 feet long, and the height is a maximum of 4,000 feet. The watershed has a total drainage area of 0.3 square miles. Elevations range from a high of about 880 at the upper reaches to the normal pool elevation of 502 feet. The existing watershed is about half wooded with some residential development. Eventually, the entire watershed will be a residential development.

Section F Dam is an off-channel dam and is built adjacent to Toms Creek. The watershed contributing to flow in the creek is about 5.3 miles long and ranges from 2.0 to 3.8 miles wide, having a total area of 13.5 square miles. Elevations range from a high of 1,837 in the upper reaches to an estimated channel invert of about 500 adjacent to the upper end of the structure. The watershed is over two-thirds wooded and contains some steep mountainsides. Residential development is limited to immediately upstream of the dam in the eastern portion of the watershed and is estimated to comprise no more than 20 percent of the total drainage area.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Small" size dam and "High" hazard potential classification is one-half to the full Probable Maximum Flood (PMF). Because the estimated total capacity of the reservoir is nearer the lower limit for a "Small" size classification and because of the adjacent Toms Creek and steep topography (indicating the possibility that the whole dam and reservoir would be submerged during the full PMF), the selected spillway design flood is one-half the PMF.

b. Experience Data. There are no records of reservoir levels or rainfall maintained for this dam. There are no estimates or records of previous high water levels.

c. Visual Observations. At the time of the inspection, the only condition observed that might indicate a possible reduction in spillway capacity is that the spillway is fairly

small, four feet high by 11 feet wide, with no trash rack, and it is possible that debris would clog the spillway entrance during a large storm. At the time of the inspection, however, no large debris was noted along the reservoir edges. Observations regarding the condition of the downstream channel, spillway and reservoir are located in Appendix A and discussed in greater detail in Section 3.

d. Overtopping Potential. The overtopping potential of this dam was estimated using the "HEC-1, Dam Safety Version" computer program. A brief description of the program is included in Appendix D. Three upstream dams have been conservatively neglected in determining the inflow hydrograph for Toms Creek. Calculations for this investigation estimate a spillway discharge of about 240 cfs with a reservoir level at the minimum top of the embankment. The HEC-1 program computed the 0.5 PMF peak inflow to be about 597 cfs. It is estimated that 0.5 PMF will overtop the embankment at the right abutment by about 0.4 foot for about 2.5 hours. The embankment is assessed not to fail as a result of surface runoff from the contributing watershed during the 0.5 PMF. It is estimated that the spillway is capable of discharging about 0.43 PMF without overtopping the embankment.

An estimate of the effects of the 0.5 PMF storm over the watershed contributing to flow in Toms Creek was also made. The runoff hydrograph with a 13.5 square mile drainage area contributing to flow in Toms Creek was computed. The hydrograph was routed through a section upstream of the reservoir to check the possibility that the reservoir would be flooded by high flows from Toms Creek entering the upstream end. The hydrograph was also routed through a section adjacent to the reservoir to check the possibility that flow in the creek would be deep enough to flood the reservoir from the side. The outflow hydrograph from the reservoir and the channel hydrograph were added and routed downstream to the hazard center. Results of these analyses indicated that during the 0.5 PMF event, a significant amount of water will not enter the reservoir from the upper end. However, flow at the section US2 shown on Plate 1A is estimated to have a maximum stage of 508.5 during the 0.5 PMF, higher than the top of the dike, thus flowing over the lower end of the embankment. The computer program also indicates about 1.6 feet of flooding in the first floor of the houses 1.5 miles downstream of the dam.

As noted in Section 3, the relocated Toms Creek channel is migrating towards its former location as a result of the sloping bedrock of the channel bottom. An erosion scarp about seven feet high is near the toe of the dam, as

shown on sheet 5B of 11, Appendix A. At a section just upstream of the rapids, the computer estimated the 0.5 PMF discharge through the channel to be about 11,800 cfs, and the depth of flow is expected to exceed the top of the embankment at this point. The estimated velocities are on the order of 12 feet per second, far in excess of what the channel bank and even the embankment slope with grass and trees are capable of withstanding. Therefore, the possibility exists that the embankment may fail during the spillway design flood, not as a result of overtopping from within the reservoir, but as a result of external overtopping of the reservoir and erosion on the downstream slope adjacent to Toms Creek.

e. Spillway Adequacy. A spillway that will not pass 0.5 PMF without overtopping the dam is rated as "Seriously Inadequate" provided two other conditions are present, one of which is failure of the dam by overtopping. As Section F Dam is assessed not to fail as a result of runoff during the spillway design flood from its contributing watershed, the spillway classification for this structure is considered to be "Inadequate" but not "Seriously Inadequate".

f. Downstream Conditions. About 2,500 feet downstream of the dam is a horse barn built on the floodplain, which would be subject to damage in the event of sudden failure of the dam. About 2,000 feet farther downstream are housing development roads built in the floodplain adjacent to the stream. About one mile downstream of the dam are two new homes built in the floodplain. About 1.3 miles downstream of the dam, Friends Creek joins with Toms Creek. At the confluence of the two creeks, two homes are built in the floodplain and are subject to flooding in the event of high flows in the creeks or as a result of sudden failure of Section F Dam. Therefore, a "High" hazard potential classification is justified for Section F Dam.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. Evaluation of structural stability of Section F Dam is composed of two separate problems: evaluation of embankment stability considering the reservoir and embankment alone, and evaluation of structural stability considering the effects of flow in Toms Creek. The upstream embankment slopes are fairly steep, ranging from about 1.4H:1V to 1.7H:1V. Downstream slopes are somewhat flatter, ranging from 1.7H:1V to 2.0H:1V. The crest width ranges from 7 to 16 feet. Although the embankment appears well constructed, lack of routine maintenance is evident. Brush and trees have apparently never been removed from the embankment since it was constructed, and damage to the embankment has resulted from burrowing animals both upstream and downstream and by foot traffic in the vicinity of the pond drain.

It is believed that the dike upstream from about Station 13+00 is natural ground excavated on one side for the relocated Toms Creek channel and on the other side for the reservoir. The old tree which predates the embankment at about Station 20+00 appears to indicate that the original ground in this vicinity has not been altered. The stump at about Station 23+00 indicates that the dike is either natural ground or that clearing and grubbing did not precede the construction of the dike. Erosion at about Station 25+50 and the slip scar at about Station 26+50 give further credence to the theory that the upstream portion of the dike was formed by excavation of the reservoir and relocated channel.

Only a relatively small amount of seepage is at the downstream end of the embankment, which can be attributed to seepage through or under the embankment. No seepage was observed that could be attributed to flow along the pond drain conduit.

A far more serious threat to the stability of the embankment and dike is the migration of Toms Creek towards the toe of the reservoir. Streambed migration is a natural phenomenon which, in this case, is accelerated by the exposed bedrock in the streambed which dips towards the embankment. Even in areas where the low flow streambed is not immediately adjacent to the toe, high flows in the creek flowing over the floodplain have started erosion immediately adjacent to the toe; see sheet 5A, Appendix A.

b. Design and Construction Data. No drawings, design data or construction documentation exist for the embankment or dike. Thus, there are no stability analyses of the embankment or dike in existence. The maximum height of the dam is about 22 feet. Based on the geometric configuration of the embankment and the fact that it appears to be well constructed, the embankment is qualitatively assessed to be stable at this time, neglecting the effects of flow in Toms Creek. The stability of the dike is questionable, owing to the existing slope failure. However, since the dike elevation is higher than the embankment, the stability is considered to be adequate, provided the existing failure is repaired.

Detrimental to the long-term stability of the embankment and dike is the flow in Toms Creek. Normal flow in Toms Creek below the rapids is directed towards the toe of the embankment by the sloping bedrock and has produced an erosion scarp on the order of seven feet high. Flood flows in Toms Creek during the spillway design flood (0.5 PMF) are estimated to approach velocities on the order of 12 feet per second and would overtop the embankment in the area of the rapids, and greater flows would fill the reservoir from the upstream end. Thus, it is considered that the embankment and dike would be unstable during high flows in Toms Creek, as a result of erosion.

c. Operating Records. There are no operational records for this structure.

d. Post-Construction Changes. There are no records nor is there any evidence that post-construction changes were made to this structure.

e. Seismic Stability. The dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. As the dam is qualitatively assessed to be stable under static loading conditions, neglecting potential erosion along the side by Toms Creek, it can reasonably be assumed to be stable under seismic loading conditions.

SECTION 7 ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. Visual inspection indicates that the spillway of Section F Dam is in good condition; that the embankment and dike are in poor condition as a result of lack of maintenance, foot traffic damage, and damage from burrowing animals; and that a serious threat to the integrity of the dike and the embankment is presented by the adjacent Toms Creek. Therefore, the overall rating of this dam is poor.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Small" size dam and "High" hazard classification is one-half to the full Probable Maximum Flood (PMF). Based on the small total reservoir capacity and the topography of the area, the one-half PMF has been selected as the spillway design flood.

Hydrologic and hydraulic computations presented in Appendix D indicate that the spillway structure is capable of discharging about 0.43 PMF without overtopping. The one-half PMF is estimated to overtop the embankment by about 0.4 foot for less than three hours. It is further assessed that, neglecting the effects of the adjacent Toms Creek, the embankment is not likely to fail during one-half the PMF. Therefore, the structure is considered to have an "Inadequate" but not "Seriously Inadequate" spillway classification.

b. Adequacy of Information. The combined visual inspection and simplified calculations presented in Appendix D were sufficient to indicate that further investigations are required for this structure.

c. Urgency. It is recommended that the measures presented in Section 7.2 be implemented as specified.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be taken immediately. Items (1) and (3) should be performed under the supervision of a registered professional engineer experienced in the design and construction of dams.

- (1) A hydrologic/hydraulic study should be made to determine the best method of increasing the spillway capacity to meet current hydrologic/hydraulic criteria. In addition, a detailed hydrologic/hydraulic investigation should be made of Toms Creek channel and its contributing watershed to more accurately determine their influence on Section F embankment and dike.
- (2) Further migration of Toms Creek channel towards the toe of the embankment must be prevented. This may be accomplished by a proper design of erosion resistant materials on the right bank of the channel.
- (3) All brush and trees should be removed from the dam and dike and the embankment returned to its original condition.
- (4) A formal agreement should be entered into by the owners of the embankment and reservoir areas. The purpose of the agreement would be to provide for the implementation of the above recommendations and to provide routine maintenance of the embankment, dike and spillway.

The following items are of a routine maintenance nature and should be done as soon as practical.

- (5) The pond drain should be fitted at the upstream end with an operational control, and the downstream gate valve should be exercised and lubricated as necessary to insure its proper functioning.
- (6) All burrowing animals must be removed and their burrows filled.

b. Operation and Maintenance Procedures. Because of the potential for property damage and loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented for this facility. An operation and maintenance procedure, including a checklist of items to be inspected regularly, should be formalized and implemented to insure that all items are inspected on a regular basis and the dam and dike are maintained in the best possible condition.

APPENDIX

A

CHECK LIST
VISUAL INSPECTION
PHASE I

Sheet 1 of 11

Name Dam Section F Dam County Adams State Pennsylvania National ID # PA 01130
Type of Dam Earth Hazard Category High
Date(s) Inspection 4/21/1980 Weather Warm, sunny Temperature 60's

Pool Elevation at Time of Inspection 502.2 M.S.L. Tailwater at Time of Inspection 485.3± M.S.L.

Inspection Personnel:

Mary F. Beck (Hydrologist) Vincent McKeever (Hydrologist)
Arthur H. Dvinoff (Geotechnical) John H. Frederick (Geotechnical)
Raymond S. Lambert (Geologist)

Mary F. Beck Recorder

Remarks:

Mr. Rick Fiscel of Carroll Valley Borough was on site and provided assistance to the inspection team.
Mr. Aylwyn Williams, Borough Manager also provided assistance.

CONCRETE/MASONRY DAMS

Sheet 2 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

Sheet 3 of 11

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

EMBANKMENT

Sheet 4 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	<i>Shallow desiccation cracks were noted on the crest and portions of the downstream slope. The crest is rutted from vehicle traffic.</i>	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	<i>None observed.</i>	
SLOUGHING OR EROSION OF EMBANKMENT AND ADJUTMENT SLOPES	<i>Several foot paths have been worn on the downstream slope. An apparent slide has occurred on the upstream side of the dike (See Sheet 5A). The adjacent stream is causing serious erosion at the downstream toe. Animal burrows were observed on the downstream slope and there is evidence of muskrats (or similar animals) on the upstream slope under water.</i>	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	<i>No discernable horizontal movement of the crest was observed. Vertical alignment was checked and is shown on Plate 3, Appendix E.</i>	
RIPRAP FAILURES	<i>None, although riprap appears undersized. Small trees are gaining foothold in the riprap.</i>	

EMBANKMENT

Sheet 5 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
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VEGETATION

The crest is protected by grass which is in fair condition. The upstream and downstream slopes are covered with trees, brush, briars, etc. Tree trunks are up to 6-7 inches in diameter. Multiflora rose is gaining a foothold on the embankment.

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

Junctions of embankment and abutments are tree and brush covered with no significant erosion noted. Foot traffic has worn paths along each side of spillway chute and has caused sloughing at the inlet and along the spillway chute.

ANY NOTICEABLE SEEPAGE

Very slight seepage was observed as shown on Sheet 5B.

STAFF GAGE AND RECORDER

None

DRAINS

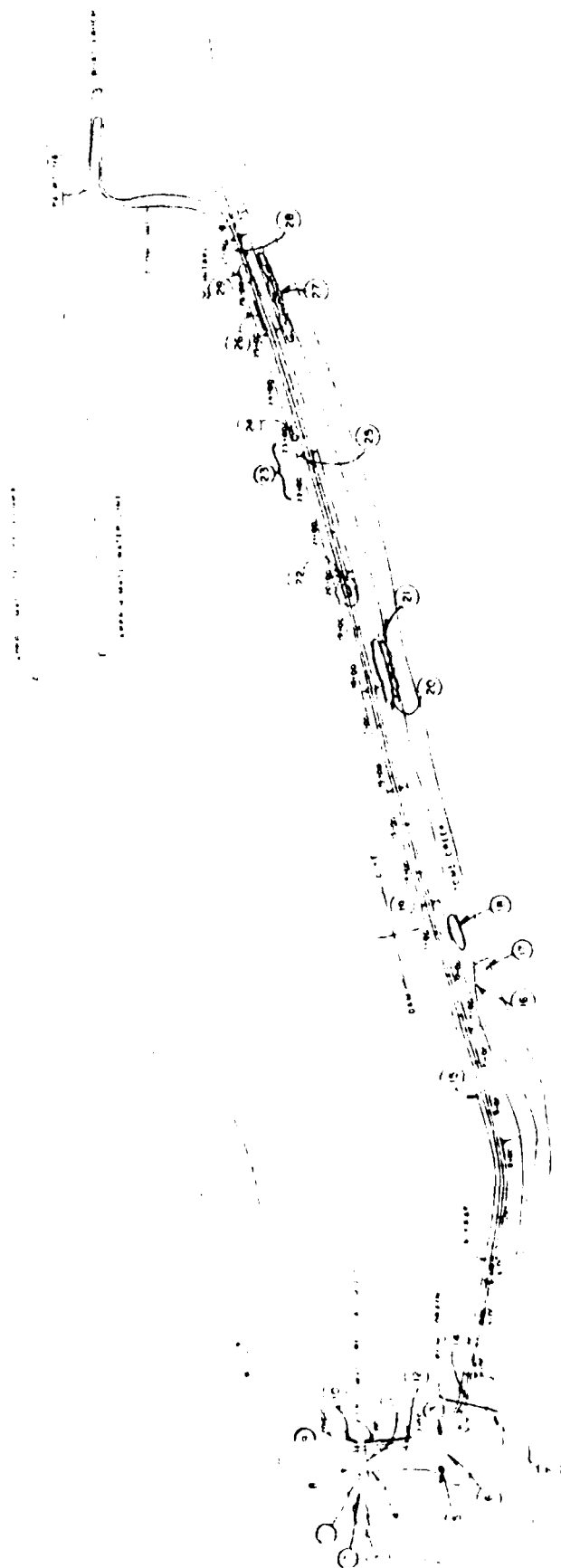
None located.

SHEET 5A OF 11

- (1) Embankment drain outlet dry.
- (2) No evidence of undercutting at downstream end of spillway.
- (3) Marshy area and cattails.
- (4) Considerable seepage through hole of head wall, root mass visible.
- (5) Slight seepage through embankment.
- (6) Downstream embankment tree and brush covered.
- (7) Standing water visible below ground adjacent to pond drain conduit.
- (8) Groundhog burrow.
- (9) Wet, marshy above reservoir level.
- (10) Erosion behind spillway wing walls, trees gaining hold on upstream slope.
- (11) Footpaths on both sides of spillway chute.
- (12) Vehicle tracks worn through vegetation and crest slightly rutted.
- (13) Minor desiccation cracks visible.
- (14) Downstream embankment damage by foot traffic.
- (15) Woody vegetation growing through riprap.
- (16) Erosion scarp on the order of 7 to 8 feet high.
- (17) Bedrock on channel bottom dips towards embankment
- (18) This area appears to contain dumped fill with considerable rock.
- (19) Evidence of burrowing animals such as muskrats.
- (20) High flow erosion on flood plain.
- (21) Small trees and brush growing at channel edge.
- (22) Large trees predating dike construction.
- (23) No brush on upstream or downstream embankment slope and grass is cut.
- (24) Large tree and tree stump immediately above water line.
- (25) Erosion has produced nearly vertical slopes.
- (26) Erosion
- (27) Brush
- (28) Upstream slopes of dike, tree and brush covered.
- (29) Slope failure scarp producing minimum width.

NOTE: Crest profile shown on Plate 3, Appendix E.

FIELD OBSERVATION PLAN
SECTION F DAM
SHEET 5B OF 11



FOR NOTE EXPLANATION SEE SHEET
5A OF 11

OUTLET WORKS

Sheet 6 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A. Conduit appears to be a 10 inch diameter metal pipe.	
INTAKE STRUCTURE	Underwater, not observed.	
OUTLET STRUCTURE	The conduit has gate valve at downstream end and discharges onto the stream floodplain. The gate valve is rusted and the invert as silted over.	
OUTLET CHANNEL	N/A	
EMERGENCY GATE	The gate valve was not operated during the inspection. Borough officials did not know of its existence.	

UNGATED SPILLWAY

Sheet 7 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE WEIR	The spillway is a concrete channel through the dam, a discharge chute, and a shallow plunge pool at downstream toe. All exposed concrete appears in good condition with no spalling, significant cracking or other deterioration noted. There were no changes resulting from settlement or rotation of wall observed.	
APPROACH CHANNEL	None	
DISCHARGE CHANNEL	The spillway chute downstream discharges about 4 feet above the plunge pool. The plunge pool appears to be about 1 foot deep.	
BRIDGE AND PIERS	A single lane bridge with no piers crosses the spillway.	
RELIEF DRAINS	A 4-inch drain through the right downstream wing wall was rust stained. A 4-inch x 2 inch hole through the left downstream wing wall was discharging an estimated 2 gpm. A ruler could be inserted 16 inches into the hole.	

GATED SPILLWAY

Sheet 8 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

Sheet 9 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION

MONUMENTATION/SURVEYS

None known.

OBSERVATION WELLS

None

WEIRS

None

PIEZOMETERS

None

OTHER

None

RESERVOIR

Sheet 10 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

SLOPES

The slope adjacent to the reservoir is moderate and vegetated to the water's edge with grass and brush. No debris was noted.

SEDIMENTATION

No sediment was observed at the upper end of the reservoir.

DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONDITION
(OBSTRUCTIONS,
DEBRIS, ETC.)

The six foot wide channel from the spillway joins with Toms Creek about 1200 feet below the dam after meandering through the floodplain.

SLOPES

The valley gradient below the dam is about 0.003.

APPROXIMATE NO.
OF HOMES AND
POPULATION

About 2500 feet below the dam is a horse barn built in the floodplain. About 500 feet further downstream are 2 houses which would be damaged in the event of failure. About one mile below the dam is a planned residential development where at least four homes are already built in the floodplain.

APPENDIX

B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Section F
ID # PA 01130

Sheet 1 of 4

ITEM

REMARKS

AS-BUILT DRAWINGS

None known. Dam plan and profile data obtained during visual inspection.

REGIONAL VICINITY MAP

Plate 1, Appendix E.

CONSTRUCTION HISTORY

See text, Section 1.2

TYPICAL SECTIONS OF DAM

Appendix E.

OUTLETS - PLAIN

DETAILS

CONSTRAINTS

DISCHARGE RATINGS

RAINFALL/RESERVOIR RECORDS

Appendix E.

Appendix D.

None

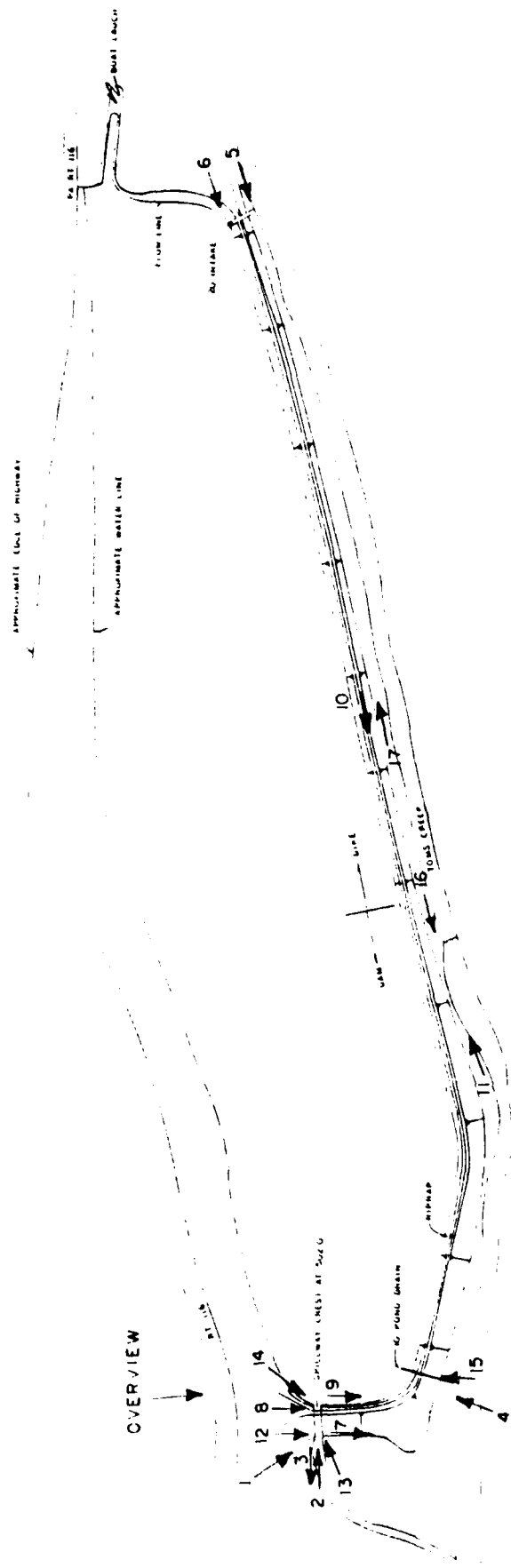
ITEM	REMARKS
DESIGN REPORTS	None
GEOLOGY REPORTS	See Section F.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None known, no hydrologic analysis performed for chute spillway.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None known.
POST-CONSTRUCTION SURVEYS OF DAM	None known.
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	<i>None</i>
MODIFICATIONS	<i>None since chute spillway constructed.</i>
HIGH POOL RECORDS	<i>None</i>
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	<i>None</i>
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	<i>None</i>
MAINTENANCE OPERATION RECORDS	<i>None</i>

ITEM	REMARKS
SPILLWAY PLAN	Appendix E.
SECTIONS DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	None

APPENDIX

C



PHOTOGRAPH LOCATION PLAN
SECTION F DAM
PLATE C-1



VIEW OF DOWNSTREAM EMBANKMENT AND
SPILLWAY.

PHOTOGRAPH NO. 1



SPILLWAY WITH FISH LADDER AND PLUNGE
POOL.

PHOTOGRAPH NO. 2



CHANNEL BELOW SPILLWAY.

PHOTOGRAPH NO. 3



POND DRAIN CONTROL.

PHOTOGRAPH NO. 4



INLET HEAD WALL AND PLATE FOR CLOSING
OF CONDUIT

PHOTOGRAPH NO. 5



CONDUIT DISCHARGING INTO RESERVOIR
FROM TOMS CREEK

PHOTOGRAPH NO. 6



DOWNSTREAM SLOPE LEFT OF SPILLWAY.

PHOTOGRAPH NO. 7



CREST AND BRIDGE OVER SPILLWAY.

PHOTOGRAPH NO. 8



UPSTREAM SLOPE.

PHOTOGRAPH NO. 9



VIEW OF CREST WITH RESERVOIR ON THE
RIGHT AND TOMS CREEK TO THE LEFT.
LEFT BANK OF TOMS CREEK IS BEDROCK.



TOMS CREEK LOOKING UPSTREAM.

PHOTOGRAPH NO. 11



DOWNSTREAM END OF SPILLWAY.
NOTE LARGE TREE.

PHOTOGRAPH NO. 12



A 2-INCH X 4-INCH HOLE DIRECTLY UNDER
LARGE TREE SHOWN IN PHOTOGRAPH NO. 12.

PHOTOGRAPH NO. 13



EROSION ADJACENT TO UPSTREAM
SPILLWAY WALL.

PHOTOGRAPH NO. 14



FOOTPATH WITH EROSION ON
DOWNSTREAM SLOPE.

PHOTOGRAPH NO. 15



BEDROCK IN LEFT BANK OF TOMS CREEK
DIPS TOWARD RIGHT CHANNEL BANK.
SCARP IS ABOUT 7 FEET DEEP.

PHOTOGRAPH NO. 16



EROSION AT TOE CAUSED BY HIGH FLOWS.
TOMS CREEK IS TO THE RIGHT OF THE
PICTURE.

PHOTOGRAPH NO. 17



DOWNSTREAM HOUSE BUILT IN FLOOD
PLAIN.

PHOTOGRAPH NO. 18

APPENDIX

D

SECTION F DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Small, steep hillside, partly wooded, full residential development planned.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 502.0 feet (125 Acre-Feet).

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 506.3 feet (231 Acre-Feet).

ELEVATION MAXIMUM DESIGN POOL: ----

ELEVATION TOP DAM: 506.3 feet.

SPILLWAY

a. Elevation 502.0 feet.

b. Type Concrete channel, chute, plunge pool.

c. Width Entrance, 17 feet; channel, 11 feet.

d. Length 58.5 feet.

e. Location Spillover Near right abutment.

f. Number and Type of Gates None

OUTLET WORKS:

a. Type 10 inch CIP.

b. Location About Station 3+00.

c. Entrance inverts Unknown.

d. Exit inverts 485.5± feet.

e. Emergency draindown facilities The above

HYDROMETEOROLOGICAL GAGES:

a. Type None within watershed.

b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE: Not determined.

SECTION F DAM
HYDROLOGIC AND HYDRAULIC
BASE DATA

Sheet 2 of 11

DRAINAGE AREA: (1) Dam Watershed 0.3 square miles; Toms Creek Watershed, 13.5 square miles.

PROBABLE MAXIMUM PRECIPITATION (PMP)
FOR 10 SQ. MILES IN 24 HOURS: (2) 23.7 inches

ADJUSTMENT FACTORS FOR DRAINAGE AREA (%): (3)

Zone	<u>6</u>
6 Hours	<u>110</u>
12 Hours	<u>120</u>
24 Hours	<u>129</u>
48 Hours	<u>140</u>

SNYDER HYDROGRAPH PARAMETERS: (4)

	SECTION F DAM 32	TOMS CREEK WATERSHED 32
Zone	<u>32</u>	<u>32</u>
C _p , C _t	<u>0.75, 1.9</u>	<u>0.75, 1.9</u>
L (5)	<u>1.14 mile</u>	<u>7.67 miles</u>
L _{ca} (6)	<u>0.71 mile</u>	<u>3.88 miles</u>
tp=C _t (L·L _{ca}) ^{0.3}	<u>1.28</u>	<u>5.26</u>

SPILLWAY CAPACITY AT MAXIMUM
WATER LEVEL (7) 263 cfs

-
- (1) Measured from USGS maps.
 - (2) Hydrometeorological Report No. 33, Figure 1.
 - (3) Hydrometeorological Report No. 33, Figure 2.
 - (4) Information received from Corps of Engineers, Baltimore District.
 - (5) Length of longest water course from outlet to basin divide, measured from USGS maps.
 - (6) Length of water course from outlet to point opposite the centroid of drainage area, (see Plate 1, Appendix E) measured from USGS maps.
 - (7) See Sheet 11 of this Appendix.

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputted and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

BY MEB DATE 6/4/80
CHKD. BY AHD DATE 6/5/80

SUBJECT Section F Dam
Hydrology / Hydraulics

SHEET 4 OF 11
JOB No. _____

Classification (Ref. - Recommended Guidelines for Safety Inspection of Dams.)

1. The hazard classification is rated as "High" as there would be loss of life in the event of failure.
2. The size classification is "Small" based on its less than 40 ft. height and 231 Ac-Ft total storage capacity.
3. The selected spillway design flood, based on size and hazard classification, is 0.5 PMF (Probable Maximum Flood).

Hydrology and Hydraulic Analysis

1. Original Data. There is no original design data for the dam. The state recommended the relocated channel be designed to discharge 4375 cfs. The channel was to be 60 ft. wide, have 2H:1V side slopes, flow 4.5 ft deep for a capacity of 4195 cfs.

2. Evaluation Data.

Inflow Hydrograph - Rainfall and Snyder's hydrograph parameters are shown on sheet 2.

Elevation - Storage Data - shown on sheet 7
Areas were measured from USGS maps and volume computed by program.

Elevation - Discharge Data - shown on sheet 7
use Manning's Equation to estimate spillway discharge

$$Q = a \frac{1.49}{n} (A/w.p.)^{2/3} S^{1/2}$$

$$n \sim 0.015$$

$$b = 11 \text{ ft.}$$

$$s = 0.002$$

} field checked

assume entrance loss to chute 0.2 velocity head ($\frac{v^2}{2g}$)

d	Q	v	$\frac{v^2}{2g}$	$0.2 \frac{v^2}{2g}$	W.S. ($d + \frac{v^2}{2g} + 0.2 \frac{v^2}{2g}$)
0	0				502.0 ✓
1	44 ✓	3.97 ✓	0.24 ✓	0.05 ✓	503.3 ✓
2	126 ✓	5.73 ✓	0.51 ✓	0.10 ✓	504.6 ✓
3	228 ✓	6.91 ✓	0.74 ✓	0.15 ✓	505.9 ✓
4	342 ✓	7.78 ✓	0.94 ✓	0.19 ✓	507.1 ✓

BY MEB DATE 6/4/80

SUBJECT

SHEET 5 OF 11CHKD. BY AND DATE 6/5/80Section F Dam

JOB No.

Hydrology / Hydraulics

Spillway Adequacy - as the spillway is not capable of passing the spillway design flood (0.5PMF) without overtopping the embankment, the spillway is considered "Inadequate". As the embankment is not assessed to fail by overtopping during 0.5PMF, the spillway is not considered "Seriously Inadequate".

3. Effect of adjacent Toms Creek

It is considered possible that flow in Toms Creek may enter the reservoir from the upstream end.

During 0.5PMF, the maximum stage at the section beside the dam is about 508.5.

Stage 508.5 ft

Discharge 11474.7 cfs

Storage 48.13 Ac-Ft

Reach Length 2275 ft

} sheet 9

$$\text{Cross Section Area} = \frac{48.13 \text{ Ac-Ft}}{2275 \text{ ft}} = \frac{43560 \text{ ft}^2}{\text{Ac}}$$

$$= 921 \text{ ft}^2 \checkmark$$

$$V = Q/A$$

$$= \frac{11474.7 \text{ ft}^3/\text{sec}}{921 \text{ ft}^2}$$

$$= 12.4 \text{ ft/sec} \checkmark$$

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	IN
ROUTE HYDROGRAPH TO	OUT
RUNOFF HYDROGRAPH AT	ICI
ROUTE HYDROGRAPH TO	US1
ROUTE HYDROGRAPH TO	US2
COMBINE 2 HYDROGRAPHS AT	COM
ROUTE HYDROGRAPH TO	US3
ROUTE HYDROGRAPH TO	US4
END OF NETWORK	

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAN SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE= 80/05/25.
 TIME= 12.09.44.

SECTION F DAN
 NAT ID NO. PA 01130 DEN ID NO. 1-86
 OVERTOPPING ANALYSIS

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	INR	IMIN	NETRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0
			JOPER	NUT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED

NPLAN= 1 NRTIO= 4 LRTIO= 1
 RTIO= .40 .50 .60 1.00

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH OF DAN

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IASTG
IN	0	0	0	0	0	1	0	0

HYDROGRAPH DATA									
INYD	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOV	ISAME	LOCAL
1	1	.30	0.00	13.80	1.00	0.000	0	1	0

PRECIP DATA							
SPFE	PNS	R4	R12	R24	R48	R72	R96
0.00	23.20	113.00	123.00	132.00	142.00	0.00	0.00

LOSS DATA										
LROPT	STKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSNX	RTIAP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA		
TP	CP	RTA
1.78	.75	0

RECESSION DATA		
STRTO	SRCSN	RTIOR
-1.50	-.05	2.00

UNIT HYDROGRAPH 20 END-OF-PERIOD ORBINATES, LAG= 1.77 HOURS, CP= .74 VOL= 1.00									
4.	16.	32.	48.	64.	76.	82.	82.	73.	42.
49.	39.	30.	24.	19.	15.	12.	9.	7.	4.
5.	4.	3.	2.	2.	1.	1.	1.		

END-OF-PERIOD FLOW													
NO. DA	HR. MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO. DA	HR. MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
SUM 32.94 30.50 2.44 23853. (837.) (775.) (42.) (675.44)													

HYDROGRAPH ROUTING

OUTFLOW HYDROGRAPH FOR DAN

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

ROUTING DATA							
GLOSS	CLOSS	AVG	IRIS	ISAME	IOPT	IPNP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	ANSKX	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-502.	-1

STAGE	502.00	503.30	504.40	505.90	507.20	508.40
FLOW	0.00	44.00	126.00	228.00	342.00	400.00
SURFACE AREA=	0.	24.	33.			
CAPACITY=	0.	125.	431.			
ELEVATION=	486.	502.	520.			

CREL	SPUID	COBW	EXPU	ELEVL	COQL	CAREA	EXPL
502.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA			
TOPEL	COOB	EIPD	DAMWID
506.3	0.0	0.0	0.

CREST LENGTH	0.	1000.	1300.	1840.	2050.
AT OR BELOW					
ELEVATION	506.3	507.0	508.0	510.0	514.0

SUB-AREA RUNOFF COMPUTATION

SHEET 8 OF 11

TOMS CREEK INFLOW HYDROGRAPH

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRY	INARE	ISTAGE	IAUTO
TCI	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

INHB	IUNB	TAREA	SNAP	IRSDA	IRSPC	RATIO	ISNBW	ISARE	LOCAL
1	1	13.50	0.00	13.80	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PNS	R6	R12	R24	R48	R72	R96
0.00	23.70	110.00	120.00	129.00	140.00	0.00	0.00

IRSPC COMPUTED BY THE PROGRAM IS .811

LOSS DATA

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

UNIT HYDROGRAPH DATA

TP= 5.26 CP= .75 RTA= 0

RECESSION DATA

STRTO= -1.50 ORCSM= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 02 END-OF-PERIOD ORIGINATES, LAQ= 5.23 HOURS, CP= .75 VOL= 1.00

15.	56.	114.	182.	258.	338.	421.	507.	595.	684.
773.	862.	951.	1033.	1103.	1161.	1207.	1242.	1267.	1281.
1284.	1277.	1258.	1226.	1177.	1105.	1021.	944.	872.	806.
745.	688.	636.	588.	543.	502.	464.	429.	396.	366.
338.	313.	289.	267.	247.	228.	211.	195.	180.	166.
154.	142.	131.	121.	112.	103.	96.	88.	82.	75.
70.	64.	60.	55.	51.	47.	43.	40.	37.	34.
32.	29.	27.	25.	23.	21.	20.	18.	17.	16.
14.	13.								

NO.0A	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP 0	NO.0A	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP 0
-------	-------	--------	------	------	------	--------	-------	-------	--------	------	------	------	--------

SUM 26.91 24.49 2.42 854786.
 (684.) (622.) (62.) (24204.84)

HYDROGRAPH ROUTING

SECTION 700 FEET UPSTREAM OF RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRY	INAME	ISTAGE	IAUTO
US1	1	0	0	0	0	1	0	0

ROUTING DATA

GLOSS	CLOSS	AVG	IRCS	ISAME	IDPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

INSTPS INSTDL LAB AMSKE I TSK STORA ISPRAT

1	0	0	0.000	0.000	0.000	0.000	0.	0
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NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELNAX	RLNTH	SEL
.0350	.0350	.0350	505.8	520.0	1080.	.01000

River stage greater than about
 516 will cause flow from Toms
 Creek to enter the upstream end
 of the reservoir

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

0.00	520.00	15.00	515.00	40.50	506.50	42.40	505.80	86.40	505.80
87.10	506.50	118.10	516.30	500.00	520.00				

STORAGE	0.00	.78	1.62	2.55	3.55	4.63	5.79	7.03	8.35	9.74
	11.22	12.78	14.41	16.12	17.92	20.37	24.18	29.35	35.89	43.79
OUTFLOW	0.00	116.05	379.46	762.03	1235.49	1856.12	2542.27	3373.41	4289.69	5311.74
	6440.47	7677.02	9022.69	10478.91	12047.18	13170.95	15034.41	17361.51	20188.66	23581.53
STAGE	505.80	506.35	507.29	508.04	508.79	509.34	510.28	511.03	511.78	512.53
	513.27	514.02	514.77	515.52	516.26	517.01	517.76	518.51	519.25	520.00
FLOW	0.00	116.05	379.46	762.03	1235.49	1856.12	2542.27	3373.41	4289.69	5311.74
	6440.47	7677.02	9022.69	10478.91	12047.18	13170.95	15034.41	17361.51	20188.66	23581.53

MAXIMUM STAGE IS 515.0

MAXIMUM STAGE IS 516.1

MAXIMUM STAGE IS 517.4

MAXIMUM STAGE IS 520.0

HYDROGRAPH ROUTING

SECTION BESIDE DAM

SHEET 9 OF 11

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRY	INANE	ISTAGE	IAUTO
US2	1	0	0	0	0	1	0	0
ROUTING DATA								
GLOSS	CLOSS	AVG	IRIS	ISANE	IOPT	IPMP	LSTR	
0.0	0.000	0.00	1	1	0	0	0	
NSTPS NSTDL LAG AMSKE I TSK STORA ISPRAT								
1 0 0 0.000 0.000 0.000 0. 0								

NORMAL DEPTH CHANNEL ROUTING

ON(1)	ON(2)	ON(3)	ELNVT	ELMAX	RLNTH	SEL
.0450	.0350	.0450	494.0	510.0	2275.	.00500

Top of dike adjacent to this channel section is 507.3.

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

0.00	510.00	13.00	499.50	18.00	498.50	22.00	495.50	50.00	494.00
55.00	497.00	77.00	499.30	107.00	510.00				

STORAGE	0.00	.38	1.49	2.91	4.47	4.39	8.74	11.55	14.53	17.64
	20.75	24.38	27.96	31.70	35.58	39.61	43.79	48.13	52.61	57.24
OUTFLOW	0.00	12.07	80.24	230.44	445.97	734.49	1115.96	1607.28	2196.52	2875.50
	3642.49	4496.83	5438.47	6467.73	7585.18	8791.57	10087.76	11474.72	12953.48	14525.12
STAGE	494.00	494.84	495.68	496.53	497.37	498.21	499.05	499.89	500.74	501.58
	502.42	503.26	504.11	504.95	505.79	506.63	507.47	508.32	509.16	510.00
FLOW	0.00	12.07	80.24	230.44	445.97	734.49	1115.96	1607.28	2196.52	2875.50
	3642.49	4496.83	5438.47	6467.73	7585.18	8791.57	10087.76	11474.72	12953.48	14525.12

MAXIMUM STAGE IS 507.1

MAXIMUM STAGE IS 508.5

MAXIMUM STAGE IS 509.8

MAXIMUM STAGE IS 514.9

HYDROGRAPH ROUTING

SECTION 500 FT DOWNSTREAM OF DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRY	INANE	ISTAGE	IAUTO
DS3	1	0	0	0	0	1	0	0
ROUTING DATA								
GLOSS	CLOSS	AVG	IRIS	ISANE	IOPT	IPMP	LSTR	
0.0	0.000	0.00	1	1	0	0	0	
NSTPS NSTDL LAG AMSKE I TSK STORA ISPRAT								
1 0 0 0.000 0.000 0.000 0. 0								

NORMAL DEPTH CHANNEL ROUTING

ON(1)	ON(2)	ON(3)	ELNVT	ELMAX	RLNTH	SEL
.0550	.0400	.0500	482.8	495.0	580.	.00300

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

0.00	500.00	13.00	490.00	42.00	486.10	52.00	482.00	110.00	482.00
110.00	486.10	290.00	486.20	375.00	496.00				

STORAGE	0.00	.43	.88	1.35	1.82	2.32	3.88	5.80	7.80	9.87
	12.01	14.23	16.51	18.84	21.22	23.65	26.12	28.65	31.22	33.84
OUTFLOW	0.00	56.41	178.80	351.13	567.03	822.81	1230.52	1868.59	2686.14	3666.91
	4802.29	4887.10	7525.23	9106.47	10825.27	12679.10	14666.04	16784.65	19033.84	21412.85
STAGE	482.00	483.44	484.00	484.73	485.37	486.01	486.65	487.29	487.94	488.58
	489.22	489.86	490.51	491.15	491.79	492.43	493.07	493.72	494.36	495.00
FLOW	0.00	56.41	178.80	351.13	567.03	822.81	1230.52	1868.59	2686.14	3666.91
	4802.29	4887.10	7525.23	9106.47	10825.27	12679.10	14666.04	16784.65	19033.84	21412.85

MAXIMUM STAGE IS 491.4

MAXIMUM STAGE IS 492.2

MAXIMUM STAGE IS 493.0

MAXIMUM STAGE IS 495.7

HYDROGRAPH ROUTING

SECTION 1.5 MILES BELOW DAM

ISTAB	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	LAUTO
BS4	1	0	0	0	0	1	0	0
ROUTING DATA								
CLOSS	CLOSS	AV8	IRIS	ISANE	ISPT	IPMP	LSTR	
0.0	0.000	0.00	1	1	0	0	0	
WSTPS	WSTBL	LAG	ANSKK	I	TSK	STORA	ISPRAT	
1	0	0	0.000	0.000	0.000	0.	0	

NORMAL DEPTH CHANNEL ROUTING

ON(1)	ON(2)	ON(3)	ELRVT	ELMAX	RLRTH	SEL
.0500	.0400	.0500	443.0	460.0	2190.	.00570

First floor of house at about 453.

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

0.00	460.70	10.00	454.20	20.00	448.70	45.00	443.70	90.00	445.70
102.00	448.70	100.00	454.70	800.00	460.00				

STORAGE	0.00	.23	2.43	4.91	7.69	10.82	15.20	21.12	28.39	37.61
	48.18	40.30	73.96	89.35	107.03	127.03	149.34	173.96	200.90	230.15
OUTFLOW	0.00	2.67	123.33	368.73	724.12	1209.23	1808.63	2774.37	3907.35	5323.76
	7055.51	9133.25	11586.24	14322.69	17500.82	21216.49	25509.37	30418.90	35983.79	42241.86
STAGE	445.00	445.79	446.58	447.37	448.16	448.95	449.74	450.53	451.32	452.11
	452.89	453.68	454.47	455.26	456.05	456.84	457.63	458.42	459.21	460.00
FLOW	0.00	2.67	123.33	368.73	724.12	1209.23	1808.63	2774.37	3907.35	5323.76
	7055.51	9133.25	11586.24	14322.69	17500.82	21216.49	25509.37	30418.90	35983.79	42241.86

MAXIMUM STAGE IS 453.9

MAXIMUM STAGE IS 454.6

MAXIMUM STAGE IS 455.3

MAXIMUM STAGE IS 457.3

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	RATIO 2	RATIO 3	RATIO 4
				.40	.50	.60	1.00
HYDROGRAPH AT	IN	.30	1	477.	597.	716.	1194.
	(	.78)	(	13.32)	16.90)	20.28)	33.80)
ROUTED TO	OUT	.30	1	242.	408.	632.	1191.
	(	.78)	(	6.85)	11.35)	17.89)	33.72)
HYDROGRAPH AT	TC1	13.50	1	9435.	11794.	14152.	23587.
	(	34.96)	(	267.17)	333.96)	400.75)	667.92)
ROUTED TO	US1	13.50	1	9434.	11793.	14152.	23588.
	(	34.96)	(	267.14)	333.93)	400.73)	667.94)
ROUTED TO	US2	13.50	1	9437.	11796.	14158.	23594.
	(	34.96)	(	267.23)	334.03)	400.90)	668.12)
2 COMBINED	COM	13.00	1	9656.	12052.	14423.	23941.
	(	35.74)	(	273.41)	341.27)	408.40)	677.95)
ROUTED TO	BS3	13.00	1	9657.	12053.	14425.	23937.
	(	35.74)	(	273.47)	341.31)	408.47)	677.82)
ROUTED TO	BS4	13.00	1	9659.	12056.	14425.	23940.
	(	35.74)	(	273.51)	341.40)	408.40)	677.91)

SUMMARY OF DAM SAFETY ANALYSIS

		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION		502.00	502.00	506.30
STORAGE		125.	125.	231.
OUTFLOW		0.	0.	263.

RATIO OF PMF	MAXIMUM RESERVOIR U.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
.40	506.06	0.00	225.	242.	9.00	43.25	9.00
.50	506.64	.34	240.	408.	2.50	42.75	9.00
.60	506.82	.52	244.	632.	3.25	42.00	0.00
1.00	507.07	.77	251.	1191.	5.00	41.50	0.00

PLAN 1 STATION US1

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.40	9434.	513.0	44.50
.50	11793.	514.1	44.50
.60	14152.	517.4	44.50
1.00	23588.	520.0	44.50

PLAN 1 STATION US2

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.40	9437.	507.1	44.50
.50	11794.	508.5	44.50
.60	14158.	509.8	44.50
1.00	23594.	514.9	44.50

PLAN 1 STATION DS3

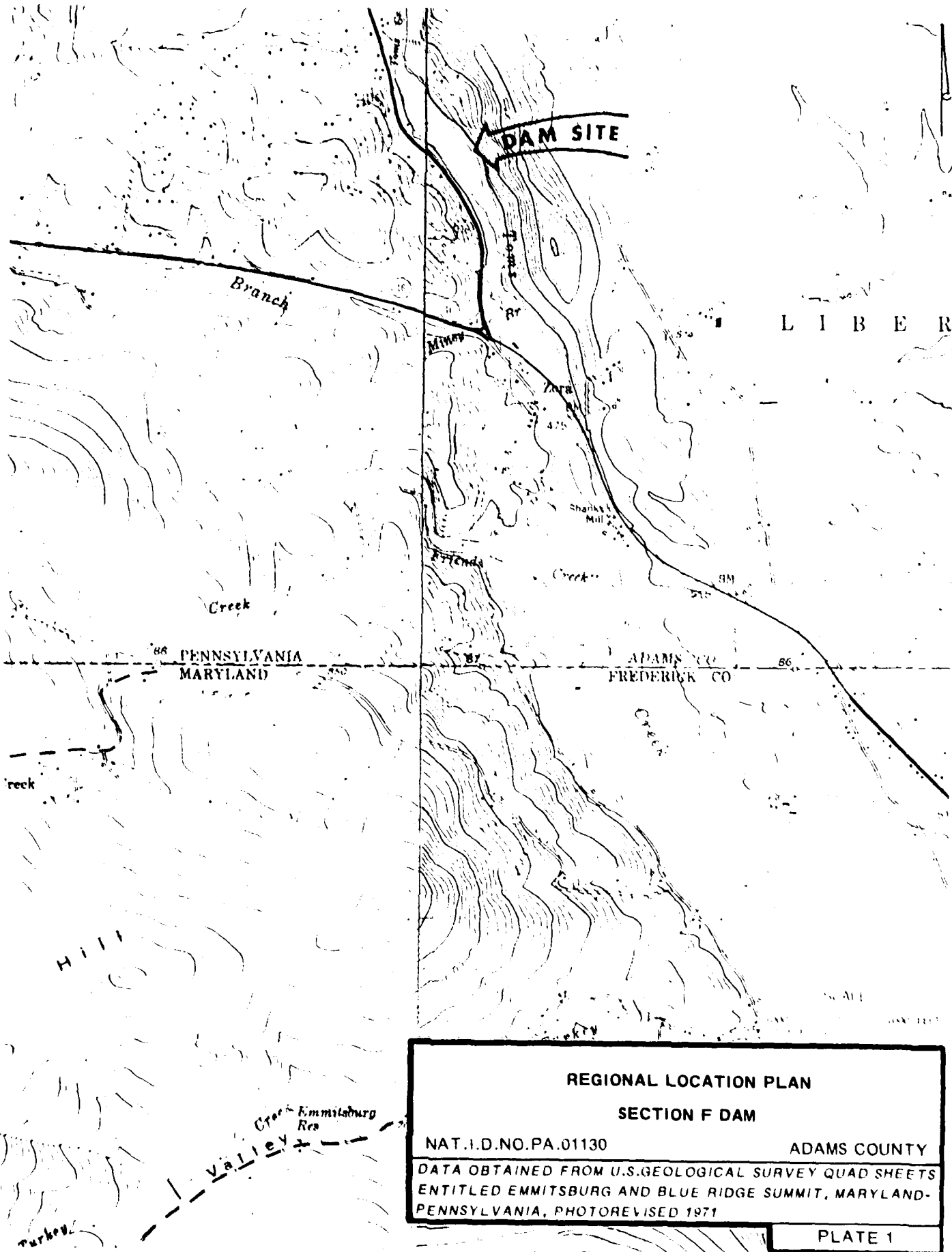
RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.40	9457.	491.4	44.50
.50	12053.	492.2	44.50
.60	14429.	493.0	44.50
1.00	23937.	495.7	44.25

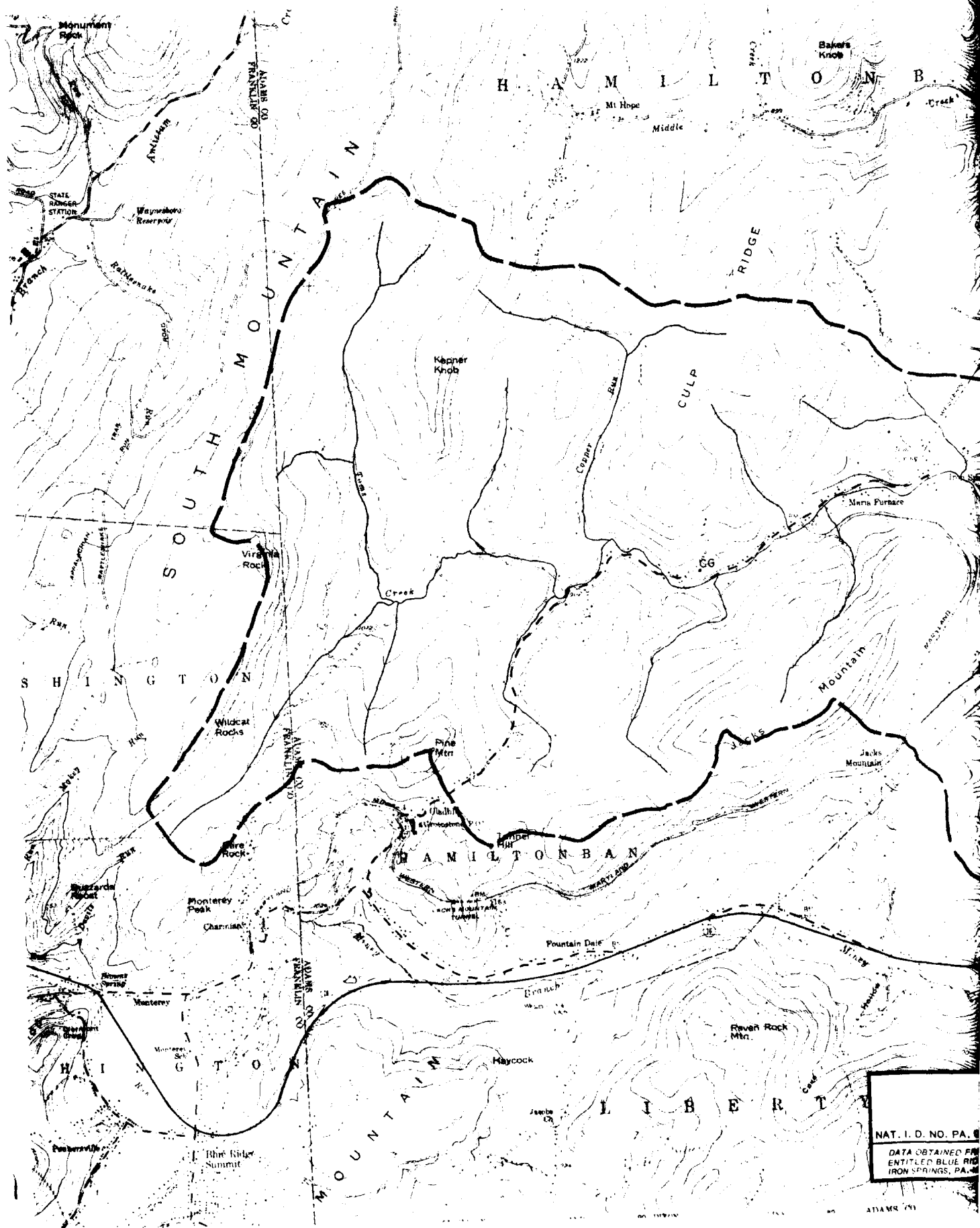
PLAN 1 STATION DS4

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.40	9459.	453.9	44.50
.50	12054.	454.6	44.50
.60	14425.	455.3	44.50
1.00	23940.	457.3	44.50

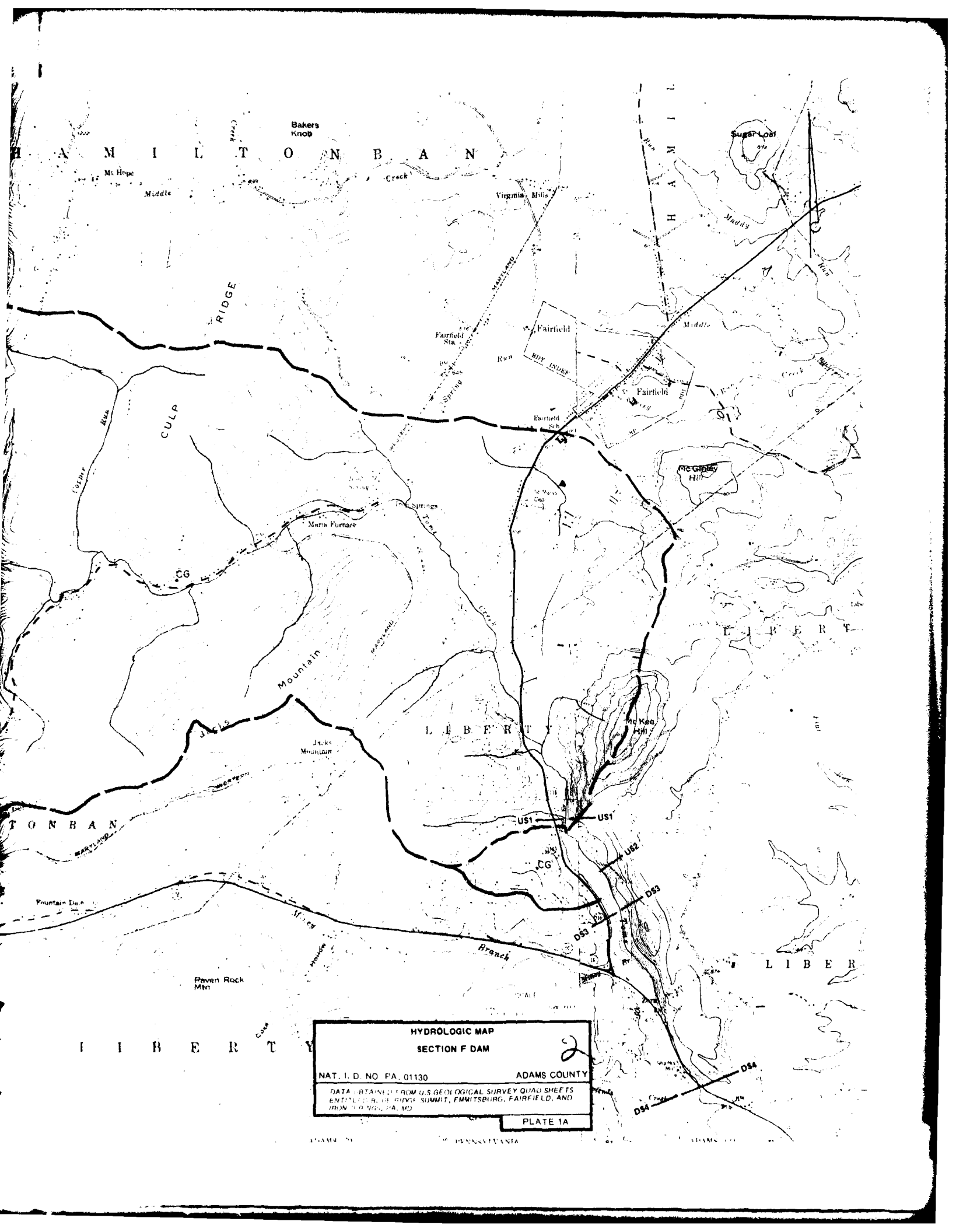
APPENDIX

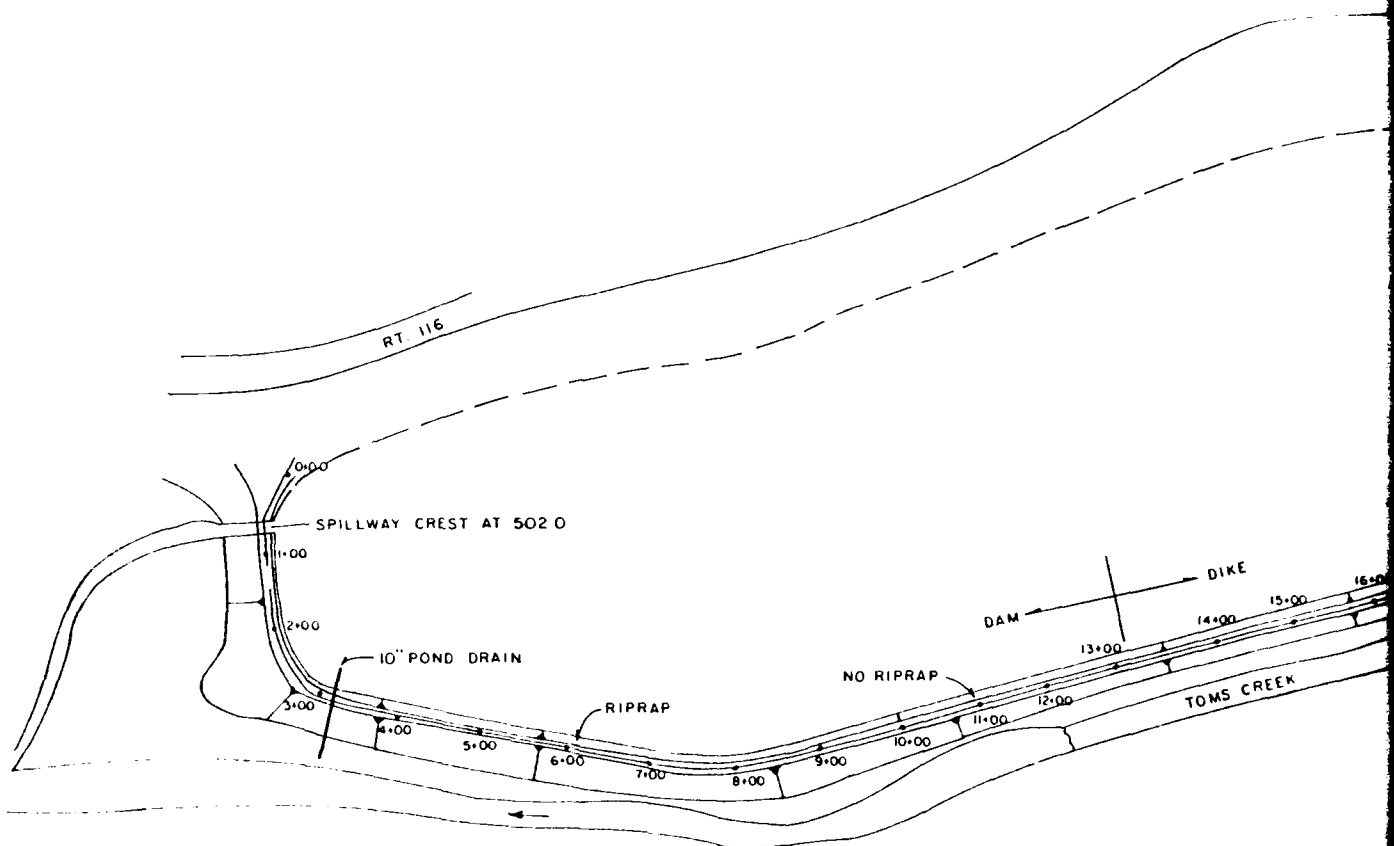
E



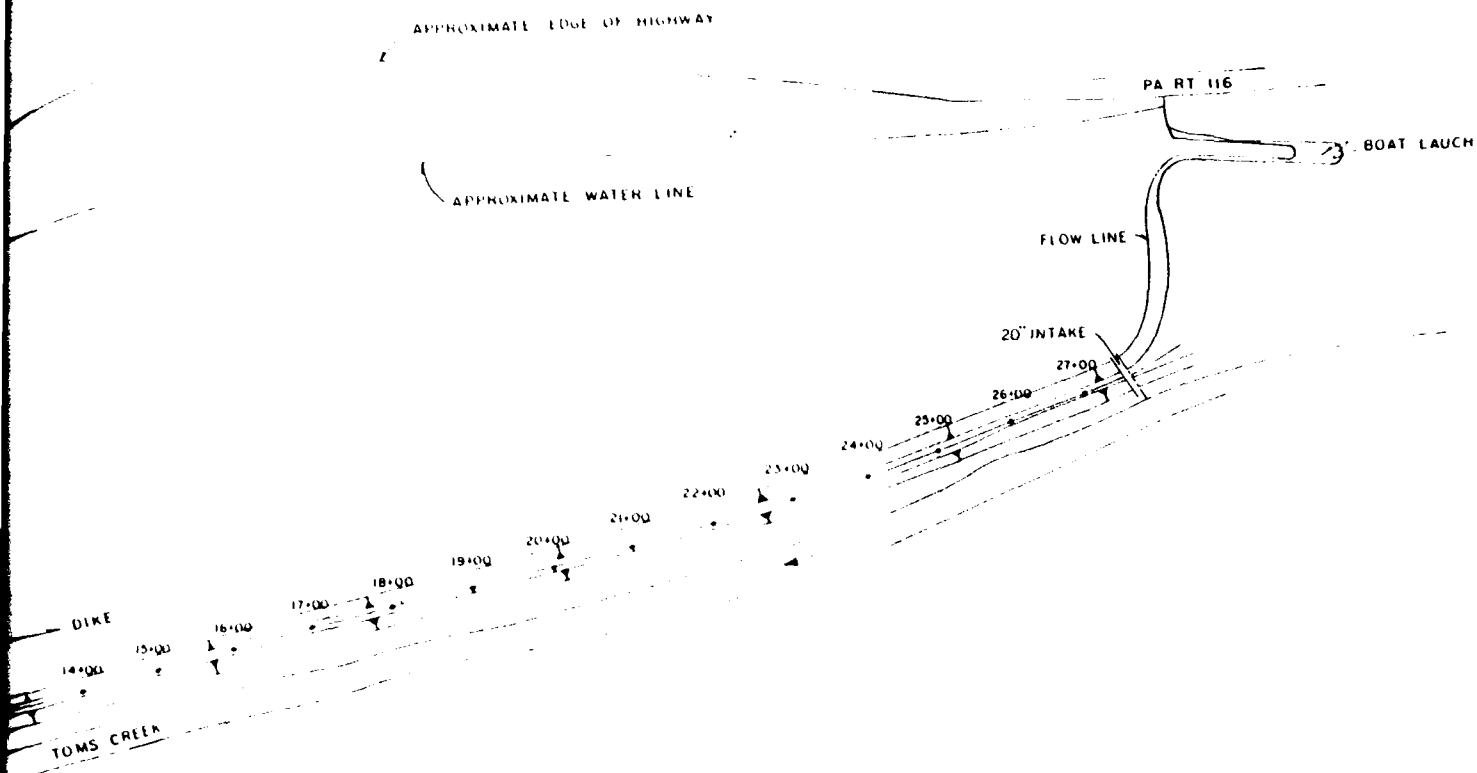


NAT. I. D. NO. PA. 6
DATA OBTAINED FROM
ENTITLED BLUE RIDGE
IRON SPRINGS, PA. 4



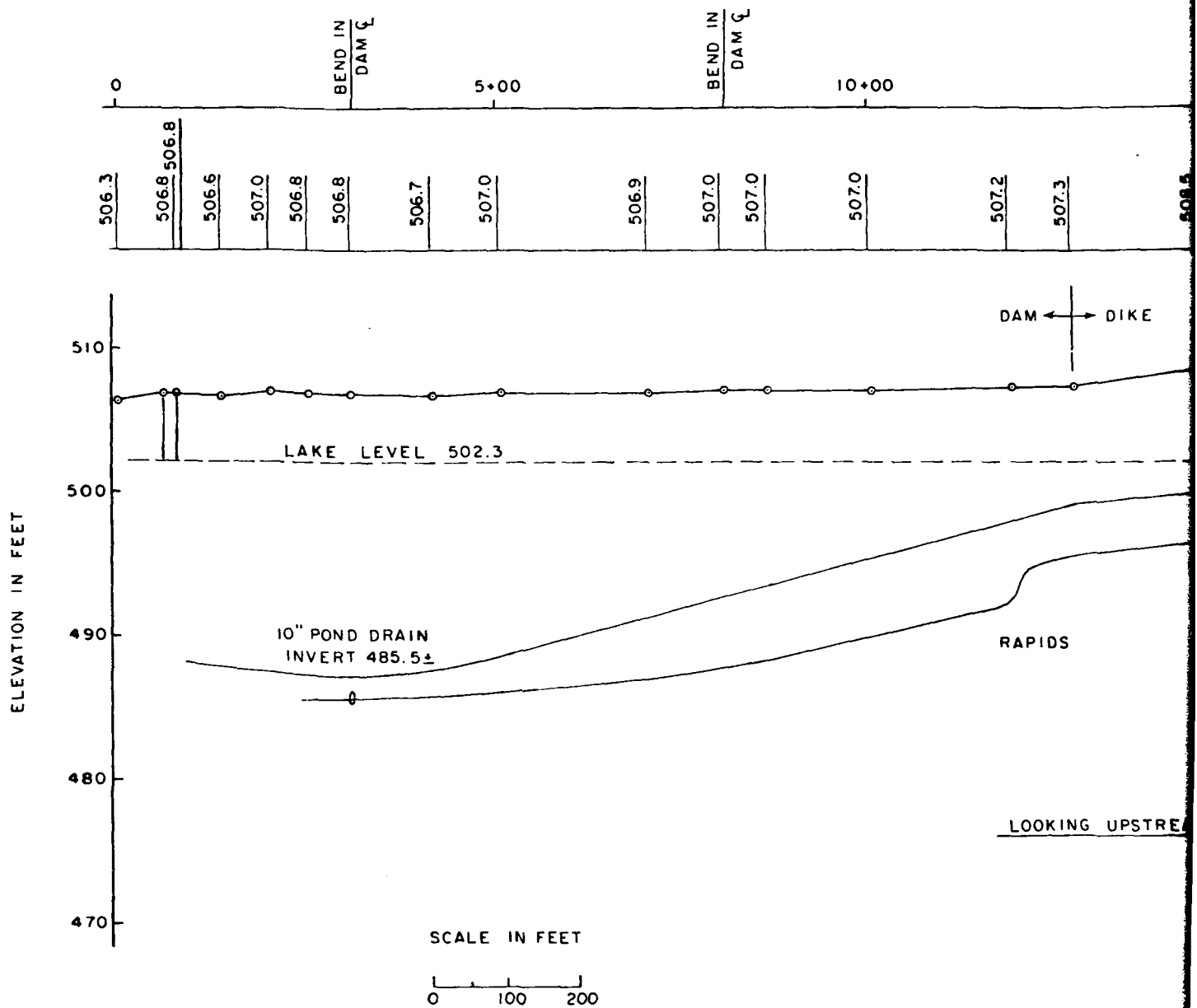


1



DATA OBTAINED FROM FIELD
INSPECTION ON APRIL 21, 1980

SECTION F DAM
PLATE 2



15+00

20+00

25+00

28+00

507.3

508.5

510.1

511.0

511.9

511.7

512.3

512.6

512.6

512.6

513.0

514.3

AM ← DIKE

APPROXIMATE TOE OF DAM/DIKE

CREEK LEVEL

INVERT PIPE 502.3

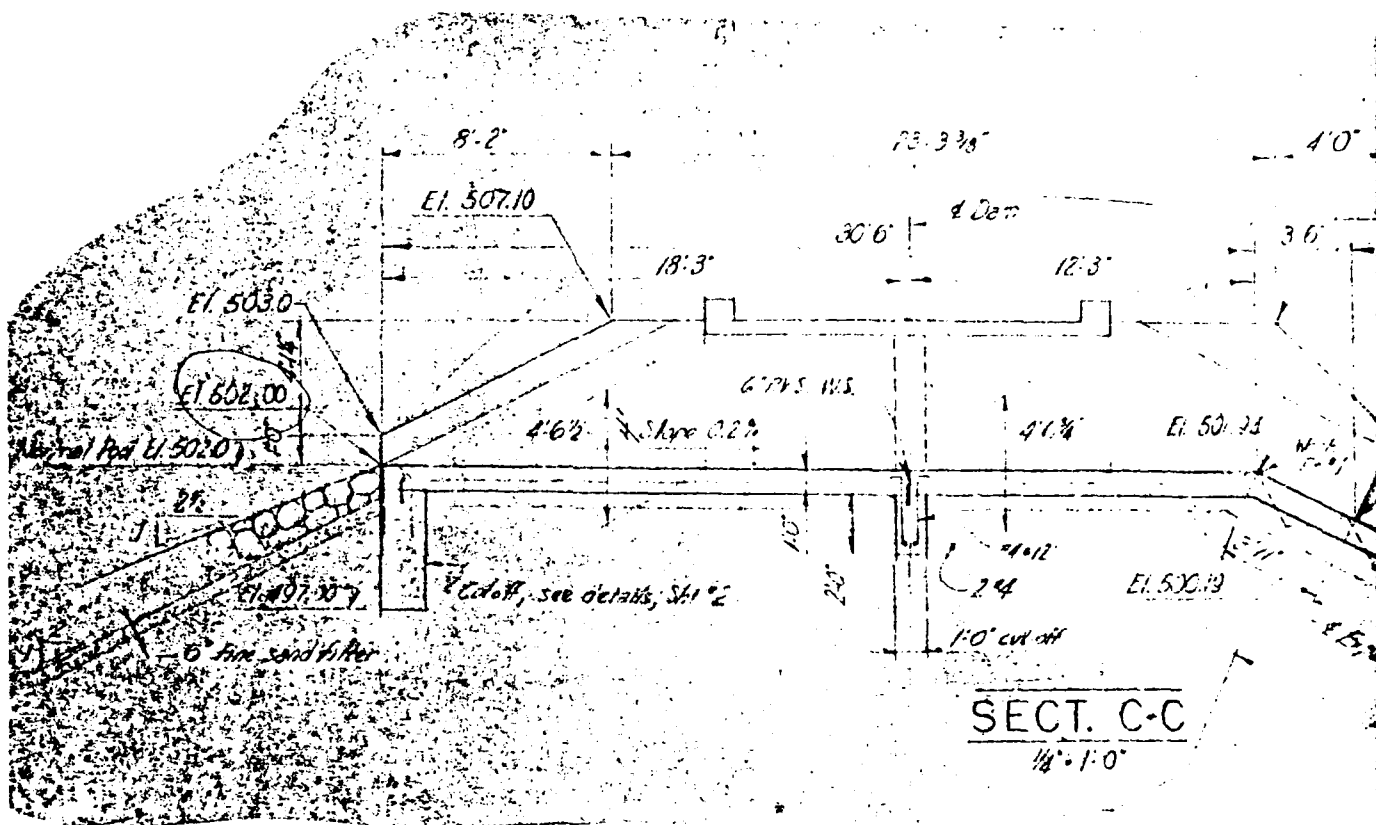
RAPIDS

LOOKING UPSTREAM

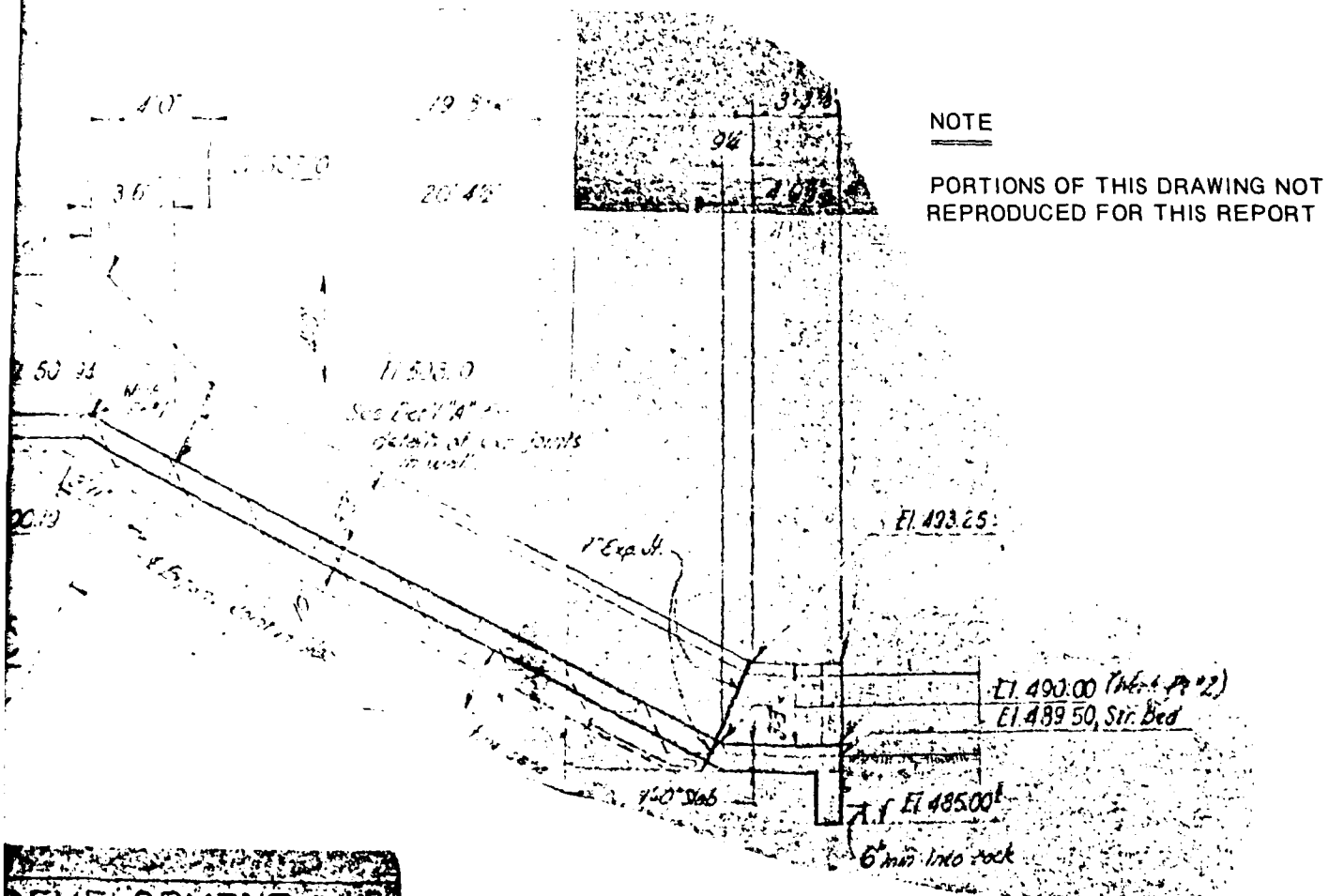
PROFILE OF CREST
SECTION F DAM

PLATE 3

2



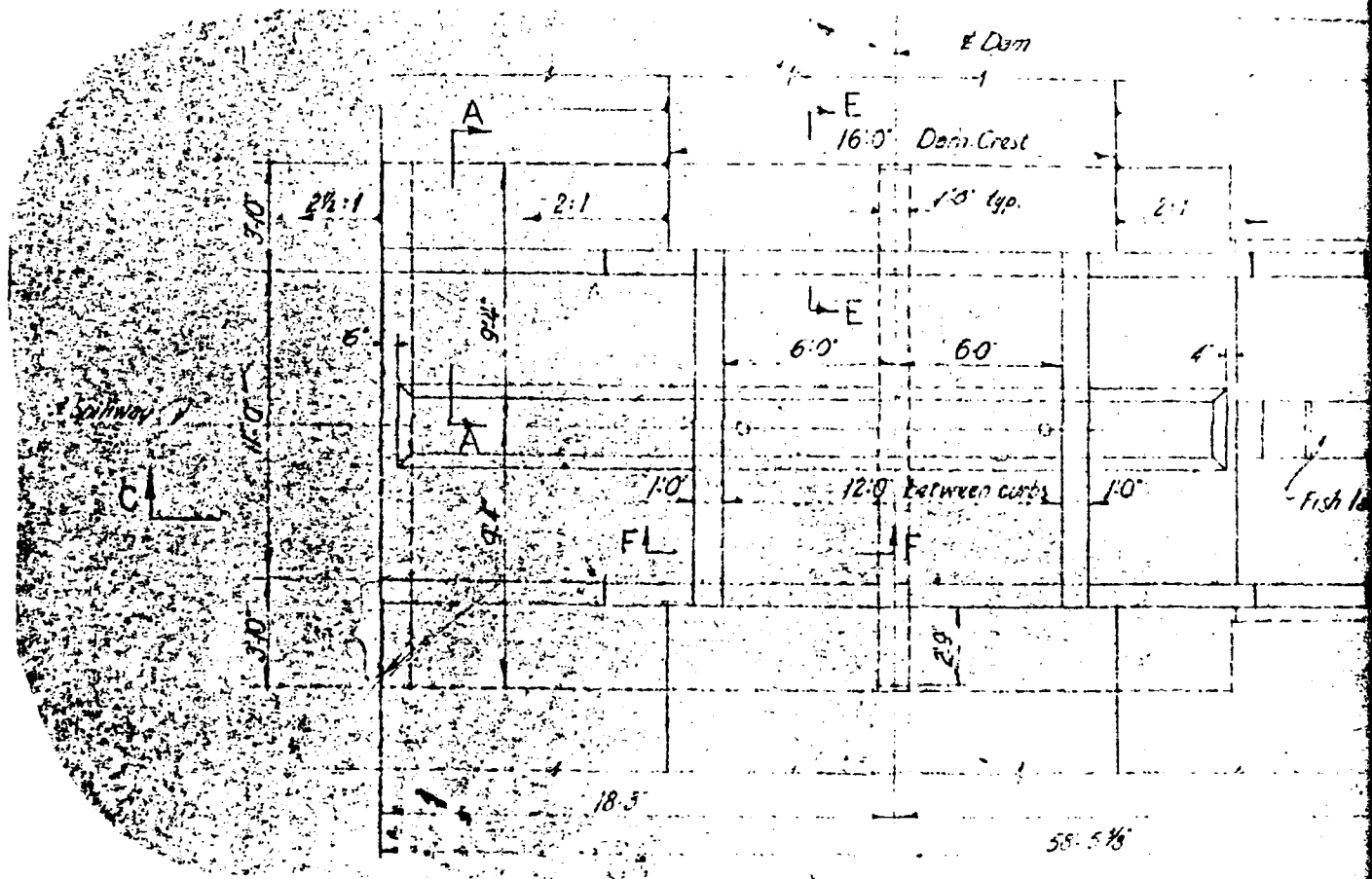
	CHARNITA DEVELOP	
	LIBERTY TOWNSHIP • ADAMS COUNTY	
	SPILLWAY	
J.L. Niedemann Associates Structural Engineers		Geo. G. V. Harrisburg, Pa.



NOTE

PORTIONS OF THIS DRAWING NOT
REPRODUCED FOR THIS REPORT

DEVELOPMENT
DAMS, COUNTY 1, PENNA.
WAY
Geo. Technical Services
4 Yonkers, N.Y.
May 21, 1967



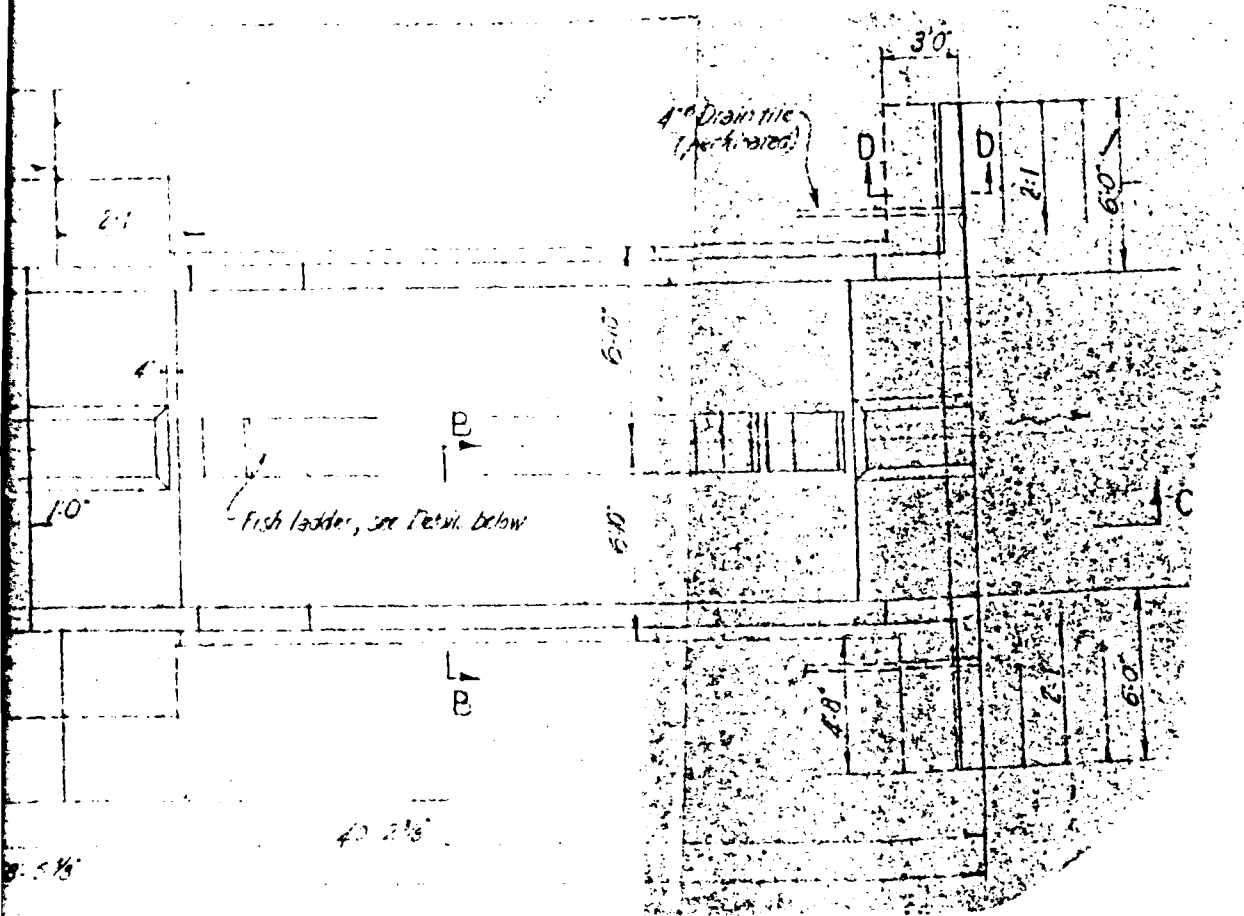


PLATE 4B

2

Notes

Concrete design and details in accordance with A.C.I. Code

28 day strength of concrete, $f'_c = 3,000$ p.s.i.

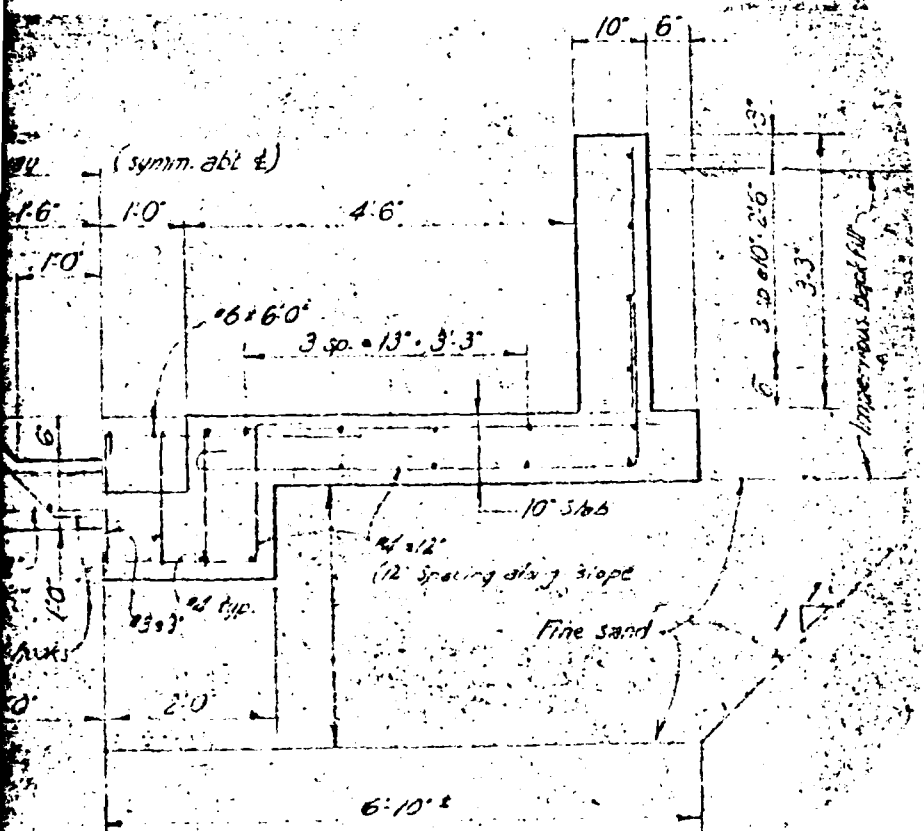
Reinforcement shall be intermediate grade. f3 - 20,000

All concrete shall be air-entrained.

Rub finish of concrete is not permitted. Holes shall be patched and ridges removed with no further finishing.

1"x1" chamfers on all exposed edges.

30 dia. bkr. Sp's. 1/25.

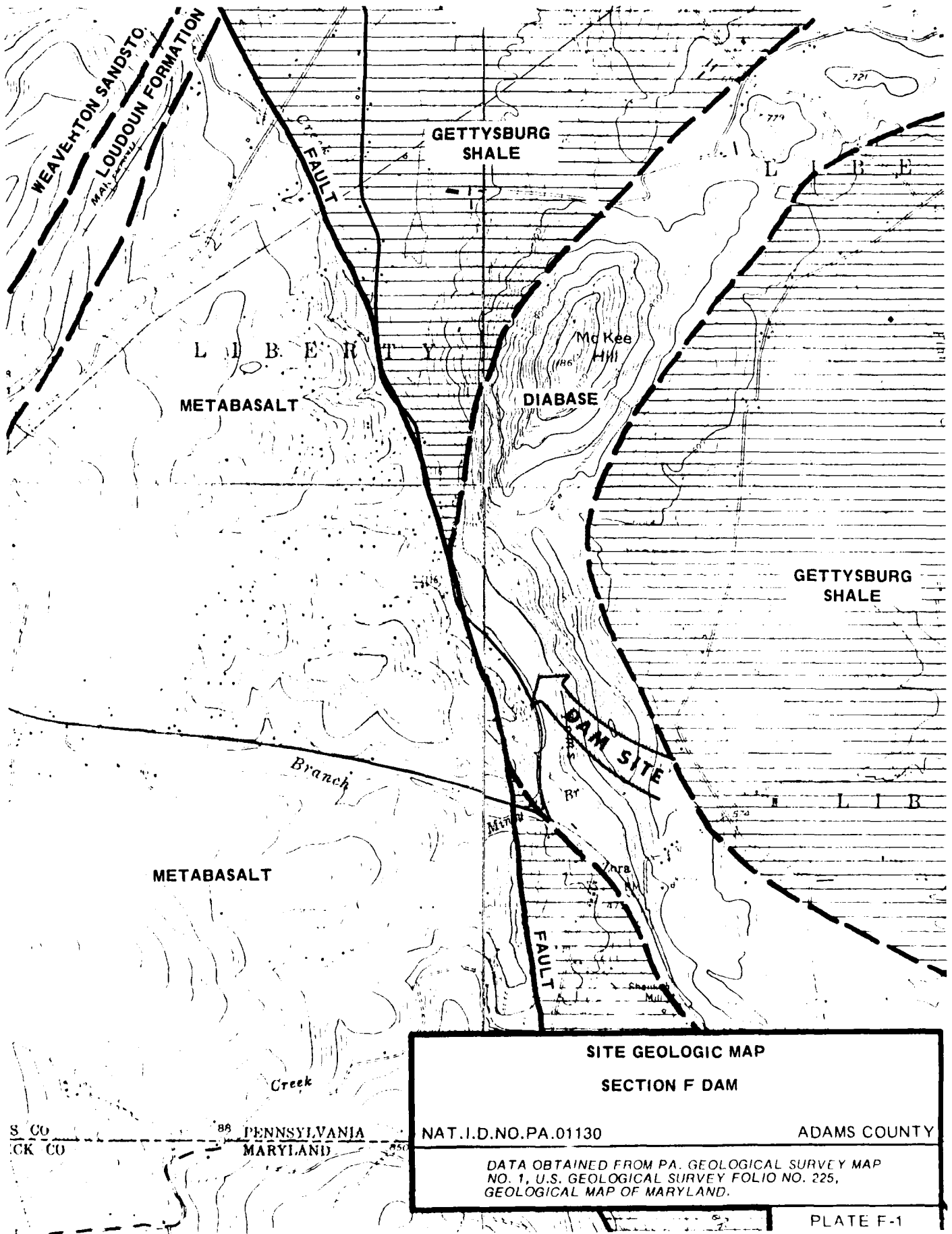


APPENDIX

F

SITE GEOLOGY
SECTION F DAM

Section F Dam is located at the boundary between the Triassic Lowland Section of the Piedmont Physiographic Province and the Blue Ridge Physiographic Province. As shown on Plate F-1, the dam is constructed upon Triassic age bedrock of igneous origin of the type diabase. The diabase has been intruded into the shale and sandstone units of the Gettysburg Formation. Rock exposures at the dam are limited to the diabase outcrop along the dam embankment in the vicinity of the rapids in Toms Creek. Here several high angle fracture sets occur, one striking northeast and the other northwest. The dipping bedrock and resistant nature of the diabase exposure has thrusts water flow in Toms Creek against the dam embankment toe and has resulted in localized intense erosion of soil adjacent to the embankment.



SITE GEOLOGIC MAP

SECTION F DAM

NAT. I.D. NO. PA.01130

ADAMS COUNTY

DATA OBTAINED FROM PA. GEOLOGICAL SURVEY MAP
NO. 1, U.S. GEOLOGICAL SURVEY FOLIO NO. 225,
GEOLOGICAL MAP OF MARYLAND.

PLATE F-1

AD-A087 914

WOODWARD-CLYDE CONSULTANTS PLYMOUTH MEETING PA
NATIONAL DAM INSPECTION PROGRAM. SECTION F DAM
JUN 80

F/8 13/13
(NDS I.D. NUMBER--ETC(U)
DACW31-80-C-0018
NL

UNCLASSIFIED

2 2
40
40-10-10



END
DATE
FILMED
9 80
DTIC

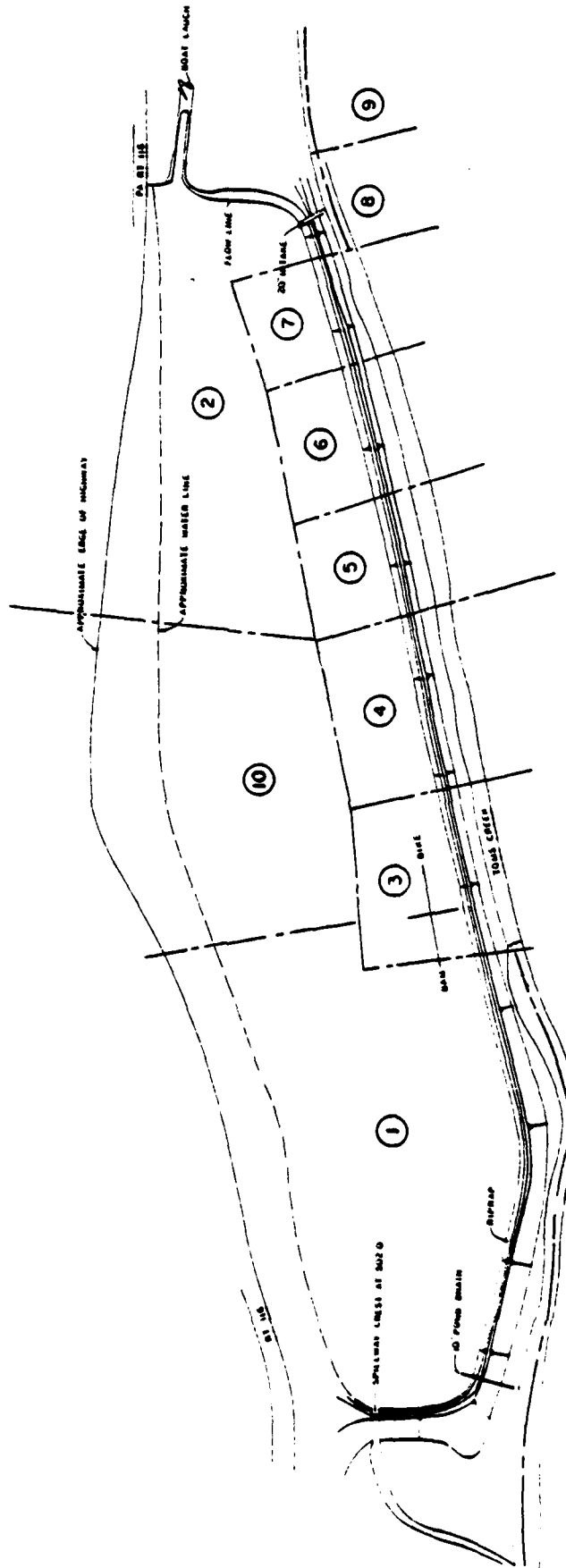
APPENDIX

G

Appendix G
Section F Dam and Reservoir Property Owners

The Adams County Tax Office supplied the names and current addresses of the owners of record for Section F Dam and Reservoir. The numbers correspond to plots shown on Plate G-1.

- | | | | |
|----|---|-----|---|
| 1. | Shu Sing Chang
9725 Glen Road
Potomac, MD 20854 | 6. | Paige D. Johnson
4703 Sellman Road
Beltsville, MD 20705 |
| 2. | Shu Sing Chang
9725 Glen Road
Potomac, MD 20854 | 7. | Donald Dick
8804 Orwood Lane
Laurel, MD 20810 |
| 3. | Paul C. Stull
R.D. 2
Gettysburg, Pa 17325 | 8. | William S. Cremen
1007 Wayson Way
Davidsonville, MD 21035 |
| 4 | William L. Burmester
Route 3 Box 44
Cape George Colony
Port Townsend, WA 98368 | 9. | Richard C. McCleary
326 Woodlawn Road
Baltimore, MD 21210 |
| 5. | Clifton Addicks
10 Country Club Drive
Fairfield, Pa 17320 | 10. | Paul G. Melesky
P.O. Box 206
Fairfield, Pa 17320 |



ALL PROPERTY LINES ARE APPROXIMATE,
 FOR EXACT PROPERTY LINES CONSULT THE
 ADAMS COUNTY TAX OFFICE

DATE
FILMED
-8