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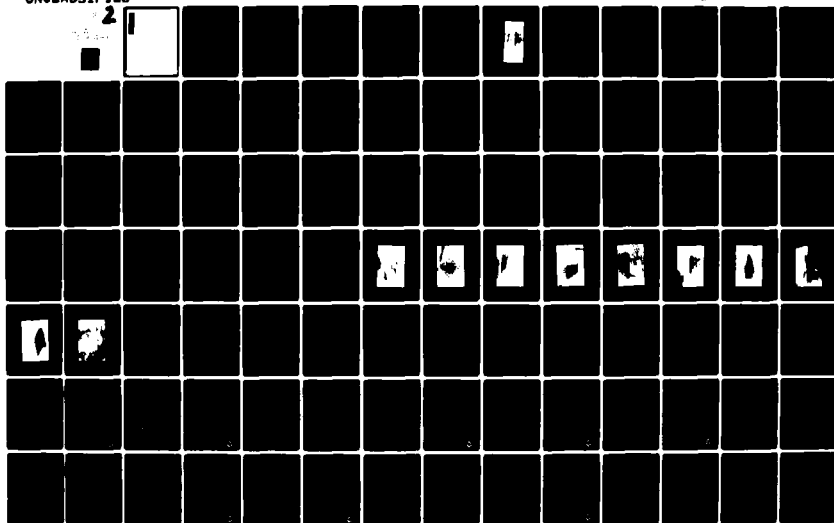
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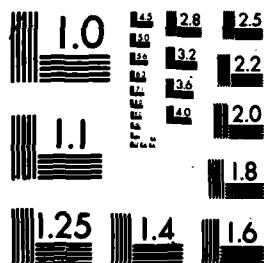
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DELAWARE RIVER BASIN

NEWTOWN DAM, BUCKS COUNTY
PENNSYLVANIA

(6) National Dam Inspection Program • Newtown Dam

(NDS I.D. ~~PA~~ PA 01064)

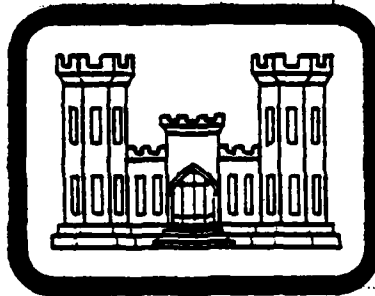
DER I.D. No. 9-178

SCS PA 621)

Delaware River Basin, Newtown Creek,
Bucks County, Pennsylvania.

PHASE I INSPECTION REPORT,
NATIONAL DAM INSPECTION PROGRAM

(16) Mr. E. Buck John H. / [unclear] Jr |



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(15) DACW 31-84-C-2018

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Submitted to:

DEPARTMENT OF THE ARMY
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(11) AUG 11 1988

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JCB

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.

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**

Name of Dam:	Newtown Dam (SCS PA 621)
County Located:	Bucks County
State Located:	Pennsylvania
Stream:	Newtown Creek
Coordinates:	Latitude 40° 14.7' Longitude 74° 56.0'
Date of Inspection:	July 1, 1980

Newtown Dam is owned by the Neshaminy Water Resources Authority and maintained by Bucks County. The dam and reservoir are used as a flood control structure for the downstream town of Newtown, Pennsylvania. The impoundment was designed by the United States Department of Agriculture, Soil Conservation Service, in 1976-77, and the structure was officially completed in 1980.

The dam and its appurtenant facilities are considered to be in good condition. The dam is classified as an "Intermediate" size structure with a "High" hazard classification, consistent with its potential in the event of failure for extensive property damage and loss of life downstream of the dam and in Chalfont, Pennsylvania.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Intermediate" size dam and "High" hazard classification is the Probable Maximum Flood (PMF). The Soil Conservation Service designed this dam as a Class C structure, which requires that the spillway systems be designed to pass the PMF.

The hydrologic and hydraulic computations presented in Appendix D indicate that the spillway structures are capable of discharging the PMF without overtopping the embankment. Therefore, the structure is considered to have an "Adequate" spillway system.

It is recommended that, during the period required for establishment of Crownvetch, the embankment, particularly the downstream berm, be periodically checked for erosion damage.

Neshaminy Water Resources Authority has an "Operations Manual" specifying agencies responsible for operation and maintenance of Neshaminy Watershed projects completed by 1977. The manual requires updating to include Newtown Dam. The Operations Manual refers to a "Development, Operation and

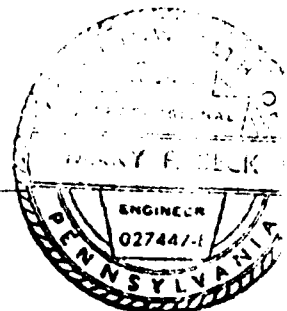
Newtown Dam (SCS PA 621), NDS 1D PA 01064

Maintenance Manual" prepared by SCS for a maintenance inspection checklist, which should be used to insure that all items are periodically inspected and maintained in the best possible condition. It is recommended that these procedures provide for a period of observation during and following impoundment of significant quantities of water behind the embankment. These observations should include monitoring discharge from the embankment drainage system and looking for sources of uncontrolled seepage.

A warning procedure has been developed and approved by the Neshaminy Water Resources Authority. This procedure indicates that the structure should be monitored on a 24 hour basis when the severity of a forecasted storm is predicted to be near, at or above the design capacity of the structure. The procedure also includes emergency telephone numbers and areas downstream of the dam which should be notified in the event a hazardous condition develops.

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8/2/80
Date



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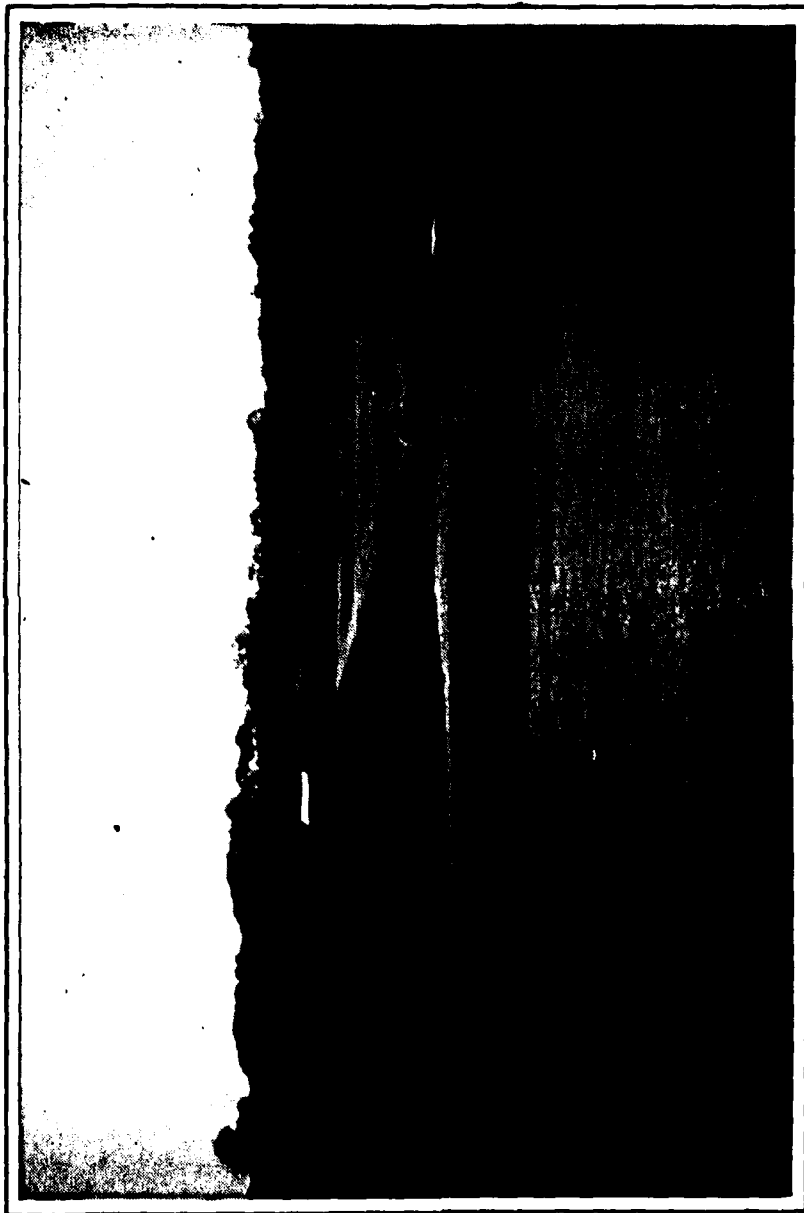
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Date



APPROVED BY:

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

5 Sep 80
Date



OVERVIEW
NEWTOWN DAM (SCS PA 621), NEWTOWN TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NEWTOWN DAM
(SCS PA 621)
NATIONAL ID NO. PA 01064
DER NO. 9-178

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. Newtown Dam is a 44 foot high zoned earth embankment about 850 feet long, with an emergency spillway at the left end of the embankment. The embankment contains an impervious core constructed over a cutoff trench under the dam center line. The core and cutoff trench are composed of materials classified as clayey silts and silty gravels (Zone 1), and are encompassed by more permeable materials classified as silty gravels (Zone 2). Plate 5, Appendix E, identifies a Zone 3, which is a 12 inch thick layer of topsoil or clayey silt over the entire downstream face and above the riprap on the upstream face. The upstream design slope is 3H:1V with a ten foot berm at approximately elevation 213. The downstream design slope is 2.5H:1V. Surface runoff is intercepted by a berm on the downstream face. The berm has a positive one percent slope to the right. The cutoff trench bottom width is 12 feet, and upstream and downstream slopes are 2H:1V. The upstream and downstream slopes of the relatively impervious Zone 1 core are 1H:1V. The embankment crest is 14 feet wide and has a design settled fill elevation of 239.6. Both the upstream and downstream slopes are to be protected with Crownvetch, and the crest is protected by a gravel road.

Embankment seepage is controlled by a trench drain about midway between the dam center line and the downstream

toe. The trench drain is connected to the rock gutter at the downstream toe of the dam by a blanket drain. Embankment seepage in the vicinity of the principal spillway is to be discharged through two eight inch PVC drain pipes which outlet through the sidewalls of the impact basin. Plan and cross-section views of the dam are shown on Plates 2 through 7, Appendix E, and embankment drainage details are shown on Plate 8.

The principal spillway consists of a concrete drop inlet riser, 240 feet of 30 inch diameter reinforced concrete, steel cylinder pressure pipe, with nine anti-seep collars and an impact basin at the downstream toe. The reservoir drain located at the base of the riser has an invert elevation of 199.25, and the elevation of the riser weirs is 213.0. The outlet invert and impact basin end sill elevations are 196.0.

The emergency spillway is a trapezoidal channel excavated through rock around the left end of the embankment. The 185 foot wide channel has side slopes of 3H:1V, and the 50 foot level section (crest) is at elevation 231.9. A tributary to Newtown Creek enters the emergency spillway upstream of the control section through a channel excavated in rock, Photograph 8, Appendix C.

A 16 inch reinforced concrete pressure pipe sanitary sewer passes beneath the dam embankment, as shown on Plate 4, Appendix E. At the dam center line, the sanitary sewer is about 12 feet below the surface of the bedrock and about 10.5 feet below the dam cutoff trench. Four anti-seep collars have been constructed upstream of the dam center line around the sewer. A 12 to 16 foot thick concrete curtain wall was installed beneath the dam cutoff trench around the pipe. The sewer trench was backfilled with Zone 1 materials upstream of the center line and with Zone 2 materials downstream of the center line.

b. Location. The dam is located on Newtown Creek, a tributary to the Neshaminy Creek in Newtown Township, Bucks County, Pennsylvania. The dam is located 1.1 miles north of the center of Newtown, Pennsylvania, and is located on the USGS Quadrangle entitled "Langhorne, Pennsylvania", at coordinates N 40° 14.7' W 74° 56.0'. A regional location plan of Newtown Dam is included as Plate 1, Appendix E.

c. Size Classification. The dam is classified as an "Intermediate" size dam by virtue of its 44 foot height and 1,420 acre-foot total storage capacity.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive

property damage and loss of life along Newtown Creek downstream of the dam.

e. Ownership. Newtown Dam is owned by the Neshaminy Water Resources Authority. All correspondence should be sent to Mr. William Taylor, Neshaminy Water Resources Authority, Post Office Box 6, Cross Keys Office Center, 4259 Swamp Road, Doylestown, Pennsylvania 18901.

f. Purpose of Dam. The purpose of this dam is flood control. The structure is one of ten dams in the Neshaminy Creek Watershed that are scheduled for construction with the assistance of the United States Department of Agriculture, Soil Conservation Service (SCS). This is the eighth project of the series.

g. Design and Construction History. The original work plan was developed by the SCS in the late 1960's for the ten flood control sites in the Neshaminy Creek Watershed. The final design for this dam was prepared by SCS in 1976 and 1977, with the final design drawings being completed in 1977. The application to construct a flood control dam and reservoir was submitted July 21, 1977. The Report Upon the Application was prepared by the State of Pennsylvania on September 28, 1977. The project was approved by the Delaware River Basin Commission on September 28, 1977, and the permit was issued on October 3, 1977. On July 13, 1978, the contractor, Riebe Construction Company, was given notice to proceed.

The design drawings for the sanitary sewer under the dam are dated June 30, 1978. On July 20, 1978, the engineer for the Newtown Sewer Authority requested that permission for construction of the sewer under the dam be added to the dam construction permit. On August 14, the state gave permission for the sewer to be constructed under the dam.

In October 1978, the impact basin footers and floor slab were removed and replaced as a result of low concrete strength. Work on the sewer line in the right abutment began November 29, 1978, after work on the dam had shut down for the winter. The embankment was completed by November 1979, and the SCS final inspection was held on July 2, 1980.

h. Normal Operating Procedures. Reservoir outflow is controlled by the principal and emergency spillways. Under normal conditions, the pond drain gate is closed and water flows through the principal spillway over the weirs. Excess water is stored to elevation 231.9, the emergency spillway crest. Water is discharged through the emergency spillway at the left abutment only during storms with recurrence interval of once in 100 years or more.

1.3 Pertinent Data.

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

a.	Drainage Area (square miles)	3.0
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood at Dam Site	Unknown
	Design High Water	2,092
	At Top of Dam (design)	10,967
c.	Elevation (feet above MSL)	
	Top of Dam (design)	239.6
	(existing)	240.4
	Design High Water	234.7
	Emergency Spillway Crest	231.9
	Principal Spillway	
	Weir Crest	213.0
	Pond Drain Inlet Invert	199.25
	Outlet Invert	196.0
	Downstream Toe	202.2
d.	Reservoir (feet)	
	Length at Normal Pool	1,600
	Length at Maximum Pool	4,000
e.	Storage (acre-feet)	
	Normal Pool	56
	To Top of Dam	1,420
f.	Reservoir Surface Area (acres)	
	Sediment Pool	11
	Design High Water	82
g.	Dam Data	
	Type	Zoned earth embankment
	Volume	87,600 cubic yards
	Length	850 feet
	Maximum Height	44 feet
	Top Width	14 feet
	Side Slopes	
	Upstream (design)	3H:1V
	Downstream (design)	2.5H:1V
	Cutoff	Trench beneath dam center line
	Grout Curtain	None

h.	Principal Spillway	
	Type	Concrete drop inlet riser with 30 inch conduit
	Reservoir Drain	Intake at base of riser
	Elevation	
	Weirs	213.0
	Pond Drain Inlet Invert	199.25
	Conduit Outlet Invert	196.0
	Energy Dissipator	Concrete impact basin at downstream toe
i.	Emergency Spillway	
	Type	Trapezoidal channel excavated through rock
	Width	185 feet
	Side Slopes	3H:1V

SECTION 2 ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of the available engineering data on Newtown Dam (SCS PA 621) is attached as Appendix B. Engineering data available for review are contained in a several hundred page design folder and a 35 page set of design drawings. As-built drawings are in the process of being prepared by the Soil Conservation Service (SCS) project engineer, and were available for review. The design folder and plans are located in SCS files, and as-built drawings are to be located in the Department of Environmental Resources' (DER) and the Owner's files. All of these records were prepared by the United States Department of Agriculture, Soil Conservation Service. Additional information was obtained from miscellaneous letters, correspondence and monthly construction reports in DER files.

b. Design Features. The principal design features of Newtown Dam are illustrated on the plans and profiles enclosed in Appendix E as Plates 2 through 13. A detailed description of the design features is also presented in Section 1.2, paragraph a, and pertinent data relative to the structure are presented in Section 1.3. In addition to the plans of the dam, Plates 14 and 16 are enclosed to show the locations of the test borings and the results of typical compaction tests performed as part of the design. Typical test boring logs are shown on Plate 15.

2.2 Construction.

Construction history is presented in Section 1.2, paragraph g. Summary construction records are located in DER files. Complete construction records are located in SCS files and were reviewed for this investigation.

2.3 Operational Data.

There are no operational records maintained. There are no minimum flow requirements for the downstream channel. There are no water level measurements or rainfall records maintained within the watershed, although the Neshaminy Water Resources Authority maintains a rain gauge at their office in Cross Keys, Doylestown, Pennsylvania.

2.4 Evaluation.

a. Availability. All engineering data evaluated and reproduced for this report were provided by either DER or SCS, and were supplemented by conversations and data obtained from representatives of the Neshaminy Water Resources Authority.

b. Adequacy. Data included in state files, supplemented with data obtained from the Neshaminy Water Resources Authority and information received from state and authority representatives, are considered adequate to evaluate the dam and appurtenant structures.

c. Validity. There is no reason to question the validity of these data.

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 as follows. In general, the dam and its appurtenant structures are considered to be in good condition. At the time of the inspection, the pond drain gate was open and stream flow was passing through the riser of the principal spillway.

b. Dam. The vegetation cover on the upstream and downstream faces is in fair condition. Very little Crownvetch is in evidence. The embankment was dormant seeded in the fall and reseeded again this spring. It will be another year before Crownvetch becomes abundant. Little or no damage to the embankment has occurred during the period of vegetation establishment. The crest is protected by a gravel road, Photograph 2, which is uniform with no vehicle ruts or depressions.

The vertical and horizontal alignments were checked and found to be satisfactory. The vertical alignment is shown on Sheet 5B, Appendix A. Junctions between the embankment and abutment and the embankment and spillway were judged to be in good condition, with no erosion or deterioration noted. In addition to the rock gutter at the downstream toe, a rock gutter was added to the right upstream toe above the normal pool level, and rock spoil was placed at the left upstream toe. No seepage was observed beyond the dam toe or discharging from embankment drain outlets through the impact basin sidewalls. No water was impounded in the reservoir, however. A ten foot wide berm, 540 feet long with a one percent slope, intercepts surface runoff from the downstream face of the dam and conducts it to a rock gutter along the toe. While no erosion was noted at the intersection of the berm and the downstream slope, the potential for erosion exists, particularly before the vegetation becomes well established. It is recommended that this area be inspected frequently for gullying.

c. Appurtenant Structures.

1. Principal Spillway. As shown on the plates, the riser is located at the upstream toe of the embankment. The exposed portions of the riser were inspected and evaluated to be in good condition with no signs of concrete deterioration, spalling or other structural deficiency or defects, Photograph

4. An angle in the low stage trash rack is slightly bent. The impact basin at the downstream toe was inspected and found to be in good condition, Photograph 5, with no cracking or spalling of the concrete or erosion adjacent to the structure. The embankment drains outlet through the walls of the impact basin and were dry. The downstream channel was also inspected and found to be in good condition, with no significant erosion or deterioration.

2. Emergency Spillway. The emergency spillway at the left abutment was inspected and found to be in good condition, Photographs 6 and 7. The emergency spillway was recently seeded and mulched. A tributary to Newtown Creek enters the emergency spillway upstream of the control section, Photograph 8. The stream was dry at the time of the inspection.

d. Reservoir. At the time of the inspection, no water was impounded behind the embankment. The pond drain was open, permitting base flow to pass through the principal spillway. The reservoir slope in the vicinity of the right end of the dam has recently been seeded and mulched. No debris or sediment was noted in the vicinity of the riser.

e. Downstream Conditions. Newtown Creek downstream of the dam is about 14 feet wide with steep banks about 4 feet high. The left channel bank and flood plain is wooded with underbrush. The right channel bank is brush covered. A private road parallels the stream on the right bank. About 1000 feet downstream of the dam, Newtown Creek flows under State Route 532 (Dolington Road) through a 26 foot by 8.5 foot opening. About 2500 feet further downstream Newtown Creek enters the Borough of Newtown. In the next 0.6 mile are many homes and businesses subject to damage in the event of failure of Newtown Dam. About 2.8 miles downstream of the dam, Newtown Creek enters Nashaminy Creek. A "High" hazard classification is justified for this 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 dam, principal spillway or emergency spillway. The exposed portions of the riser and impact basin were inspected, and the principal spillway is judged to be in good condition. The emergency spillway is also considered to be in good condition. The embankment is considered to be in good condition, although the vegetative cover is not firmly established. The overall condition of the dam is considered to be good.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Procedures.

Operational procedures are discussed in some detail in Section 1.2. Operation of the dam does not require a dam tender. Under normal conditions the pond drain is closed and flow discharges over the riser weirs and through the 30 inch conduit at the base of the embankment. Additional excess water is then stored and discharged over the crest of the emergency spillway. There have been no large storms since the embankment was completed, and water has never flowed over the emergency spillway. Written operation and maintenance procedures used by the Neshaminy Water Resources Authority are contained in "State of Pennsylvania Watersheds and Resource Conservation and Development Operation and Maintenance Handbook for Projects Installed with Assistance from the Soil Conservation Service", and specific procedures for each site are contained in the "Operations Manual" prepared by William G. Major Associates, Inc., June 1977.

4.2 Maintenance of the Dam.

The dam is maintained by Bucks County personnel who periodically check the embankment, mow the grass and remove woody vegetation. As owner of the dam, Neshaminy Water Resources Authority monitors the maintenance performed and assists if possible.

4.3 Maintenance of Operating Facilities.

Maintenance of these facilities includes cleaning debris from the trash racks, lubricating the gate hoist and checking the structural integrity of the principal spillway system.

4.4 Warning Systems In Effect.

A draft warning procedure, dated January 1980, has been prepared by the local Civil Defense office. The draft was submitted to both the Neshaminy Water Resources Authority and the Pennsylvania Emergency Management Agency in Harrisburg for review. The warning procedures have been approved by the Neshaminy Water Resources Authority.

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 at Newtown Dam.

The "Operations Manual" prepared by William G. Major Associates, Inc., summarizes the control features and the responsible agency for operation and maintenance of each project constructed by 1977 within the Neshaminy Watershed. Although the operational philosophy for a single-purpose flood control structure is contained in the manual, a "fact sheet" pertaining to Newtown Dam is required. It is important that individuals responsible for the maintenance and operation of Newtown Dam are aware of the written procedures to insure that all items are carefully inspected and maintained on a periodic basis.

SECTION 5 HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The complete folder of design calculations was reviewed, and portions of this folder are presented in Appendix D.

The watershed is about 2.7 miles long and averages about 1.2 miles wide, having a total area of approximately 3.0 square miles. Elevations range from 380 in the upper reaches of the watershed to about 213, the normal pool elevation. The watershed is predominantly open/farmland, with less than 15 percent residential development. Residential development can be expected to progress rapidly within the watershed, however.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Intermediate" size dam and "High" hazard classification is the Probable Maximum Flood (PMF). The Soil Conservation Service designed this dam as a Class C structure, which requires that the spillway systems be designed to pass the PMF.

b. Experience Data. There are no records of reservoir levels kept for this dam. Rainfall is measured and records are kept at the Neshaminy Water Resources Authority's office in Cross Keys, Doylestown, Pennsylvania. There are no estimates or records of previous high water levels.

c. Visual Observations. On the date of the inspection, there were no conditions observed that would indicate a reduced spillway capacity during an extreme event. Observations regarding the condition of the downstream channel, spillways and reservoir are located in Appendix A and are discussed in greater detail in Section 3.

d. Overtopping Potential. The dam was designed to pass the PMF without overtopping. The PMF inflow hydrograph and flood routing were done according to procedures in the SCS National Engineering Handbook. The flood routing was originally done by a graphical procedure. Subsequently, the flood routing was checked by the SCS computer program, TR-20, the results of which are included in Appendix D. The peak PMF inflow value computed by TR-20 is 14,853 cfs, and the combined principal and emergency spillway capacities of the reservoir at the top of the dam are 10,967 cfs. The TR-20 computer routing indicates a maximum reservoir level of 239.6 feet, the design top of dam. As the spillway systems for this dam pass

the PMF without overtopping the embankment, they are considered to be "Adequate".

e. Downstream Conditions. Immediately downstream of the dam is a farm. The barn, which is shown on Plate 3, Appendix E, and the farm house would be damaged in the event of a dam failure. About 1,000 feet downstream of the dam Newtown Creek flows under State Route 532, through a 26 foot by 8.5 foot bridge opening. Immediately downstream of the bridge are two houses, and 2,400 feet downstream of the dam Newtown Creek enters the Borough of Newtown, where there are many more homes and businesses subject to flooding and damage in the event of failure of the dam. Therefore, a "High" hazard classification is justified for this structure.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. Visual observations detected no evidence of existing or pending embankment instability. Upstream and downstream slopes appear stable, with no surficial slides or significant erosion. Both the upstream and downstream slopes were seeded with mixtures containing Crown-vetch, which will require another year to become well established. There are no exterior signs or other evidence to indicate that the internal drainage systems were not operating properly. It is noted, however, that during this inspection the reservoir was empty, the embankment was not retaining a head of water, and the performance of the internal drainage system could not be evaluated.

Exposed portions of the principal spillway were inspected and judged to be in good condition.

b. Design and Construction Data. Design documentation is very complete as a several hundred page design folder prepared by the Soil Conservation Service (SCS) was available and reviewed for this investigation. Data included in these files are a foundation report containing permeability test results, shear strength test results and a stability analysis, structural calculations for the principal spillway and a complete set of hydrologic/hydraulic calculations. Portions of the Hydrology/Hydraulics section are presented in Appendix D. Principal features of this structure are presented in the drawings located in Appendix E.

A stability analysis of the embankment was performed by SCS using the ICES-LEASE computer program. Soil strength parameters were based on two consolidated-undrained triaxial compression test series conducted on compacted Zone 1 material and one series on compacted Zone 2 material. The foundation materials were assumed to have sufficient strength to prevent potential failure arcs from passing through the foundation. The shear strength parameters adopted for design were reviewed and judged to be conservative, based on the test results. Stability analyses using the Swedish circle method resulted in the following minimum factors of safety:

<u>Slope</u>	<u>Condition</u>	<u>Minimum Factor of Safety</u>
Upstream	Rapid Drawdown	1.57
Downstream	Steady Seepage	1.86

The recommended allowable factors of safety for these conditions, in accordance with Corps of Engineers EM 1110-2-1902, are 1.2 and 1.5, respectively. Therefore, it is concluded that the stability of the embankment is adequate.

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

d. Post-Construction Changes. There are no reports nor is there any evidence that modifications were made to this dam.

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 stability analysis resulted in a minimum factor of safety of 1.57 during rapid drawdown, the most critical loading condition, it can be assumed that seismic stability requirements are satisfied.

SECTION 7 ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. Visual inspection and review of design and construction documentation indicate that the dam and appurtenant structures of Newtown Dam are in good condition.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this intermediate size dam and "High" hazard classification is the Probable Maximum Flood (PMF). The Soil Conservation Service designed this dam as a Class C structure, which requires that the spillway systems be designed to pass the PMF.

The hydrologic and hydraulic computations presented in Appendix D indicate that the spillway structures are capable of discharging the PMF without overtopping the embankment. Therefore, the structure is considered to have an "Adequate" spillway system.

b. Adequacy of Information. The information available for this investigation was adequate to evaluate the structural and hydraulic aspects of the dam.

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

7.2 Remedial Measures.

a. Facilities. It is recommended that, during the period required for establishment of Crownvetch, the embankment, particularly the downstream berm, be periodically checked for erosion damage.

b. Operation and Maintenance Procedures. Neshaminy Water Resources Authority has an "Operations Manual" specifying agencies responsible for operation and maintenance of Neshaminy Watershed projects completed by 1977. The manual requires updating to include Newtown Dam. The Operations Manual refers to a "Development, Operation and Maintenance Manual" prepared by SCS for a maintenance inspection checklist, which should be used to insure that all items are periodically inspected and maintained in the best possible condition. It is recommended that these procedures provide for a period of observation during and following impoundment of significant quantities of water behind the embankment.

These observations should include monitoring discharge from the embankment drainage system and looking for sources of uncontrolled seepage.

A warning procedure has been developed and approved by the Neshaminy Water Resources Authority. This procedure indicates that the structure should be monitored on a 24 hour basis when the severity of a forecasted storm is predicted to be near, at or above the design capacity of the structure. The procedure also includes emergency telephone numbers and areas downstream of the dam which should be notified in the event a hazardous condition develops.

APPENDIX

A

CHECK LIST
VISUAL INSPECTION
PHASE I

Sheet 1 of 11

Name Dam Newtown Dam County Bucks State Pennsylvania National ID # PA 01064
Type of Dam Earth Hazard Category High
Date(s) Inspection 7/1/1980 Weather Sunny Temperature 80's

Pool Elevation at Time of Inspection Dry M.S.L. Tailwater at Time of Inspection N/A M.S.L.

Inspection Personnel:

Mary F. Beck (Hydrologist) Raymond Lambert (Geologist)
Arthur Drinoff (Geotechnical/ (7/14/1980)
Civil)
Vincent McKeever (Hydrologist)

Mary F. Beck Recorder

Remarks:

Mr. William Taylor, of Neshaminy Water Resources Authority was on site and
provided assistance to the inspection team.

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	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

Sheet 4 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Crest is protected by gravel. No significant erosion was observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical alignment is shown on Sheet 5B of 11. Horizontal alignment is good.	
RIPRAP FAILURES	Riprap is in good condition.	

EMBANKMENT

Sheet 5 of 11

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

VEGETATION

Upstream and downstream faces were dormant seeded and mulched in Fall, 1979 and reseeded in Spring, 1980, thus almost no Crownvetch is evident.

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

All junctions are in good condition.

ANY NOTICEABLE SEEPAGE

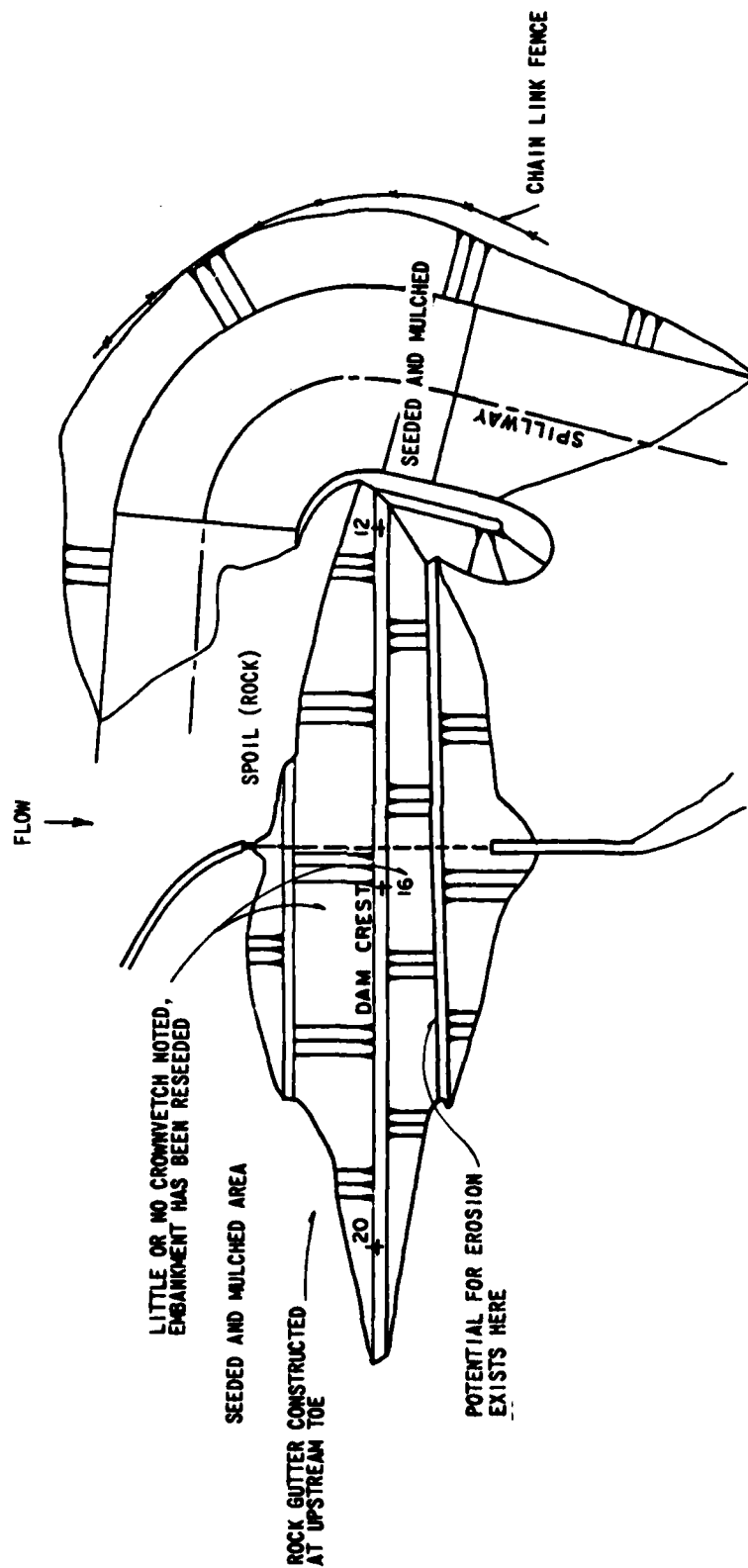
None observed, reservoir dry at time of inspection.

STAFF GAGE AND RECORDER

None

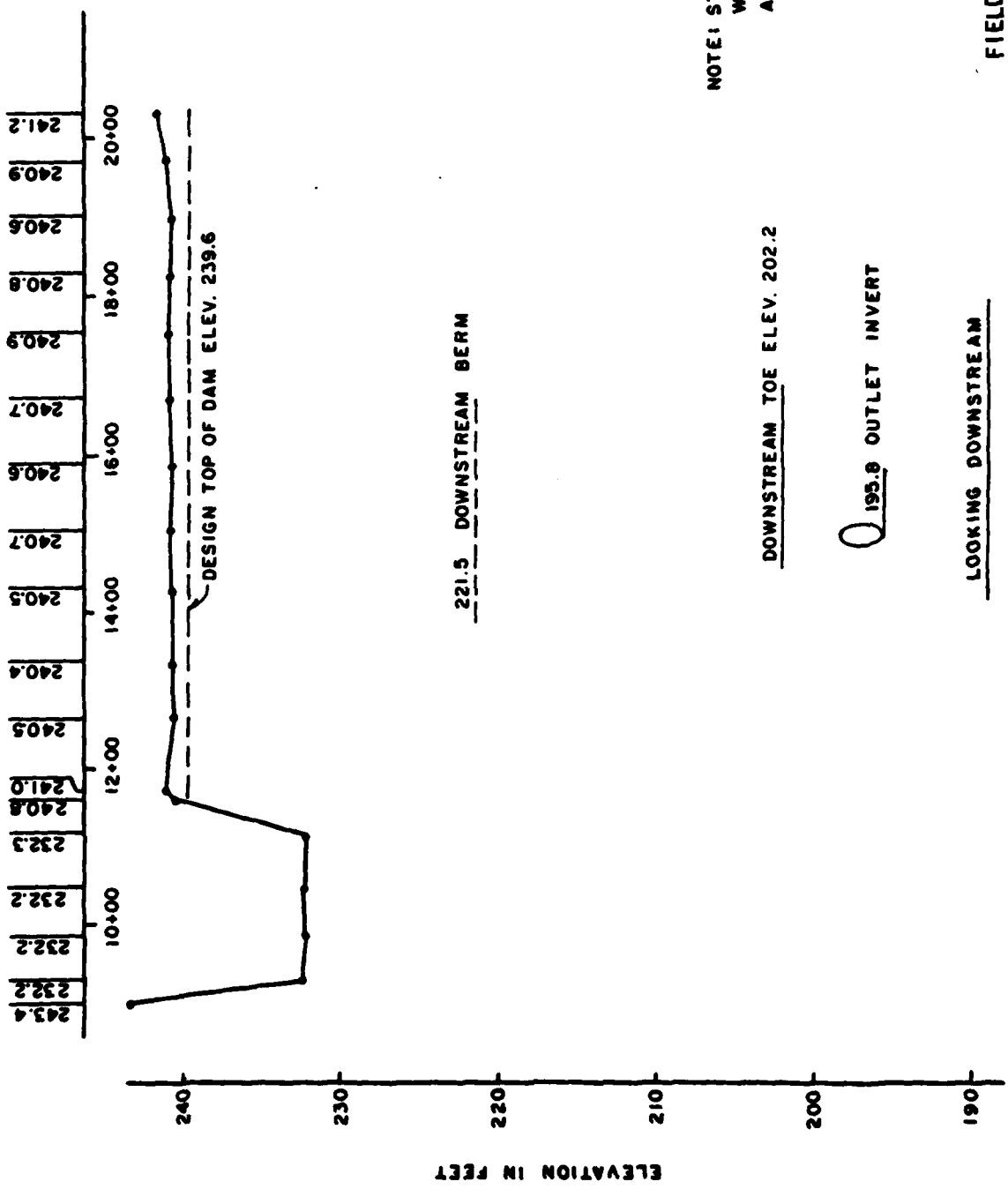
DRAINS

Embankment drains outletting through impact basin walls were dry.



FIELD OBSERVATION PLAN
SCS PA 621

SHEET 5A OF 11



NOTE: STATIONS CORRESPOND
WITH PLATE 3 OF
APPENDIX E

DOWNSTREAM TOE ELEV. 202.2

195.8 OUTLET INVERT

LOOKING DOWNSTREAM

FIELD OBSERVATION PROFILE
SCS PA 621

SHEET 58 OF 11

PRINCIPAL SPILLWAY

Sheet 6 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

CRACKING AND SPALLING OF
CONCRETE SURFACES IN
OUTLET CONDUIT

Conduit through embankment not inspected.

INTAKE STRUCTURE

*Exposed surfaces show no signs of cracking,
spalling or other concrete defects.*

OUTLET STRUCTURE

*Exposed surfaces show no signs of cracking,
spalling or other concrete defects.*

OUTLET CHANNEL

Good condition.

EMERGENCY GATE

Sluice gate open, gate was not exercised.

EMERGENCY SPILLWAY

Sheet 7 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None, the downstream edge of a 50 foot level section is the control section.	
APPROACH CHANNEL	Good condition. A tributary to Newtown Creek enters the approach channel below the control section via a channel excavated in bedrock.	
DISCHARGE CHANNEL	Good condition.	
BRIDGE AND PIERS	None.	

CONCRETE WEIR

None, the downstream edge of a 50 foot level section is the control section.

APPROACH CHANNEL

Good condition. A tributary to Newtown Creek enters the approach channel below the control section via a channel excavated in bedrock.

DISCHARGE CHANNEL

Good condition.

BRIDGE AND PIERS

None.

GATED SPILLWAY

Sheet 8 of 11

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

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	<i>None</i>	
OBSERVATION WELLS	<i>None</i>	
WEIRS	<i>None</i>	
PIEZOMETERS	<i>None</i>	
OTHER	<i>None</i>	

RESERVOIR

Sheet 10 of 11

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

SLOPES

Reservoir slopes are flat to moderate. The sluice gate has not been closed and the reservoir is empty.

SEDIMENTATION

No sediment was noted in the reservoir area.

DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is in good condition, averages 14 feet wide with 4 foot high banks on 3H:1V slopes. The banks are wooded with heavy underbrush. The left floodplain is also wooded and a farm driveway and farm is on the right floodplain.	
SLOPES	The valley gradient is about 0.007.	
APPROXIMATE NO. OF HOMES AND POPULATION	Immediately downstream of the dam is a farm, the barn is shown on Plate 3, Appendix E. About 1,200 feet downstream of the dam is one home subject to damage in the event of a dam failure. About 1,200 feet further downstream, Newtown Creek flows through the Borough of Newtown where there are many homes and businesses subject to damage in the event of a dam failure.	

APPENDIX

B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Newtown Dam
ID # PA 01064

Sheet 1 of 4

REMARKS

ITEM

AS-BUILT DRAWINGS
"As-built" drawings were provided for this investigation and will be on file with DER, SCS and the Owner.

REGIONAL VICINITY MAP

Plate 1, Appendix E.

CONSTRUCTION HISTORY

See Section 1.2 of text.

TYPICAL SECTIONS OF DAM

See Appendix E.

OUTLETS - PLAN

DETAILS

CONSTRAINTS

DISCHARGE RATINGS

RAINFALL/RESERVOIR RECORDS

Appendix E

Appendix D

Rainfall is measured by Neshaminy Water Resources Authority at their office in Cross Keys, Doylestown, Pennsylvania.

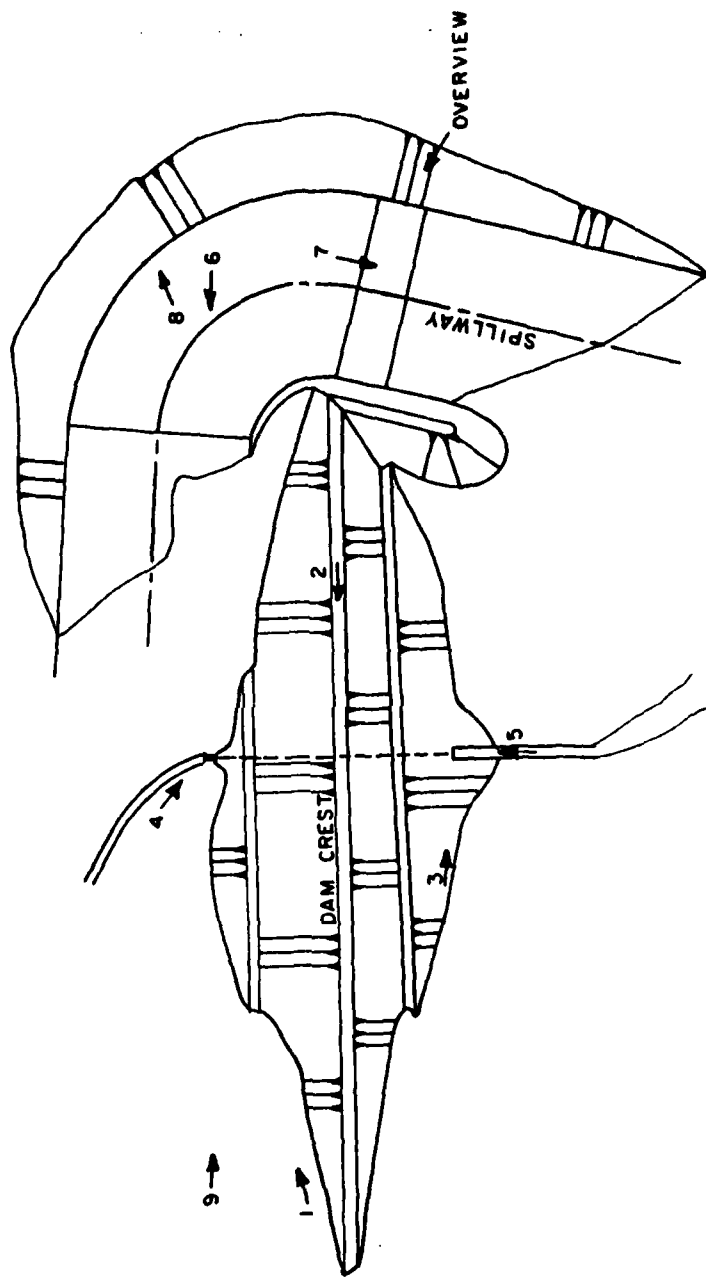
ITEM	REMARKS
DESIGN REPORTS	<i>Design folder on file with DER and SCS.</i>
GEOLOGY REPORTS	<i>Included in design folder, see also Appendix F.</i>
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	<i>See discussion in Sections 5 and 6 of text.</i>
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	<i>Complete records in SCS files.</i>
POST-CONSTRUCTION SURVEYS OF DAM	<i>A final crest profile survey was performed for "as-built" drawings.</i>
BORROW SOURCES	<i>Data located on SCS drawings.</i>

ITEM	REMARKS
MONITORING SYSTEMS	<i>None</i>
MODIFICATIONS	<i>No post-construction modifications.</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>Neshaminy Water Resources Authority maintain these files.</i>

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	
DETAILS	See Appendix E for details.
OPERATING EQUIPMENT PLANS & DETAILS	See Appendix E for details.
MISCELLANEOUS	The following information is located in DER files. 1. "Report Upon the Application of the Neshaminy Water Resources Authority" submitted by the State of Pennsylvania, September 28, 1977. 2. Permit issued by the State of Pennsylvania, October 3, 1977. 3. 35 sheet set of design drawings prepared by SCS, 1976-1977. 4. Erosion and Sediment Control Plan prepared by SCS, August 1977. 5. Progress Reports by Frederick Schuets, Project Engineer, SCS. Also available from SCS were complete construction records.

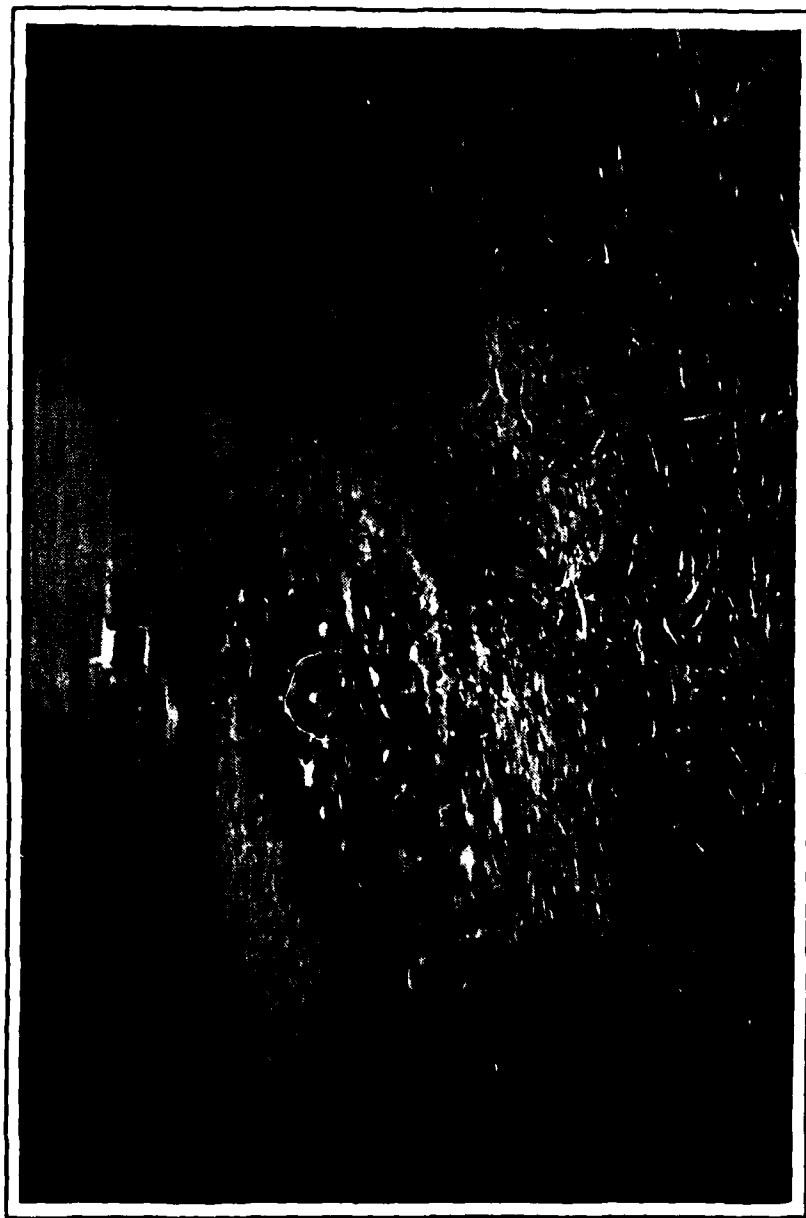
APPENDIX

C



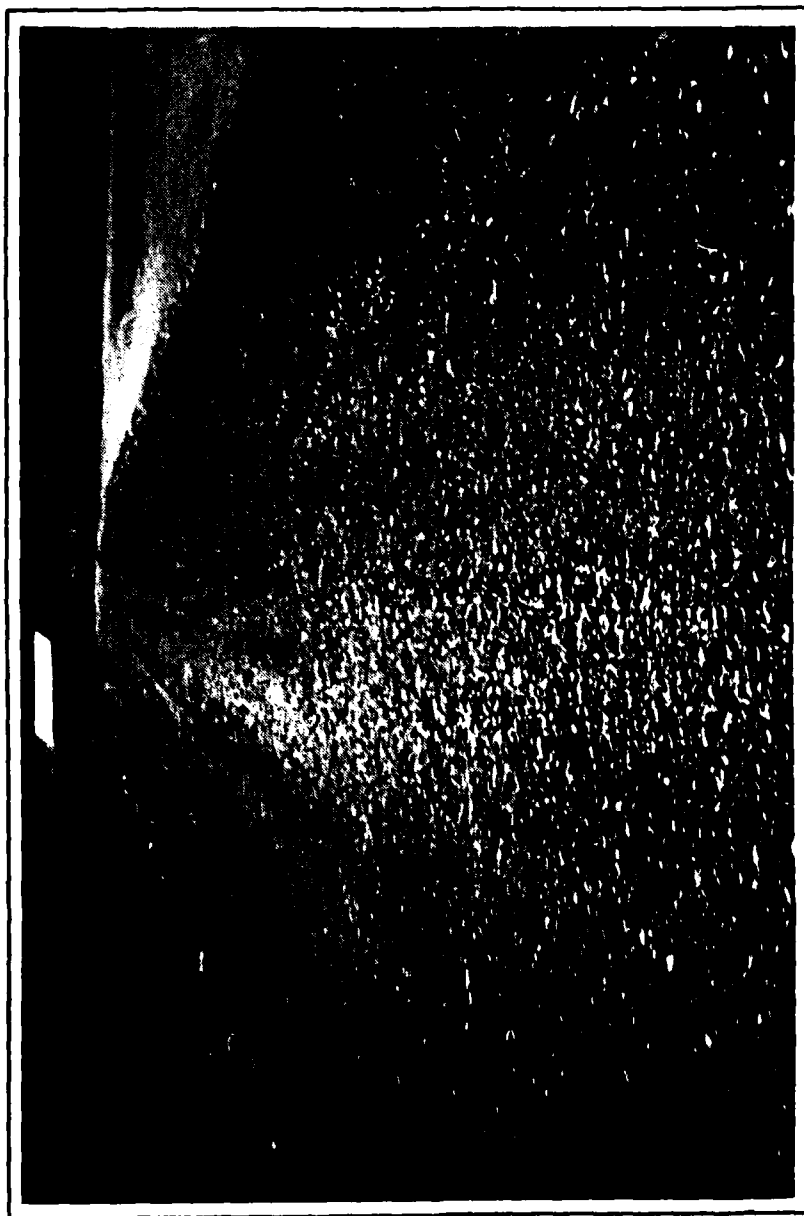
DOWNSTREAM

PHOTOGRAPH LOCATION PLAN
SCS PA 621
PLATE C-1



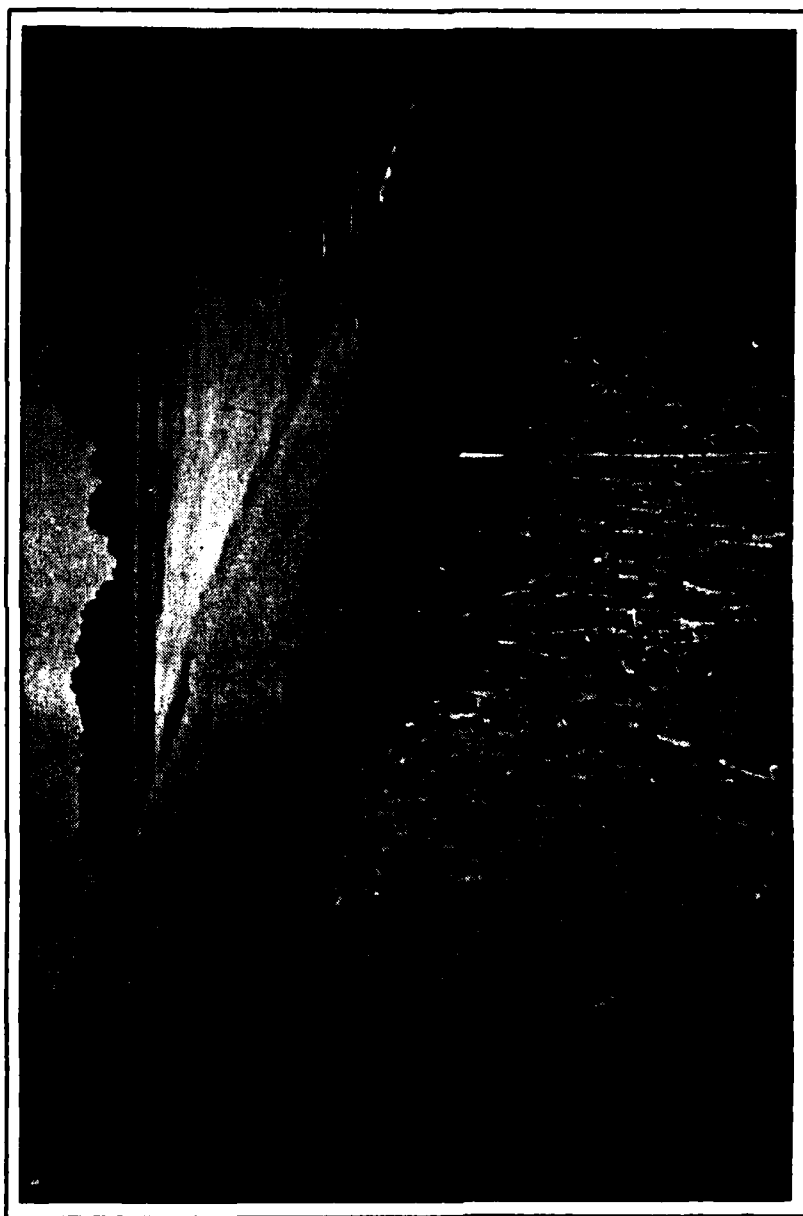
UPSTREAM FACE WITH ROCK GUTTER
AT UPSTREAM TOE.

PHOTOGRAPH NO. 1



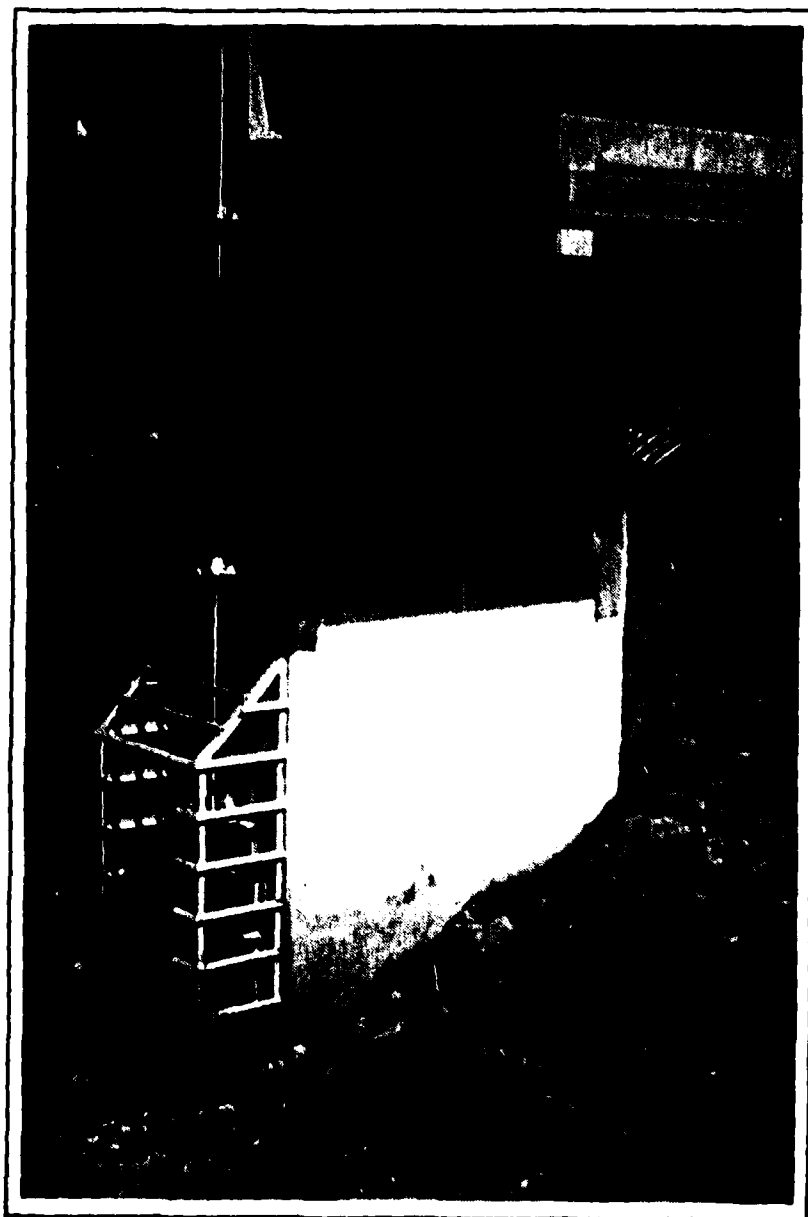
GRAVEL ROAD PROTECTS EMBANKMENT
CREST.

PHOTOGRAPH NO. 2



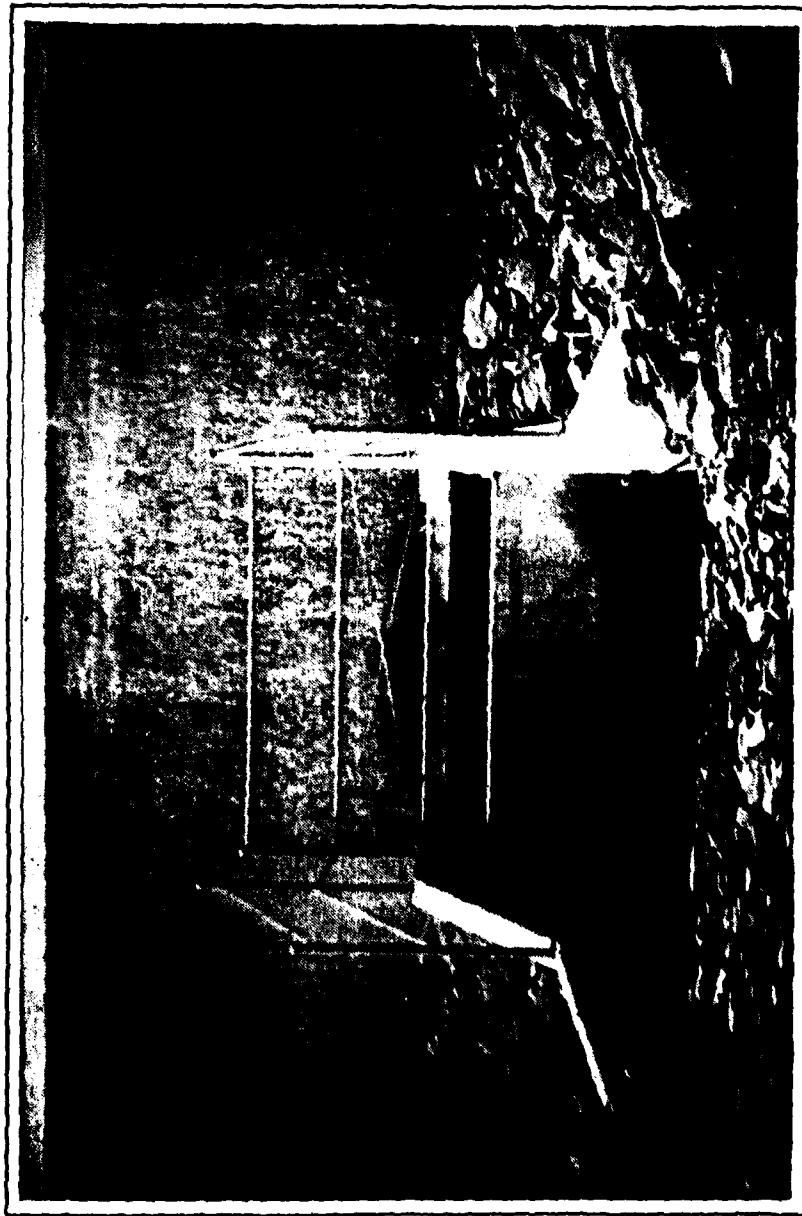
DOWNSTREAM FACE WITH ROCK GUTTER
AT TOE.

PHOTOGRAPH NO. 3



PRINCIPAL SPILLWAY RISER AT UPSTREAM
TOE.

PHOTOGRAPH NO. 4



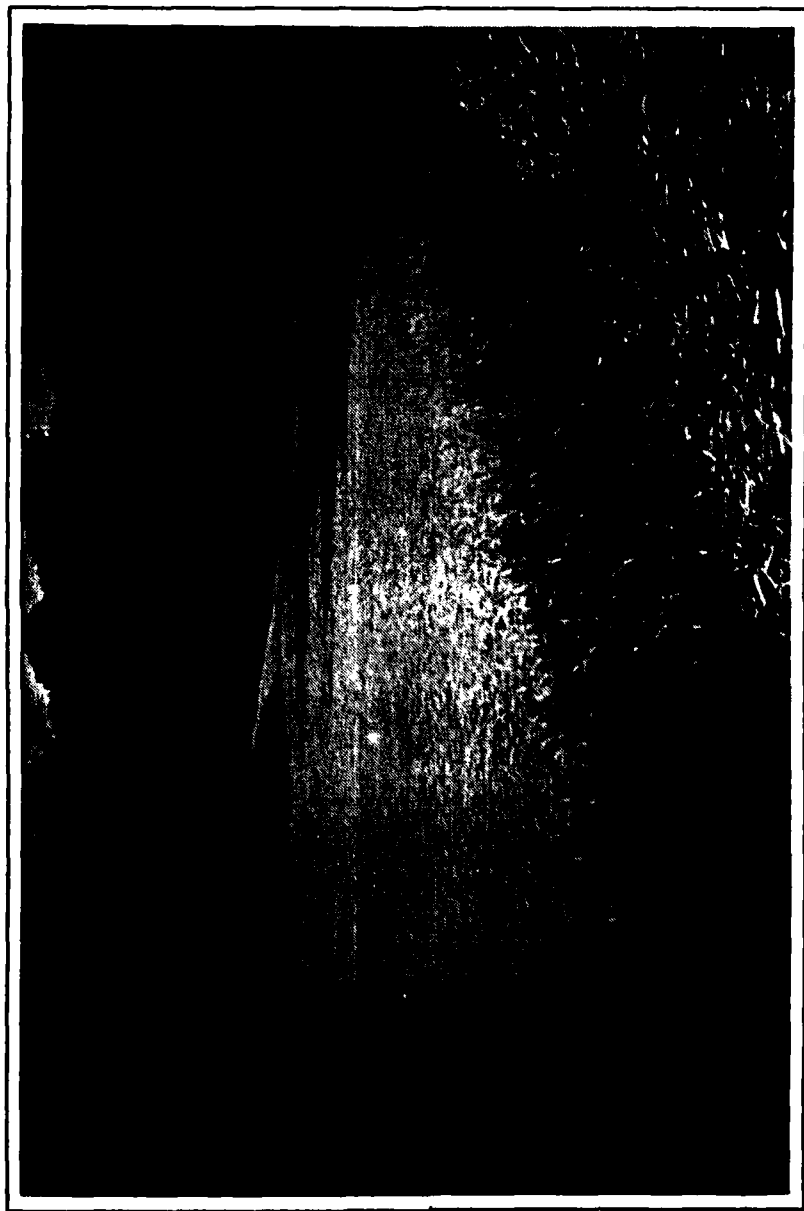
IMPACT BASIN AT DOWNSTREAM TOE.

PHOTOGRAPH NO. 5



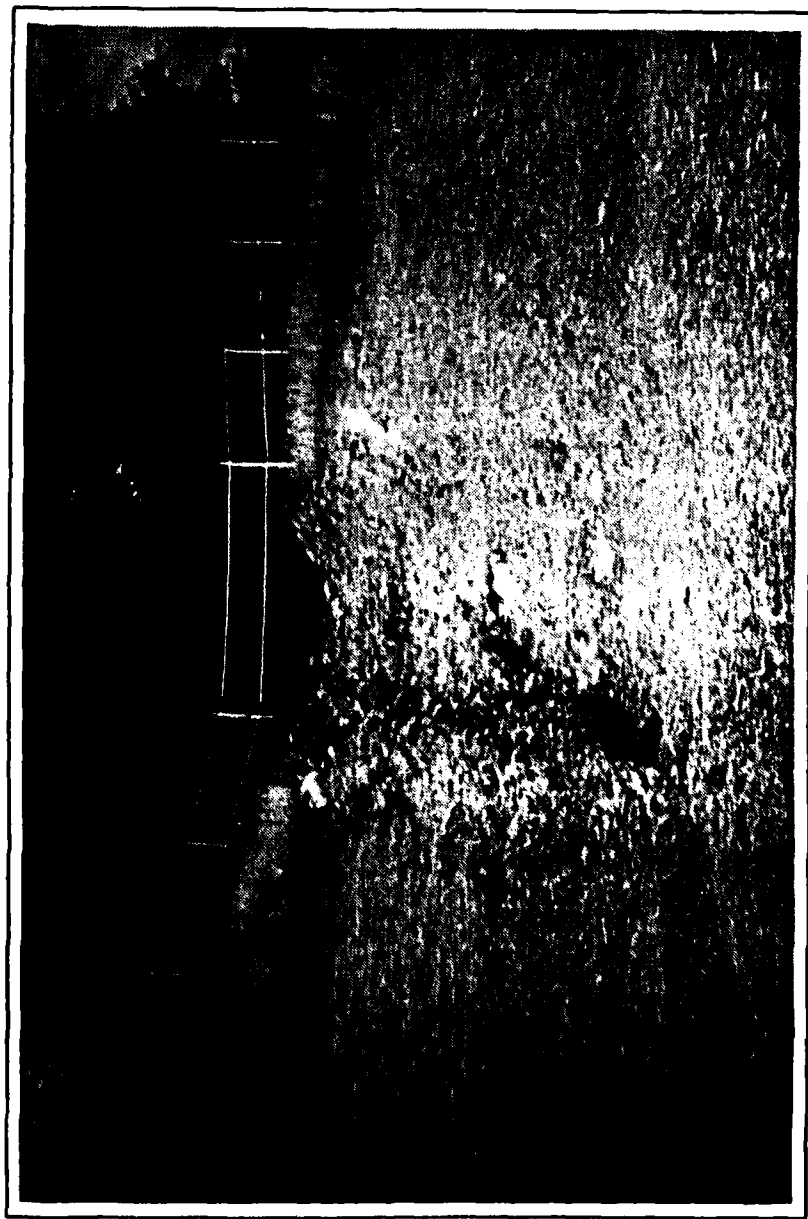
EMERGENCY SPILLWAY LOOKING UPSTREAM

PHOTOGRAPH NO. 6



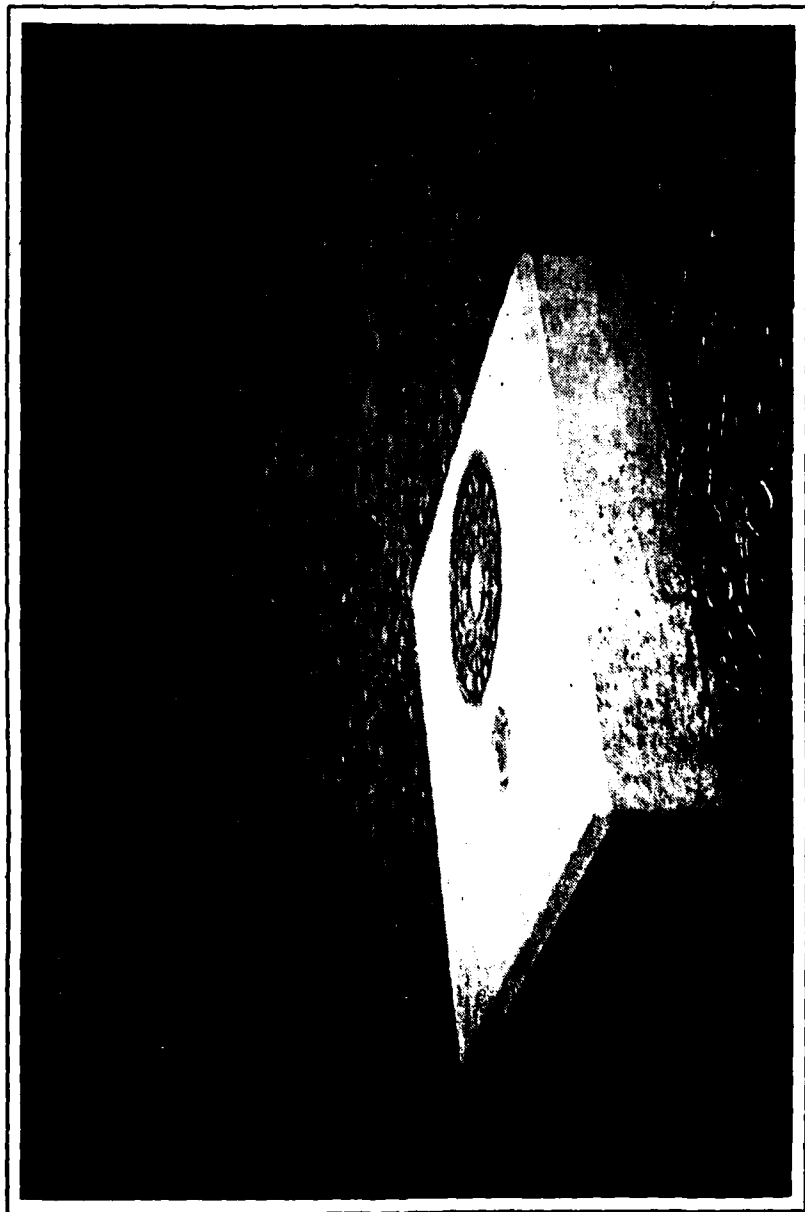
EMERGENCY SPILLWAY LOOKING DOWNSTREAM

PHOTOGRAPH NO. 7



INTERMITTENT STREAM ENTERS EMERGENCY
SPILLWAY UPSTREAM OF CONTROL SECTION.

PHOTOGRAPH NO. 8



SANITARY SEWER MANHOLE. SEWER IS
UNDER EMBANKMENT.

PHOTOGRAPH NO. 9



TYPICAL DEVELOPMENT ADJACENT TO
NEWTOWN CREEK IN NEWTOWN, PENNSYLVANIA.

PHOTOGRAPH NO. 10

APPENDIX

D

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Predominantly open farm land with little residential development.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 213.0 feet (56 Acre-Feet).

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 239.6 feet (1420 Acre-Feet).

ELEVATION MAXIMUM DESIGN POOL: 239.6 feet.

ELEVATION TOP DAM: 239.6 feet, design

EMERGENCY SPILLWAY

a. Elevation 231.9 feet.

b. Type grass lined trapezodial channel.

c. Width 185 feet.

d. Length About 650 feet.

e. Location Spillover Left abutment.

f. Number and Type of Gates None.

PRINCIPAL SPILLWAY

a. Type Deep inlet riser, 30 inch conduit and impact basin.

b. Location Dam station 15+00, at maximum section.

c. Entrance inverts 213 feet.

d. Exit inverts 196.0 feet.

e. Emergency draindown facilities Pond drain at base of riser, 199 feet.

HYDROMETEOROLOGICAL GAGES:

a. Type None within watershed.

b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE: Not determined.

HYDROLOGIC AND HYDRAULIC
BASE DATA

Sheet 2 of 8

DRAINAGE AREA: (1) 3.04 square miles.

PROBABLE MAXIMUM PRECIPITATION (PMP)
USED IN DESIGN: (1) 25.5 inches.

HYDROGRAPH PARAMETERS: (1)
Runoff Curve Number 81
Time of Concentration 1.84 hour

SPILLWAY CAPACITY AT MAXIMUM
WATER LEVEL: (1) 10,967 cfs

(1) From SCS Design Folder

Newtown Dam
(SCS PA 621)
Hydrology/Hydraulics

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

1. The hazard potential is rated as "High" as there would be loss of life if the dam failed.
2. The size classification is "Intermediate" based 1420 Acre-Feet total storage capacity and 44 feet height.
3. The spillway design flood, based on size and hazard classification, is the Probable Maximum Flood (PMF).

Hydrologic/Hydraulic Analysis

The complete H & H design folder was available for review. The PMF inflow hydrograph was determined according to procedures in the SCS National Engineering Handbook, Section 4 (NEH-4). The routing was done according to procedures in NEH-5 (1968, was not available for review) and, later, checked by SCS computer program, TR-20. The computer routing indicates a higher maximum water elevation than the original flood routing. As land rights were obtained before the computer routing, it was decided to increase the emergency spillway width to stay within the acquired land rights.

Original design parameters were checked against current information and/or criteria. The drainage area of 3.04 square miles is verified by current USGS maps.

Calculations for the PMF inflow hydrograph were based on a 6-hour rainfall of 25.5 inches and a Runoff Curve Number of 81. Rainfall criteria established for this investigation by the Corps of Engineers indicate a 26.6 inch rainfall (Ref.-Hydrometeorological Report No. 33) and the use of Hop Brook factor, a point rainfall reduction factor. For a watershed of this size, the point rainfall

is reduced by 20%, to 21.2 inches. Thus, the design rainfall is conservative compared to Corps of Engineers criteria. The Runoff Curve Number 81 (CN 81) is based on the hydroglogic soil group classification and expected future land use within the watershed. The future land use was based on projections of the Bucks and Montgomery Planning Commission to year 2010. Projected land use includes open, 3.5%; wooded, 9.5%; and residential and commercial 87.0%. The estimated current developed areas are less than 10% from the 1973 USGS map. The estimated future conditions are judged adequate.

The elevation-storage data was checked and found adequate. The emergency spillway discharge was checked according to current SCS criteria, TR-39. The maximum emergency spillway discharge was estimated as 10,852 cfs (see sheet 5), about the same as emergency spillway discharge used in the SCS computer routing.

The spillway is rated as "Adequate" as the spillways will pass the PMF without overtopping the embankment.

BY MEB DATE 7/7/80
CHKD. BY REM DATE 7/21/80

SUBJECT _____
Newtown Dam
Hydrology / Hydraulics

SHEET 5 OF 8
JOB No. _____

Emergency Spillway Capacity ref. SCS TR-39

bottom width = 30 ft.
level section = 50 ft.
total length to downstream edge of level section 455 ft.
approach channel slope = 0.02

assume $Q = 10,852$ cfs estimated emergency spillway capacity

$$q = Q/b = 10,852 / 185 = 58.6 \text{ cfs/ft.}$$

depth at upstream edge of level section: 5.9 ft.

ES-158, sheet 1 of 10

depth at entrance to approach channel ~ 15.6 ft

ES-158, sh. 3 of 10

velocity head at entrance to approach channel ~ 0.12 ft.

ES-159, sh. 1 of 2

total head at entrance to approach channel

elev. + water depth + velocity head

$$224.0 + 15.6 + 0.12 = 239.7 \sim 239.6 \text{ top of dam}$$

the above calculations are adequate as they are within the accuracy of the charts.

Penna Project : Shimmy Creek SHEET 6 OF 8
 By H. L. W. Date 8-27-74 Checked By Die Job No PA-621
 Subject WORK PLAN - DESIGN COMPARISON (DAMS) Sheet 3 of ✓

ITEM	UNIT	WORK PLAN	DESIGN	COMMENTS
<u>DRAINAGE AREA</u>	SQ. MI.	<u>3.04</u>	<u>3.04</u>	
<u>STORAGE CAPACITY</u>				
SEDIMENT (INC. AERATED)	AC. FT.	<u>69</u>	<u>69</u>	
BENEFICIAL	AC. FT.			
RETARDING	AC. FT.	<u>594</u>	<u>678.7</u>	
TOTAL	AC. FT.	<u>663</u>	<u>747.7</u>	
BETWEEN HIGH & LOW S.	AC. FT.			
<u>SURFACE AREA</u>				
NORMAL POOL	ACRE	<u>10</u>	<u>11</u>	
RETARDING POOL	ACRE			
DESIGN HIGH WATER	ACRE	<u>67</u>	<u>82</u>	
<u>VOLUME OF FILL</u>	CU. YD.	<u>63,100</u>		
TOP OF DAM ELEV.	FEET	<u>239.3</u>	<u>239.6</u>	
MAX HEIGHT OF DAM	FEET	<u>43.3</u>	<u>43.6</u>	
<u>EMERGENCY SPILLWAY</u>				
CREST ELEVATION	FEET	<u>231.0</u>	<u>231.9</u>	
BOTTOM WIDTH	FEET	<u>150</u>	<u>185.0</u>	
TYPE	-	<u>50d</u>	<u>50d</u>	
PERCENT CHANCE OF USE	-	<u>1</u>	<u>1</u>	
AVE. CURVE NO. COND. II	-	<u>81</u>	<u>81</u>	
<u>EM. SP. HYDROGRAPH</u>				
STORM RAINFALL	IN.	<u>10.5</u>	<u>10.5</u>	
STORM RUNOFF	IN.	<u>8.12</u>	<u>8.12</u>	
VELOCITY OF FLOW - V	FPS	<u>8.3</u>	<u>7.58</u>	
PEAK DISCHARGE RATE	CFS	<u>2020</u>	<u>2091</u>	
MAX. WATER SURFACE EL.	FEET	<u>234.2</u>	<u>234.7</u>	
<u>FREEBOARD HYDROGRAPH</u>				
STORM RAINFALL	IN.	<u>2.6</u>	<u>25.5</u>	
STORM RUNOFF	IN.	<u>23.39</u>	<u>22.88</u>	
VELOCITY OF FLOW - V ₀	FPS	<u>14.2</u>	<u>14.79</u>	
PEAK DISCHARGE RATE	CFS	<u>10,275</u>	<u>10967</u>	
MAX. WATER SURFACE EL.	FEET	<u>239.3</u>	<u>239.6</u>	
<u>PRINCIPAL SPILLWAY</u>				
PIER SIZE	FT.	<u>—</u>	<u>2.5 x 7.5</u>	
MAX. LOW STAGE FLOW	CFS	<u>—</u>	<u>—</u>	
ORIFICE SIZE	FT.	<u>—</u>	<u>—</u>	
MAX. HIGH STAGE FLOW	CFS	<u>136.</u>	<u>117.</u>	
PIPE SIZE	DIA.	<u>—</u>	<u>30</u>	
<u>CAPACITY EQUIVALENTS</u>				
TOTAL SEDIMENT VOL.	IN.	<u>0.42</u>	<u>0.42</u>	
RETARDING STORAGE	IN.	<u>3.66</u>	<u>4.186</u>	
EM. SPILLWAY STORAGE				
TO TOP OF DAM	IN.	<u>4.42</u>	<u>4.12</u>	
<u>CLASS OF STRUCTURE</u>	-	<u>C</u>	<u>C</u>	
<u>CONSTRUCTION COSTS</u>	-			
	-			
	-			

COMPUTATION SHEET
SCS-ENG-522 REV. 3-69

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SPD-100-O-237-000

STATE Penn PROJECT Neshaminy Creek
DATE 8/27/74 CHECKED BY _____ DATE _____ JOB NO. PA-621
SUBJECT Time of Concentration (copied from planning data) SHEET 6 OF _____

	Length	Slope	Vel.	t sec	
Overland Flow	2800'	2.17%	1.0	2800	
Gully	7000'	0.009	3.4	2060	
Channel	8000'	0.01	4.5	1790	r = 2
				<u>6640 sec</u>	

$$\frac{\Delta \text{Elev}}{\text{Sum L}} = \frac{120}{17800}$$

1.84 hours

Soil Cover Complex (copied from planning data)

Future Conditions

Cover	Hydro Soil Class	CN	% Land	% x CN	
Grass		83	4.5	129	
Woodland		70.1	9.5	666	
Public		79	2.0	158	
Commercial		89	1.0	89	
Residential 20-40,000		81.7	36.0	2941	
Residential 7-40,000		81.7	50.	4085	II
			100.	8063	III
				USP 81	94

REF - SCS DESIGN FOLDER

PAGE NO. 12

PA - 621
NESHAMINY CREEK

STRUCTURE CLASS C 07-19-76

FREEBOARD ROUTING

BOTTOM WIDTH= 185.0

ENTRANCE LENGTH= 400.0

TIME	INFLOW	AVE INFLOW	OUTFLOW	STORAGE	ELEVATION	W/L (CS + DMV)	W/E
0.25	0.07	0.03	0.03	55.00	213.00		
0.50	10.47	5.27	7.03	55.03	213.19		
0.75	52.56	31.47	21.04	55.99	213.57		
1.00	154.43	103.44	29.27	57.01	214.71		
1.25	363.39	258.91	49.54	62.14	216.09		
1.50	758.57	560.98	80.75	72.48	216.94		
1.75	1336.96	1047.77	85.27	92.31	216.12		
2.00	2231.03	1784.00	89.87	127.36	218.06		
2.25	3623.22	2927.12	95.13	185.92	220.48		
2.50	5417.98	4770.60	100.95	282.46	223.33		
2.75	4041.57	3479.77	107.65	434.03	226.75		
3.00	11979.93	16510.75	115.13	649.69	230.77	9.31	4.49
3.25	34076.13	13028.03	1452.13	902.65	234.12	3.39	10.05
3.50	14653.05	14466.59	5027.13	1134.56	236.40	11.13	13.21
3.75	14160.74	14506.64	8327.58	1296.31	238.41	11.07	14.39
4.00	12876.64	12517.43	10224.58	1383.96	239.29	12.15	14.77
4.25	11496.43	12184.53	10927.45	1416.76	239.61	12.13	14.76
4.50	10148.98	10846.70	10921.68	1414.74	239.59	6.58	7.09
8.50	562.92	608.54	1786.37	924.05	234.42		
12.50	0.00	0.00	199.59	759.54	232.27		

NON CRITICAL FLOW

VOLUME CHECK AT MP= 0.38. COMPUTED MP= 7.71 AT ELEV. 239.61 (STORAGE IS 1616.7 AC.-FT. 8.73 IN.)
 TIME= 4.25 HOURS. CRITICAL VELOCITY= 12.15 CRITICAL DEPTH= 4.59 CRITICAL SLOPE= 1.40.

PEAK INFLOW = 14053. CFS
 TOTAL VOL. THRU EMER SPILLWAY = 2953. AC.-FT.
 ASCENDING VCL. THRU EMER SPILLWAY = 731. AC.-FT.
 PEAK OUTFLOW = 10967. CFS
 ATTACK = 15.966 AC.-FT. PER FT. WIDTH

DURATION OF FLOW= 11.50

REF - SCS DESIGN FOLDER

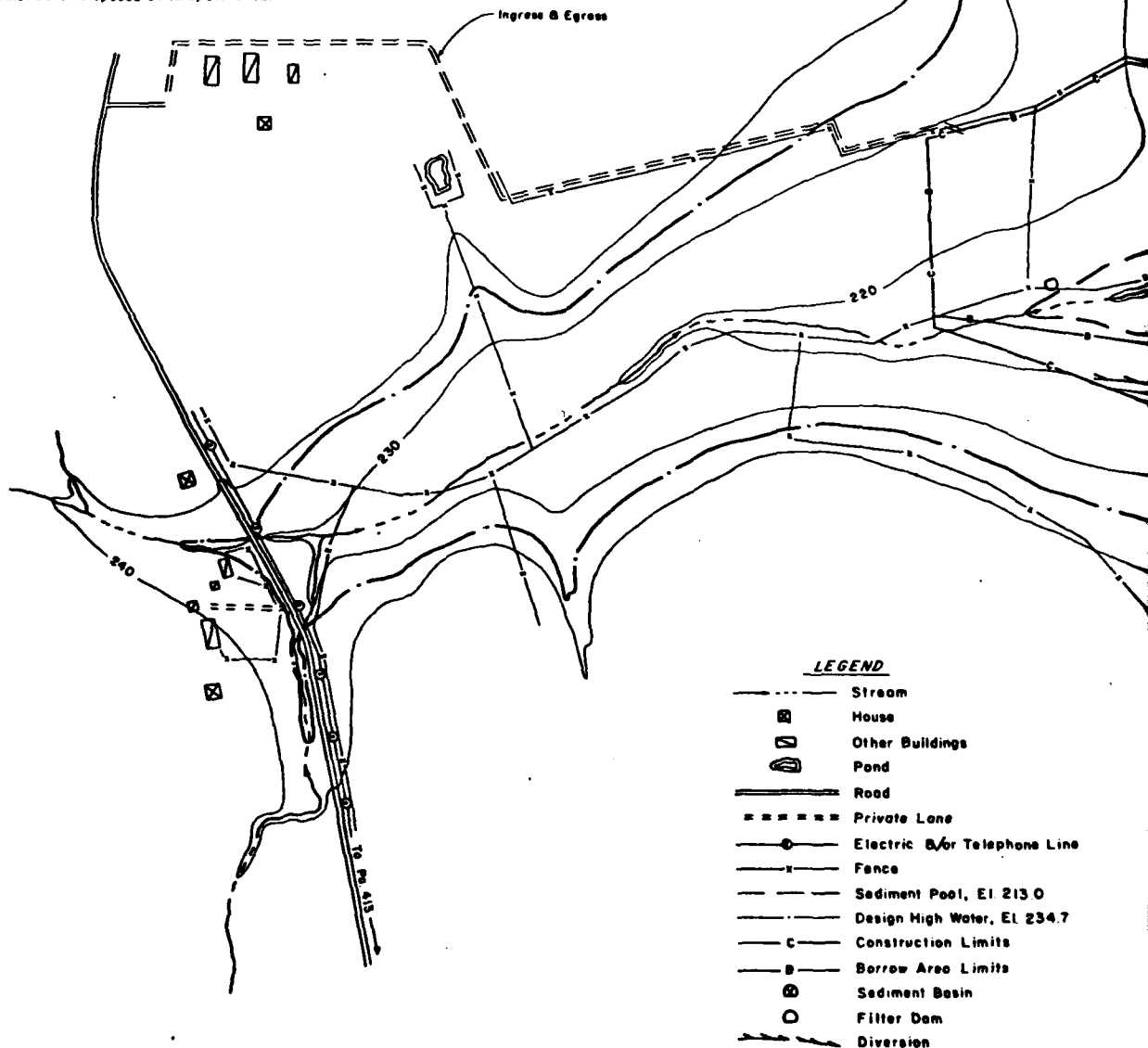
APPENDIX

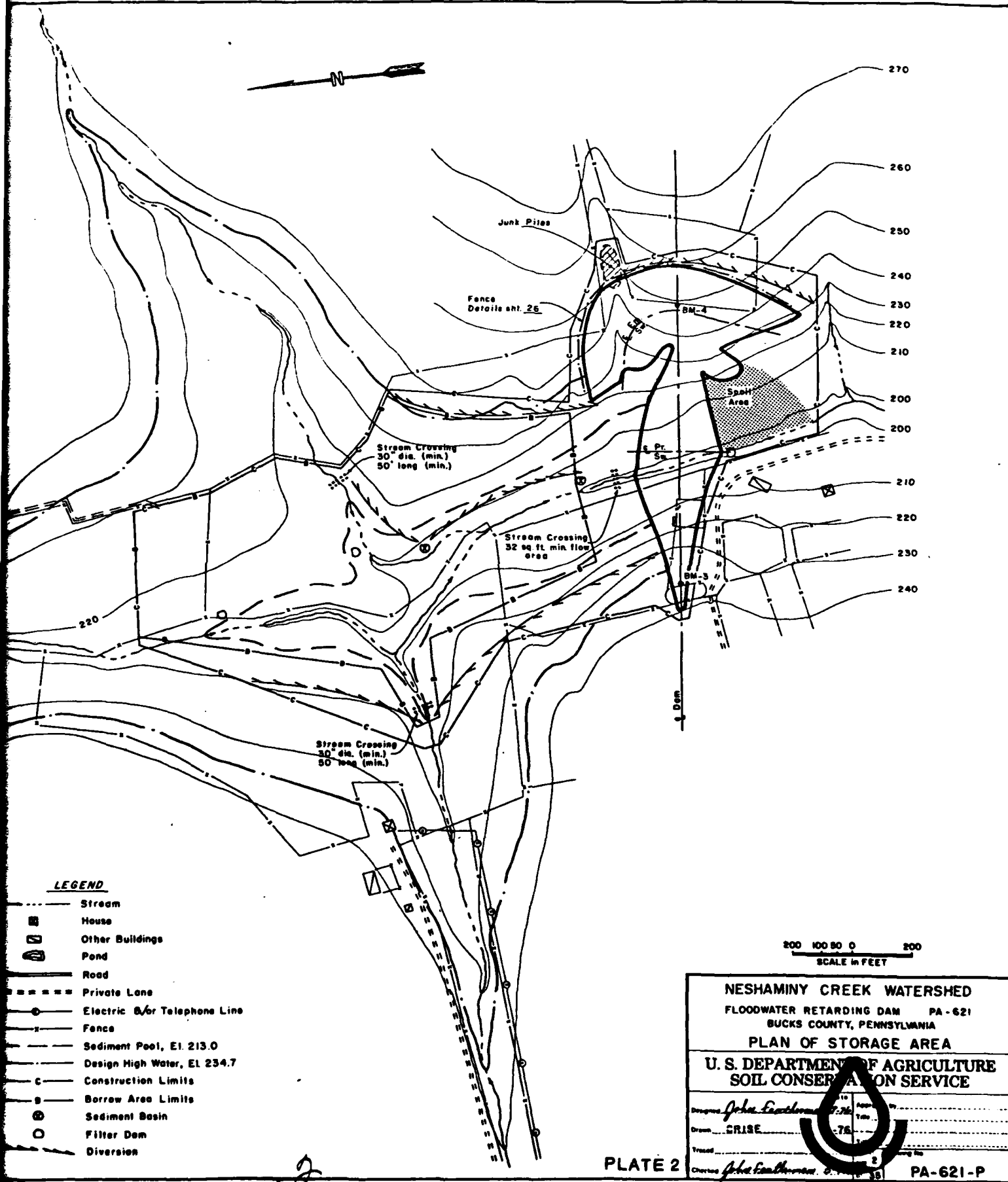
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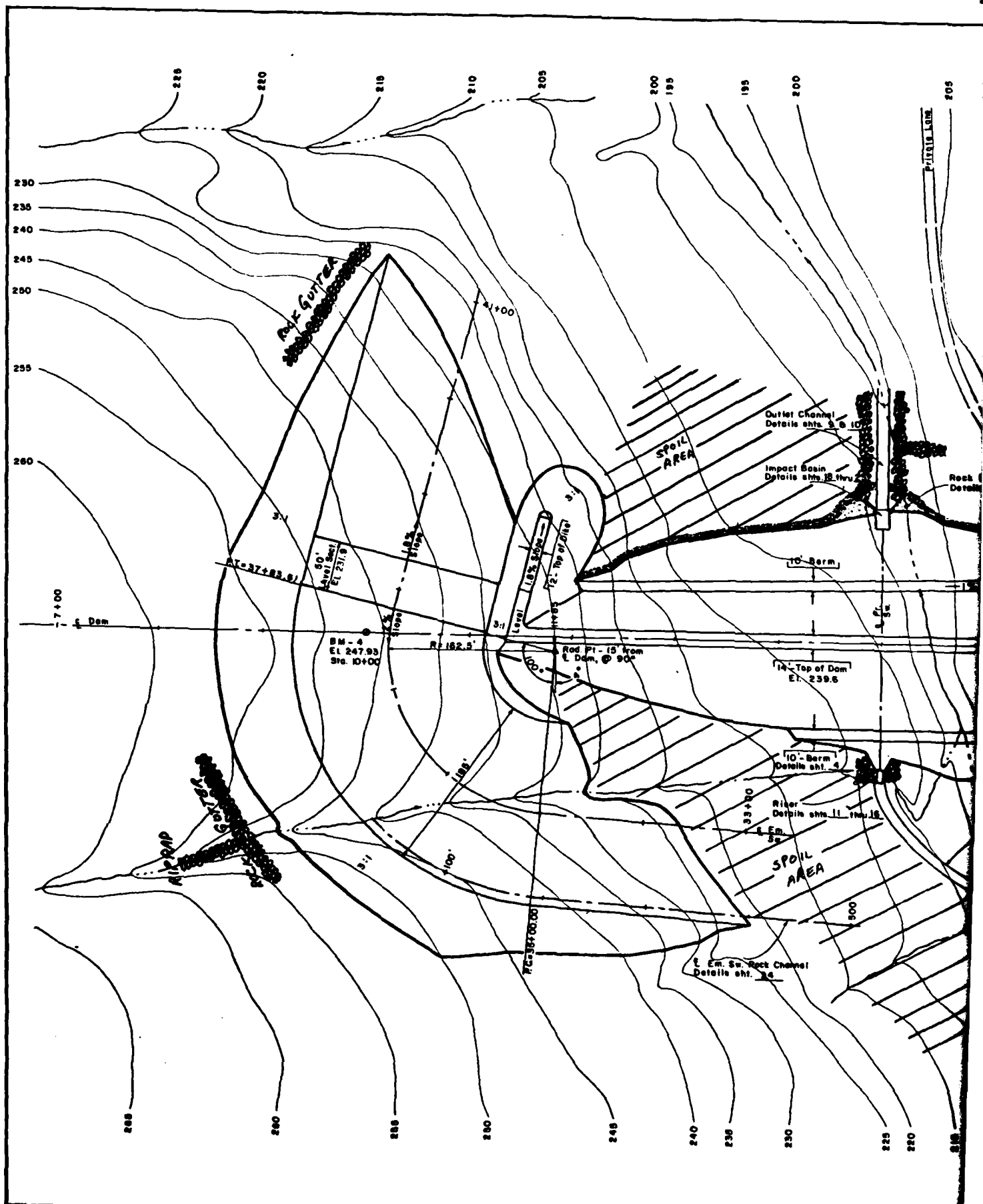
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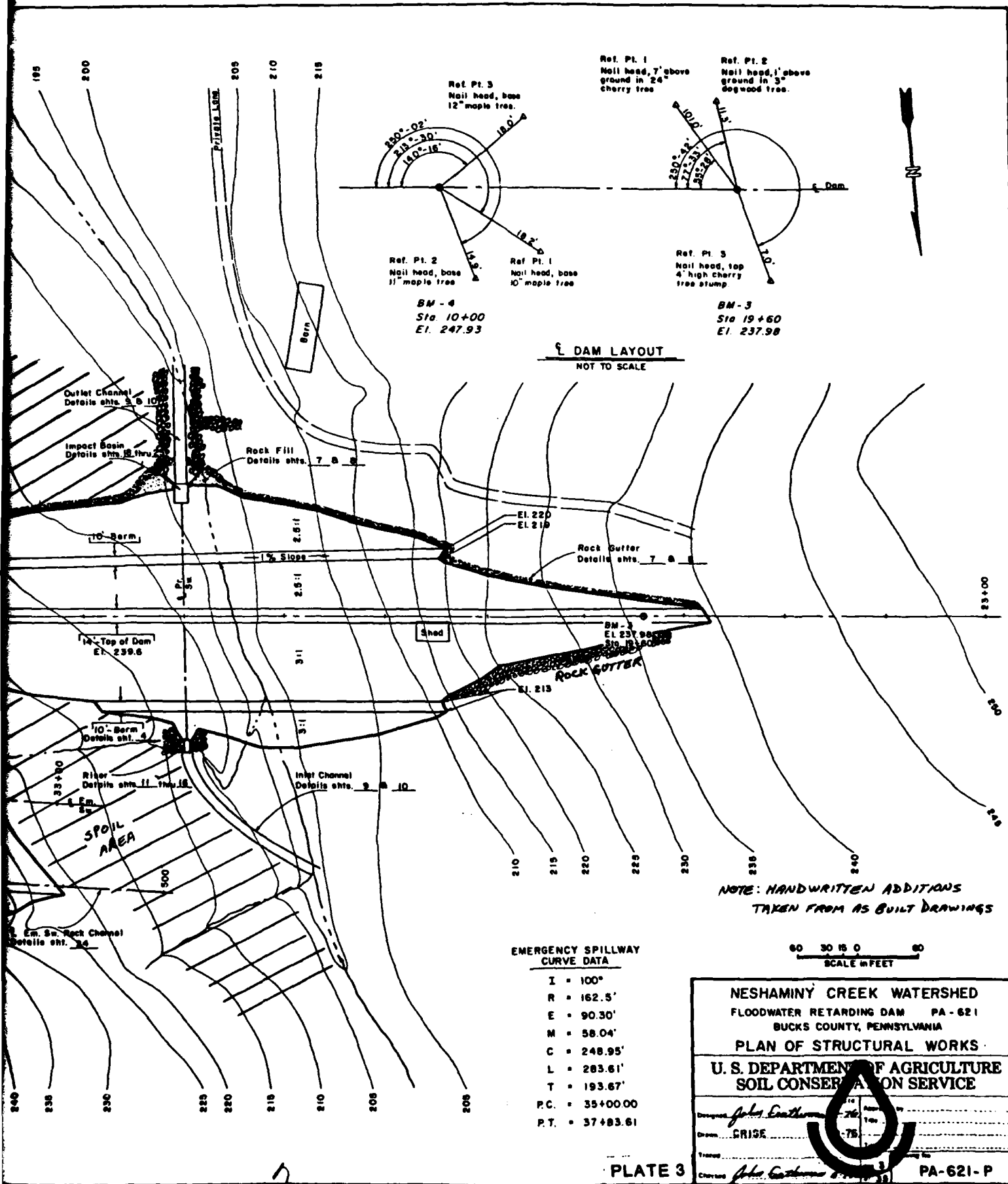
CONSTRUCTION NOTES

1. For Em. Sw section see sht. 6, for profile see sht. 24.
2. Σ Dam = Σ Cutoff Trench
3. Junk Piles within construction limits shall be disposed of in spoil area.
4. Filter Dams, Stream Crossings and Sediment Basins will be located as directed by the Engineer. (details sht. 5)
5. Diversions, final line and grade will be determined by the Engineer. (details sht. 5)
6. Borrow Area sideslopes shall be no steeper than 3:1.
7. Spoil Area shall be cleared prior to use and spoil shall be graded for drainage.
8. Clearing & Grubbing required in structure area, borrow area and upstream of dam below elev. 213.0 will be as directed by the Engineer.
9. For Σ Dam Layout see sht. 3.
10. Ingress & Egress, Final line and grade will be determined by the Engineer.
11. All fences & buildings within construction limits shall be removed & disposed of in spoil area.





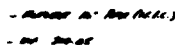
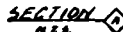




27



21.



1. THE SYSTEM OF THE FORMS OF STATE CONSTITUTIONS -
 AND THEIR WAY OF BEING SET BY THE CONSTITUTION
 AND THEIR WAY OF BEING SET BY THE CONSTITUTION
 AND THEIR WAY OF BEING SET BY THE CONSTITUTION
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5. THE SYSTEM OF THE FORMS OF STATE CONSTITUTIONS -
 AND THEIR WAY OF BEING SET BY THE CONSTITUTION
 AND THEIR WAY OF BEING SET BY THE CONSTITUTION
 AND THEIR WAY OF BEING SET BY THE CONSTITUTION

NEWTOWN CREEK TRUNK
NEWTOWN TOWNSHIP, BUCKS COUNTY PA.
F.P.A. Corporation
2507 Plumert Avenue
Huntington Valley, Pa. 19006

SANITARY SEWER DETAILS - PG. 621 (CONT.)

BOUCHER and JAMES, INC.
Engineers and Surveyors
Stamford, Pa. Cantonment, Pa.

Case: 20-2222	Case: 4-222	Page: 1
Case: 0-22-70	Case: 0-22-70	Case: 0-22-70

PLATE 4

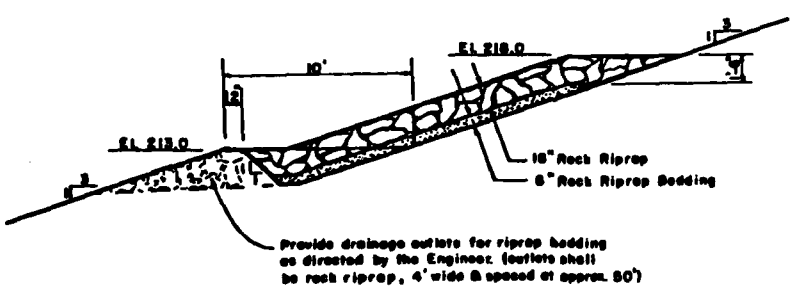
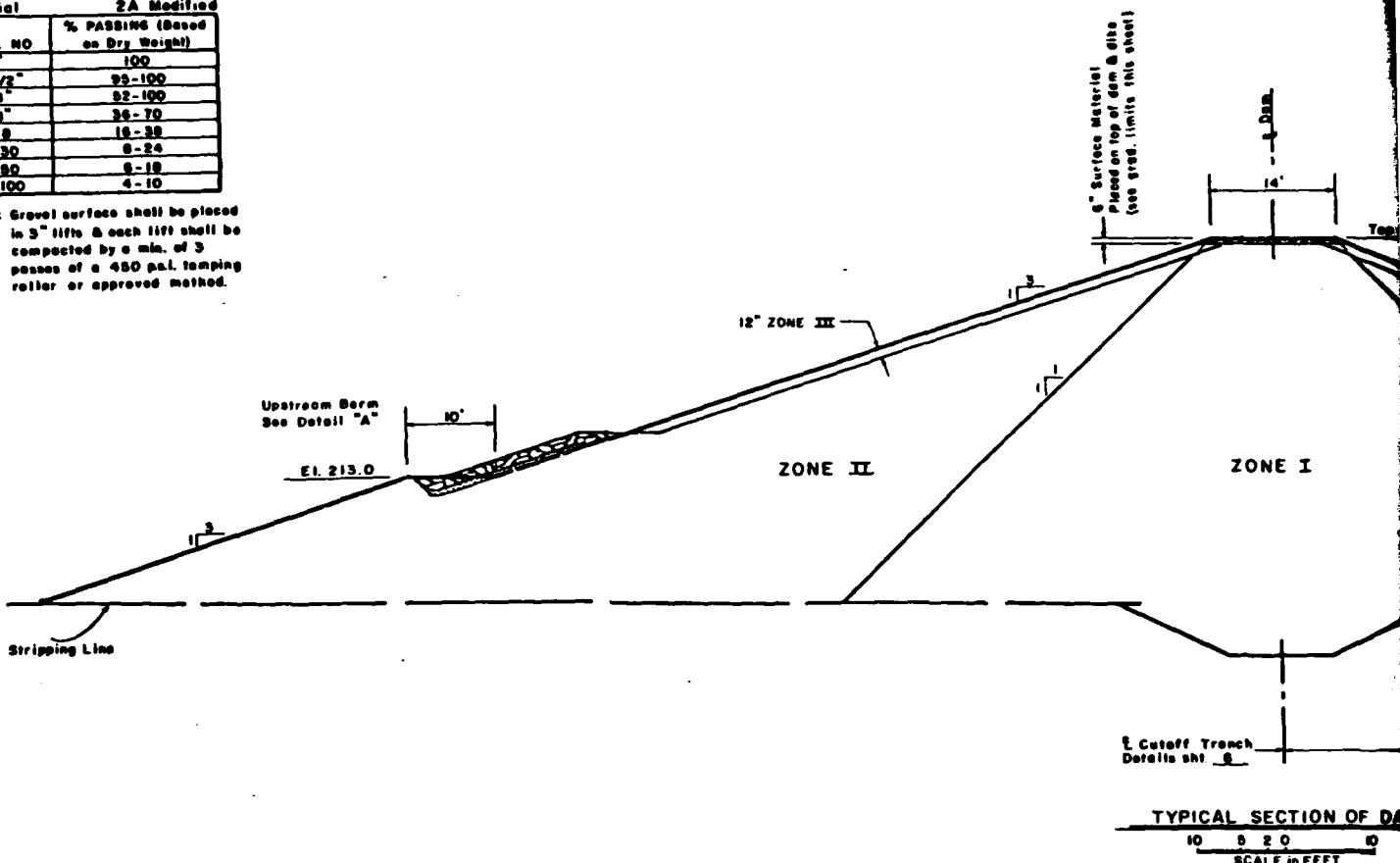
1. THE CONTINUING INTEREST OF INVESTORS AND OTHERS WHO HAVE INVESTED IN SUCH NEW ISSUES AND THAT THE INVESTMENT OPERATIONS OF THE NEW CORPORATION AS NOTED ON SHEET 22 OF 25, PG 22-1

2. AS OF 1 JAN 1957 THE NEW CORPORATION HAS THE FOLLOWING:

GRADATION LIMITS

Surface Material	PennDOT 2A Modified
SEIVE NO	% PASSING (Based on Dry Weight)
2"	100
1-1/2"	95-100
3/4"	92-100
3/8"	35-70
no. 20	15-35
no. 30	5-25
no. 60	5-15
no. 100	4-10

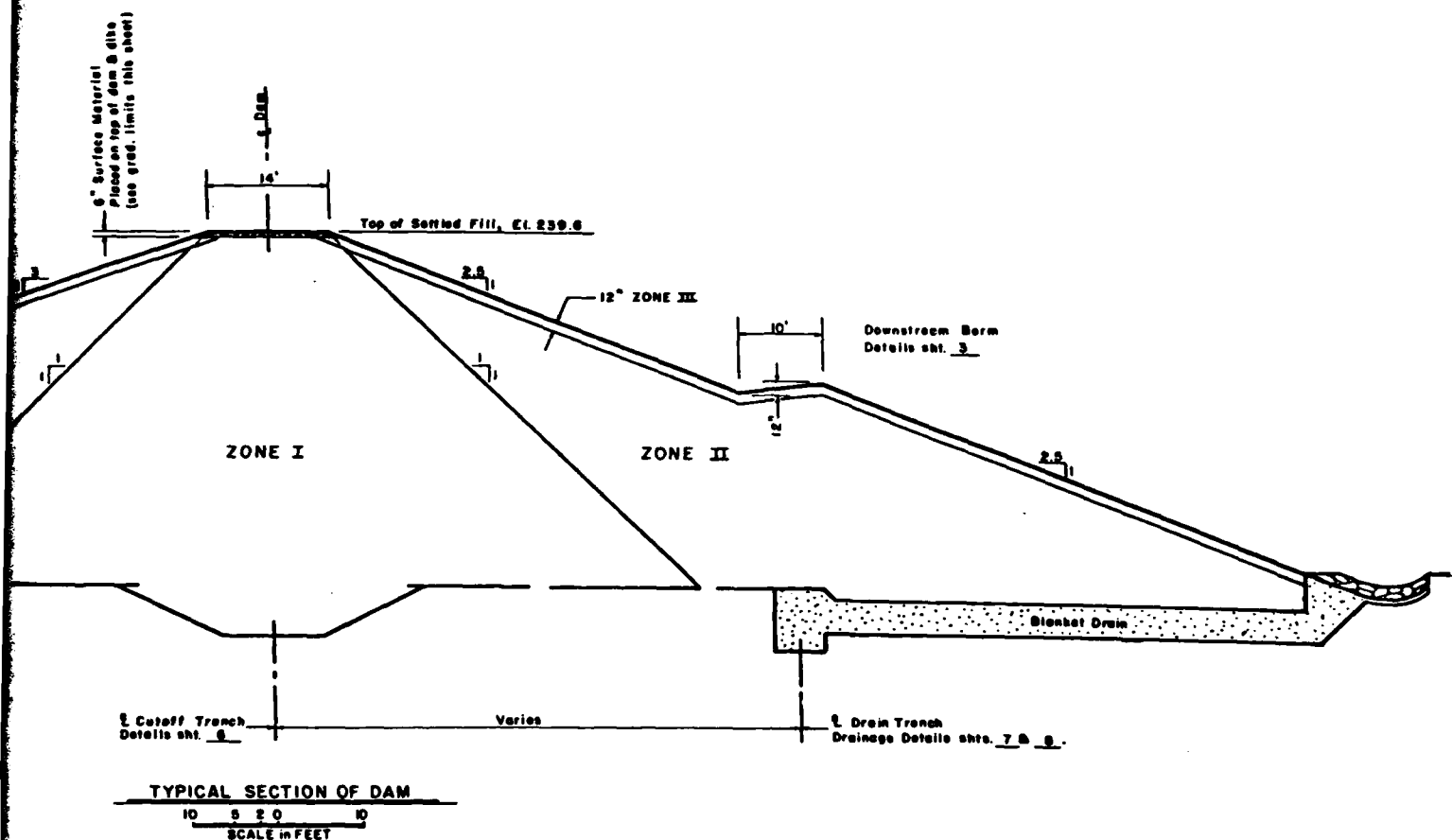
NOTE: Gravel surface shall be placed in 3" lifts & each lift shall be compacted by a min. of 3 passes of a 450 p.s.i. tamping roller or approved method.



DETAIL "A"

SELECTIVE PLACEMENT	MATERIAL	MAX. S. ROCK SIZE	20
ZONE I	Material as represented by TP-117 ML 1.0' to 5.0' TP-129 ML 1.0' to 2.5' TP-141 SM 3.5' to 5.2' TP-211 ML 0.5' to 2.0'	6"	
ZONE II	Material as represented by TP-129 SM 2.5' to 4.0'	12"	
ZONE III	Topsell or ML	—	

- 1) Maximum permissible
- 2) Water content of fill Variation from water by the Engineer
- 3) For typical compact
- 4) For hand compacted shall not exceed 3"



SELECTIVE PLACEMENT	MATERIAL	MAX. $\frac{1}{2}$ ROCK SIZE	$\frac{1}{2}$ $\frac{1}{2}$ MAX. LIFT	REQ'D. $\frac{1}{2}$ WATER CONTENT	COMPACTION $\frac{2}{3}$	
					CLASS	DEFINITION
ZONE I	Material as represented by TP-117 ML 1.0' to 5.0' TP-129 ML 1.0' to 2.5' TP-141 GM 3.5' to 5.3' TP-211 ML 0.5' to 2.0'	6"	9"	Optimum to +4%	A	95% Standard density by ASTM D-698, Method A.
ZONE II	Material as represented by TP-129 GM 2.5' to 4.0'	12"	10"	-2% to +2% of optimum Minus 3/4" matl. ASTM D-698 Method B	C	Minimum 6 passes with a 450 psi tamping roller per HFL
ZONE III	Topsoil or ML	—	12"	As designated by the Engineer.	C	Minimum 1 pass with a 450 psi tamping roller or approved method.

1. Maximum permissible lift thickness before compaction.
2. Water content of fill matrix at time of compaction.
Variation from water content shown may be approved by the Engineer.
3. For typical compaction curves see sht. 55.
4. For hand compacted backfill, the maximum rock size shall not exceed 5" & lift thickness shall not exceed 4".

CONSTRUCTION NOTES

1. Constructed Slopes are:
3:1 = 2.96:1
2.5:1 = 2.47:1
2. For constructed fill elevations
see sht. 6.

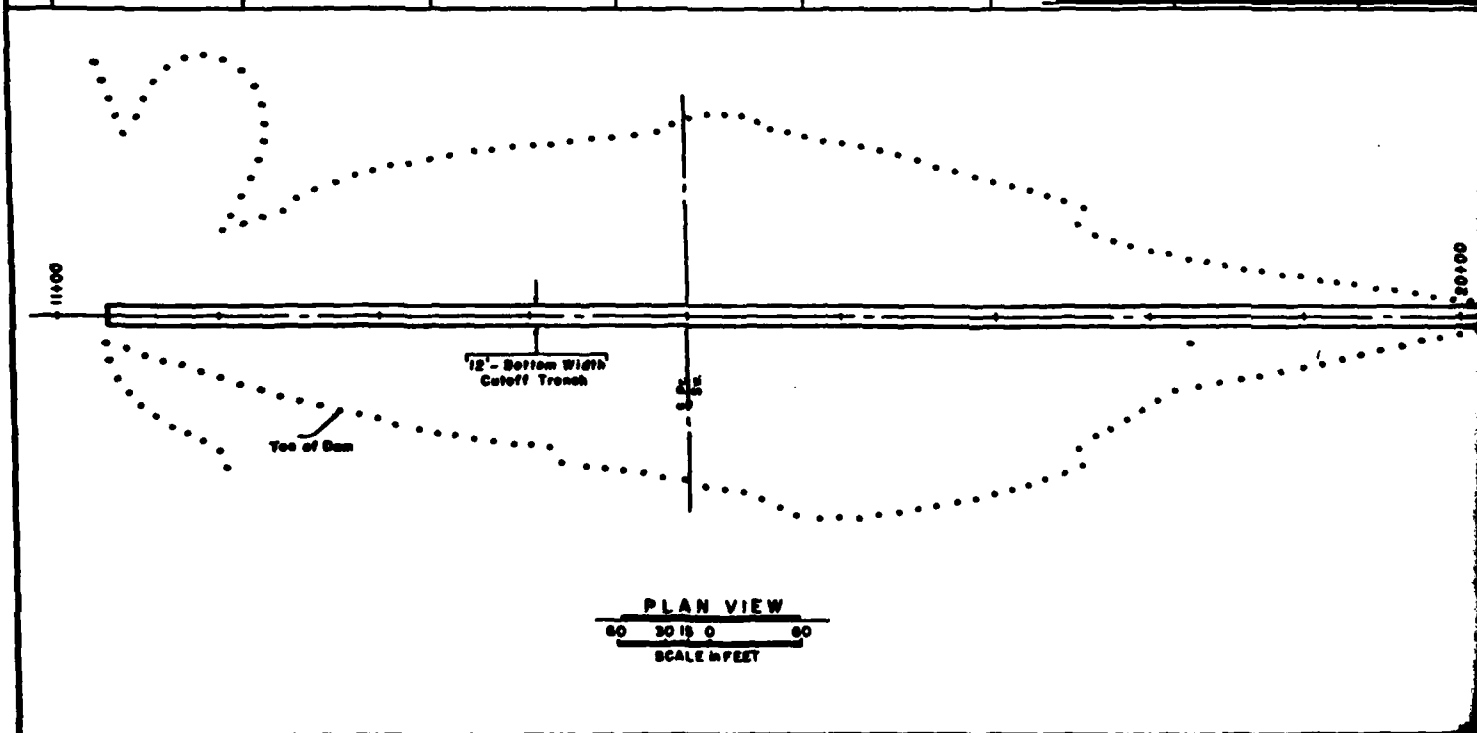
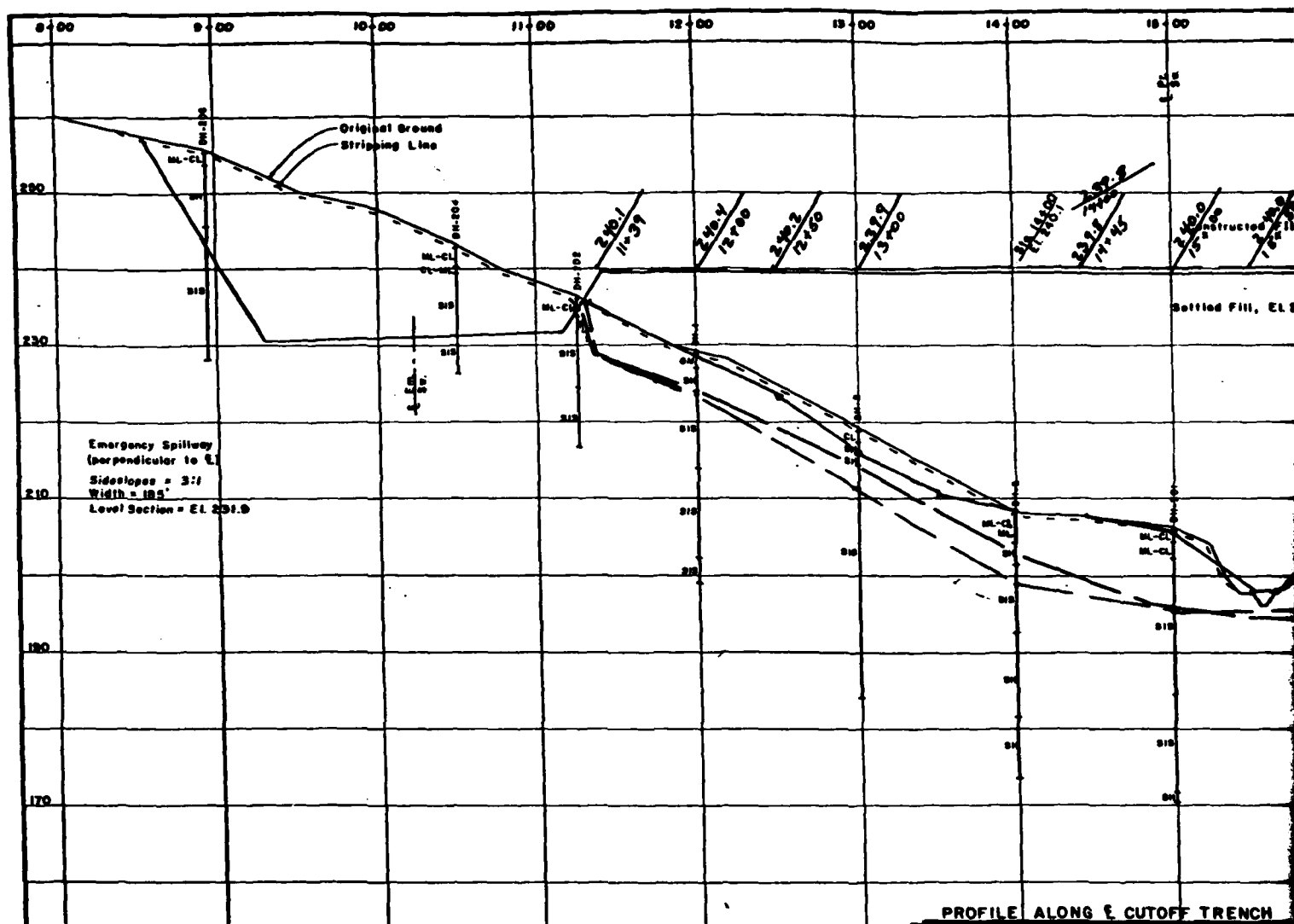
NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA

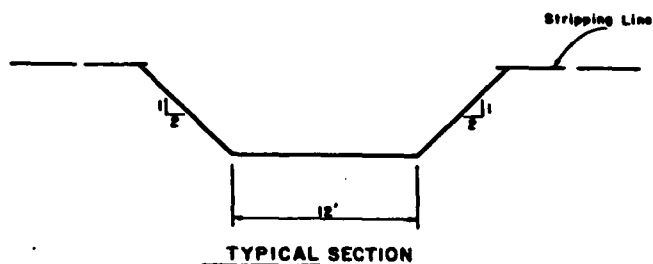
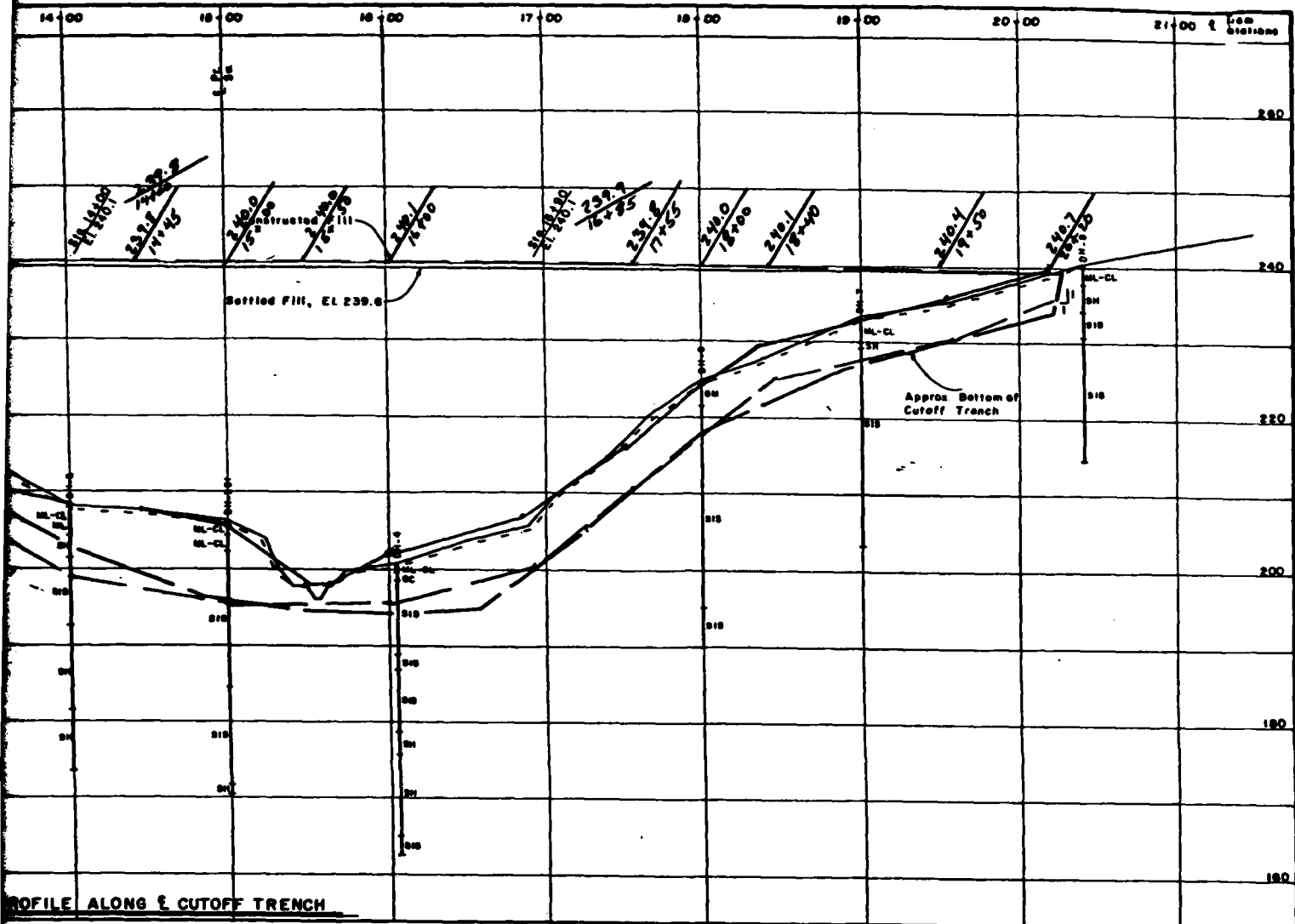
FILL PLACEMENT

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed <i>John E. Sullivan</i>	App. <i>[Signature]</i>
Drawn <i>CRISE</i>	Check <i>[Signature]</i>
Traced	By <i>[Signature]</i>
Checked <i>John E. Sullivan</i>	PA-621-P

PLATE 5





CONSTRUCTION NOTES

1. E. Dem. = E. Cutoff Trench
2. For logs of test holes see shits. 22 thru 24.

NOTE: HANDWRITTEN ADDITIONS
TAKEN FROM AS BUILT DRAWINGS

NESHAMNY CREEK WATERSHED

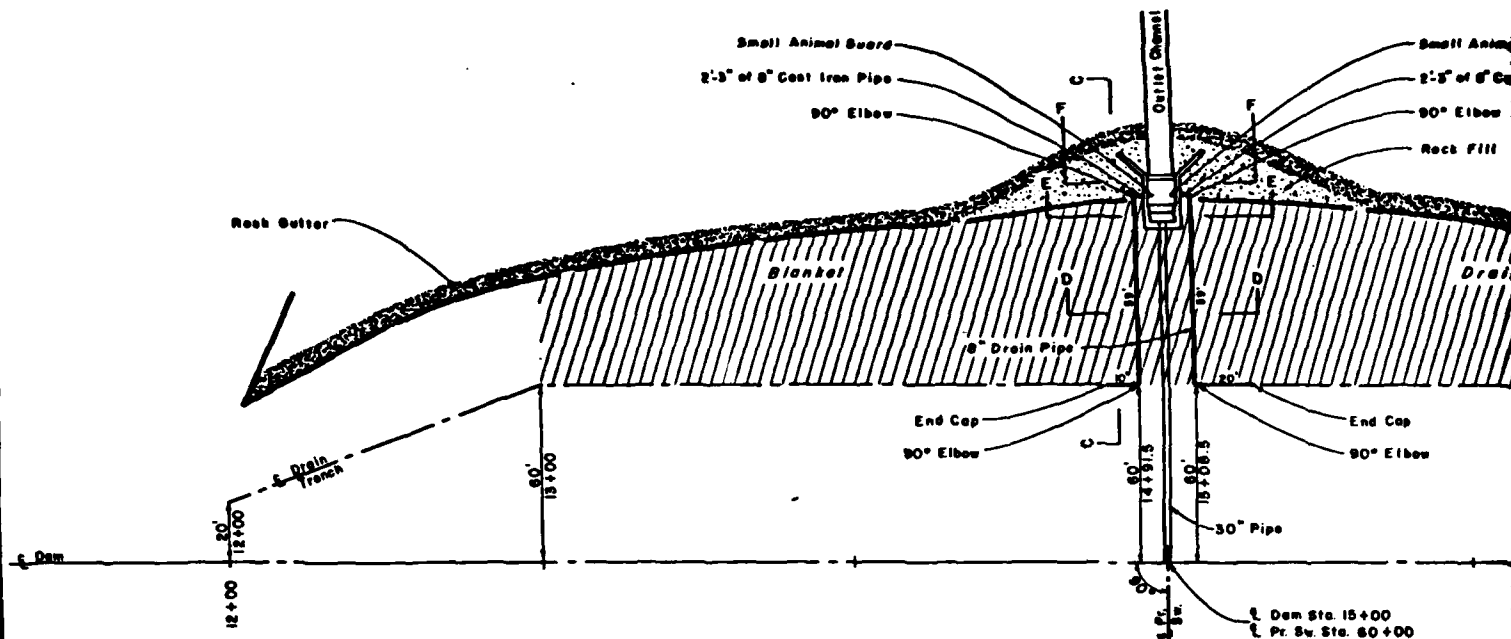
FLOODWATER RETARDING DAM PA-621

BUCKS COUNTY, PENNSYLVANIA

CUTOFF TRENCH

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

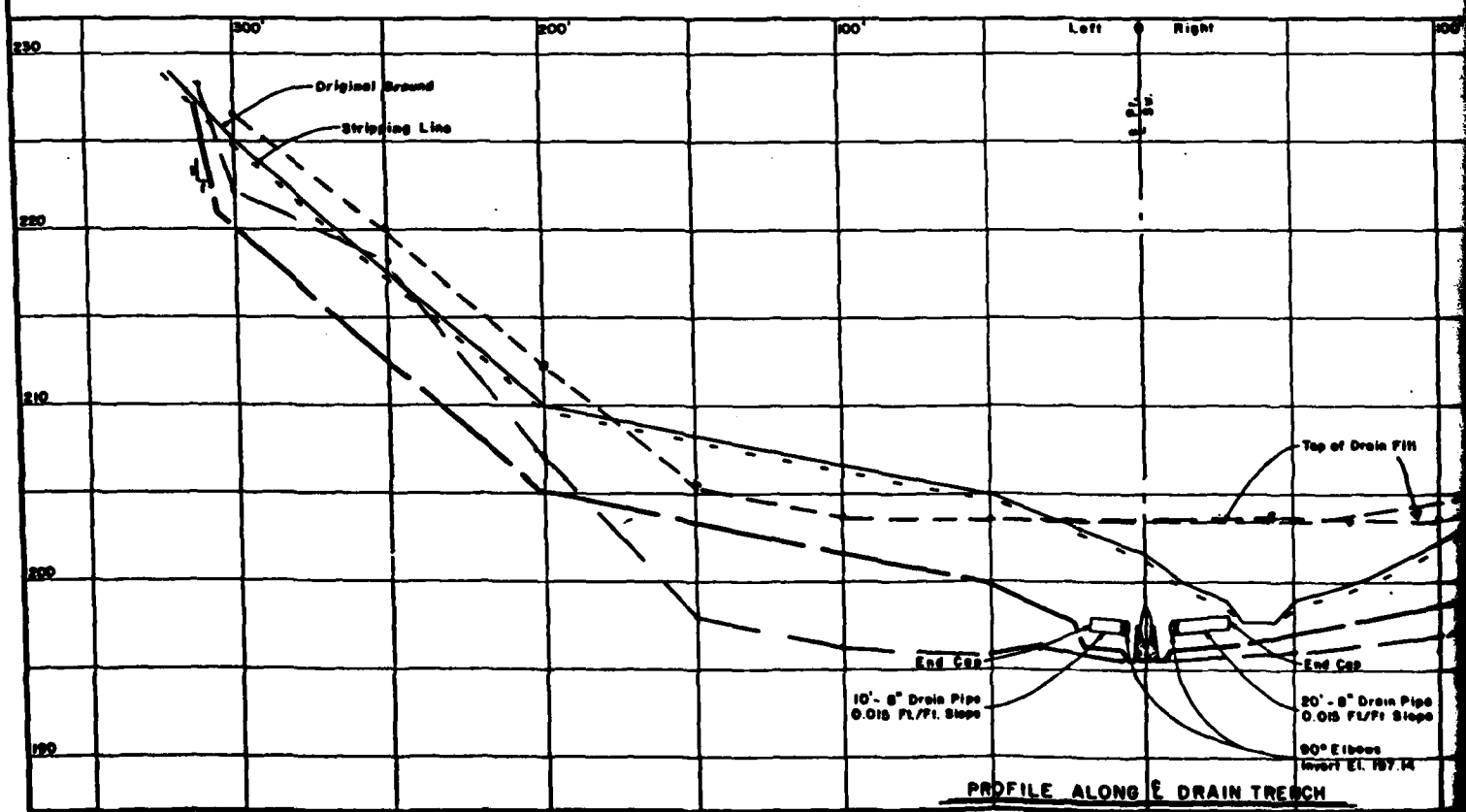
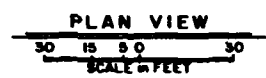
Designed by *John E. Lathrop* - 26
Checked by *CRISE* - 76
Drawn by *John E. Lathrop* - 26
PA-621-P

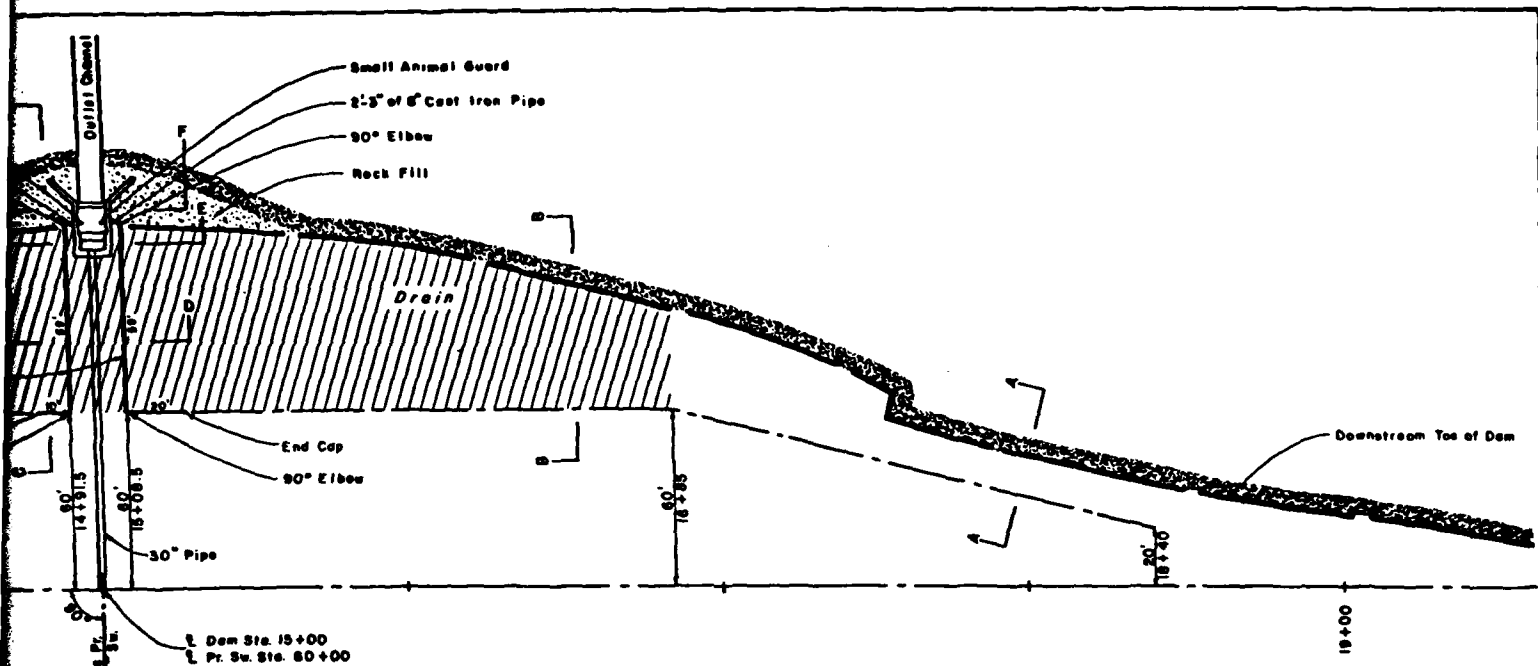


GRADATION LIMITS

FINE DRAIN FILL (PennDOT Type A)	
SEIVE NO.	% PASSING (Based on Dry Weight)
3/8"	100
no. 4	90 - 100
no. 6	70 - 100
no. 10	30 - 65
no. 30	30 - 65
no. 50	5 - 30
no. 100	0 - 10
no. 200	< 5

COARSE DRAIN FILL (PennDOT No. 2B)	
SEIVE NO.	% PASSING (Based on Dry Weight)
1-1/2"	100
1"	90 - 100
1/2"	25 - 60
no. 4	0 - 10
no. 8	0 - 5
no. 200	< 5





PLAN VIEW

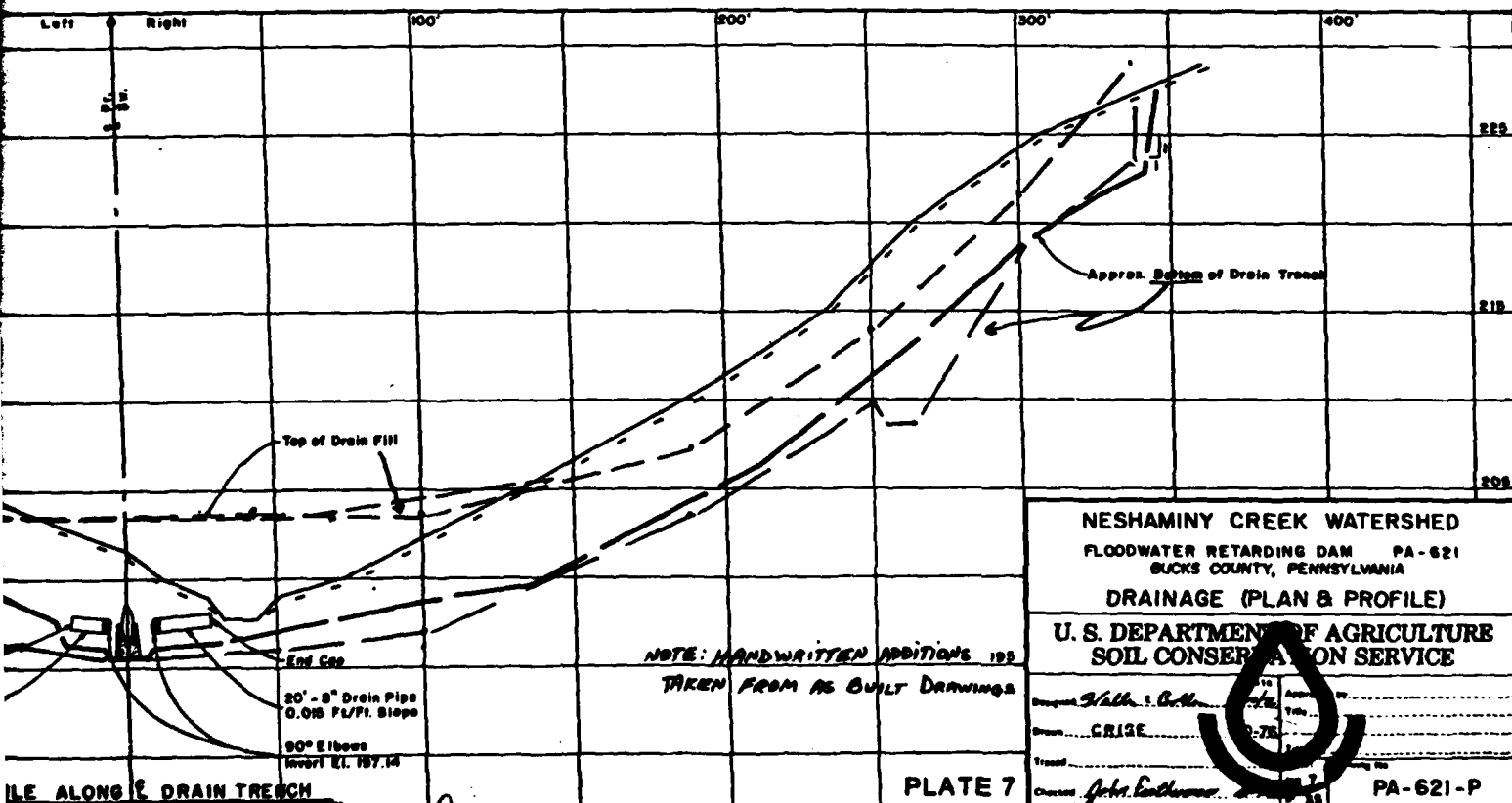
15 00 30
SCALE IN FEET

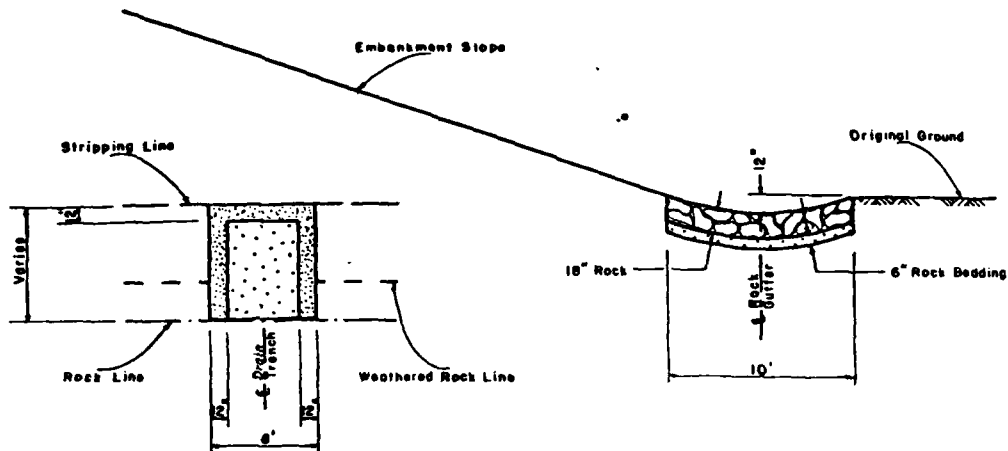
QUANTITY SUMMARY

148'-0"	8" Drain Pipe
4'-6"	8" Cast Iron Pipe
4	90° Elbows
2	End Caps
2	Small Animal Guards (Sht. 24)

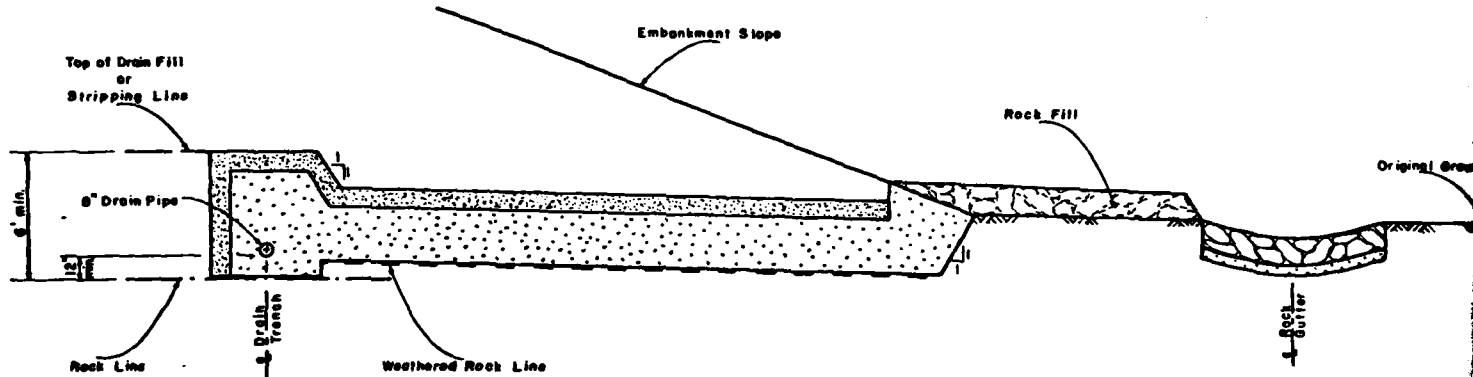
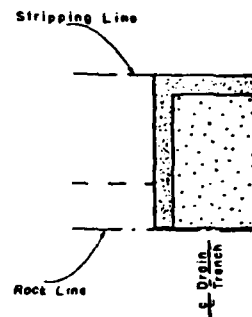
CONSTRUCTION NOTES

- 8" Drain Pipe shall be PVC, Class 200, with Standard Dimension Ratio = 13.5
- 8" Cast Iron Pipe. Spec. 201
- Rock Bedding & Rock Riprap Bedding shall meet gradation limits for coarse drain fill.
- Rock Fill - place and grade as directed by the Engineer.

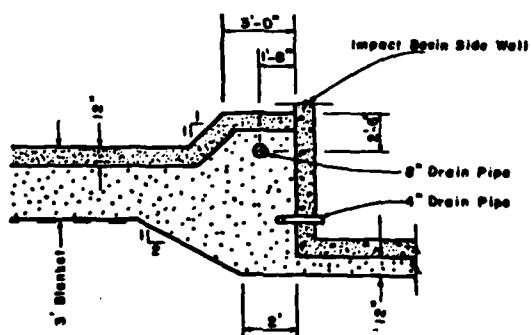




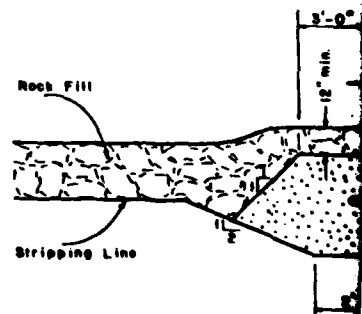
SECTION A-A



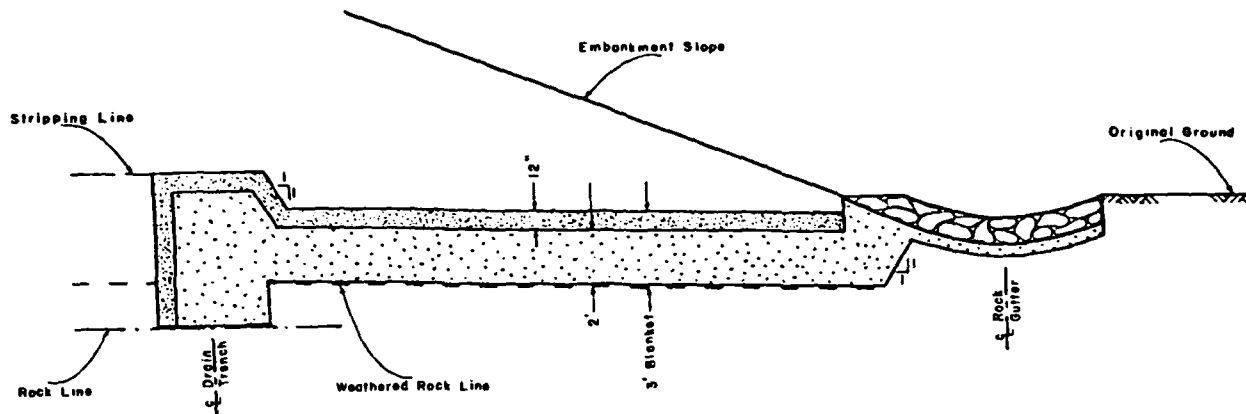
SECTION C-C



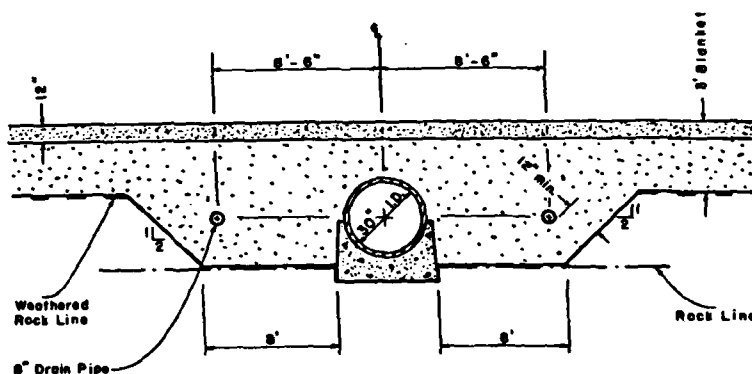
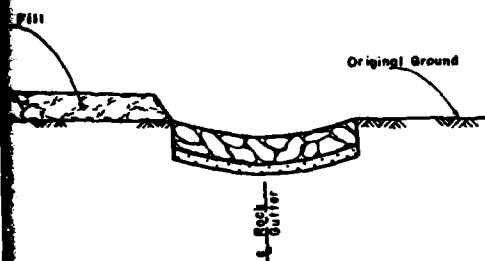
SECTION E-E



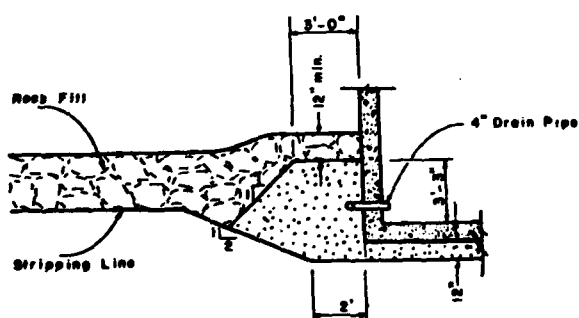
SECTION F-F



SECTION B-B



SECTION D-D



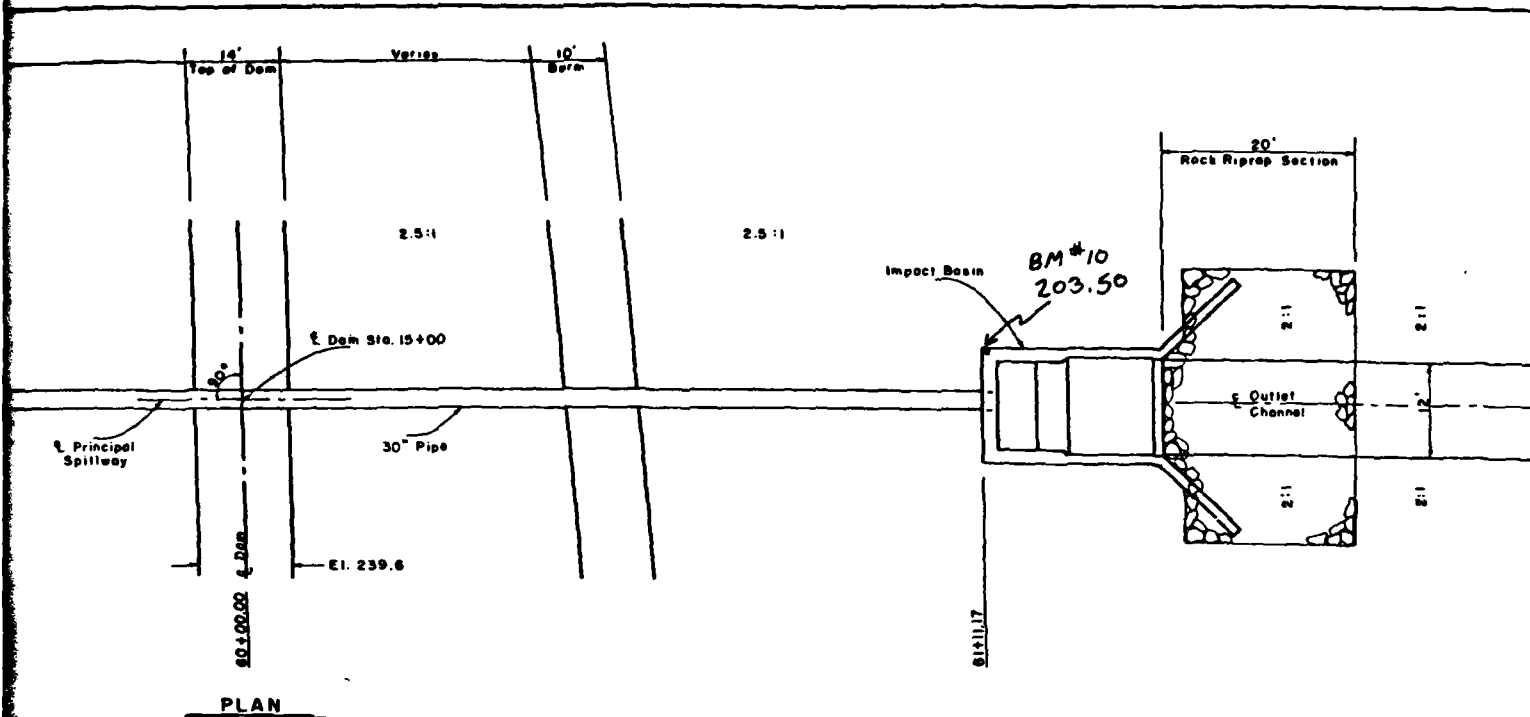
SECTION F-F

- Fine Drain Fill
- Coarse Drain Fill

NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA

DRAINAGE (SECTIONS)
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by *Walter J. Butler* Date *10-1-54*
Drawn by *CRISE* Date *7-1-54*
Traced by *John Leatherman* Date *10-1-54*
PA-621-P



30" I.D. Reinforced Concrete Pressure Pipe
Steel Cylinder Type, Spec. 541 (AWWA C-301)

240' - Straight Sections

1 - Spigot Well Fitting (10") sht. 17

240' - Total

CONSTRUCTION NOTES

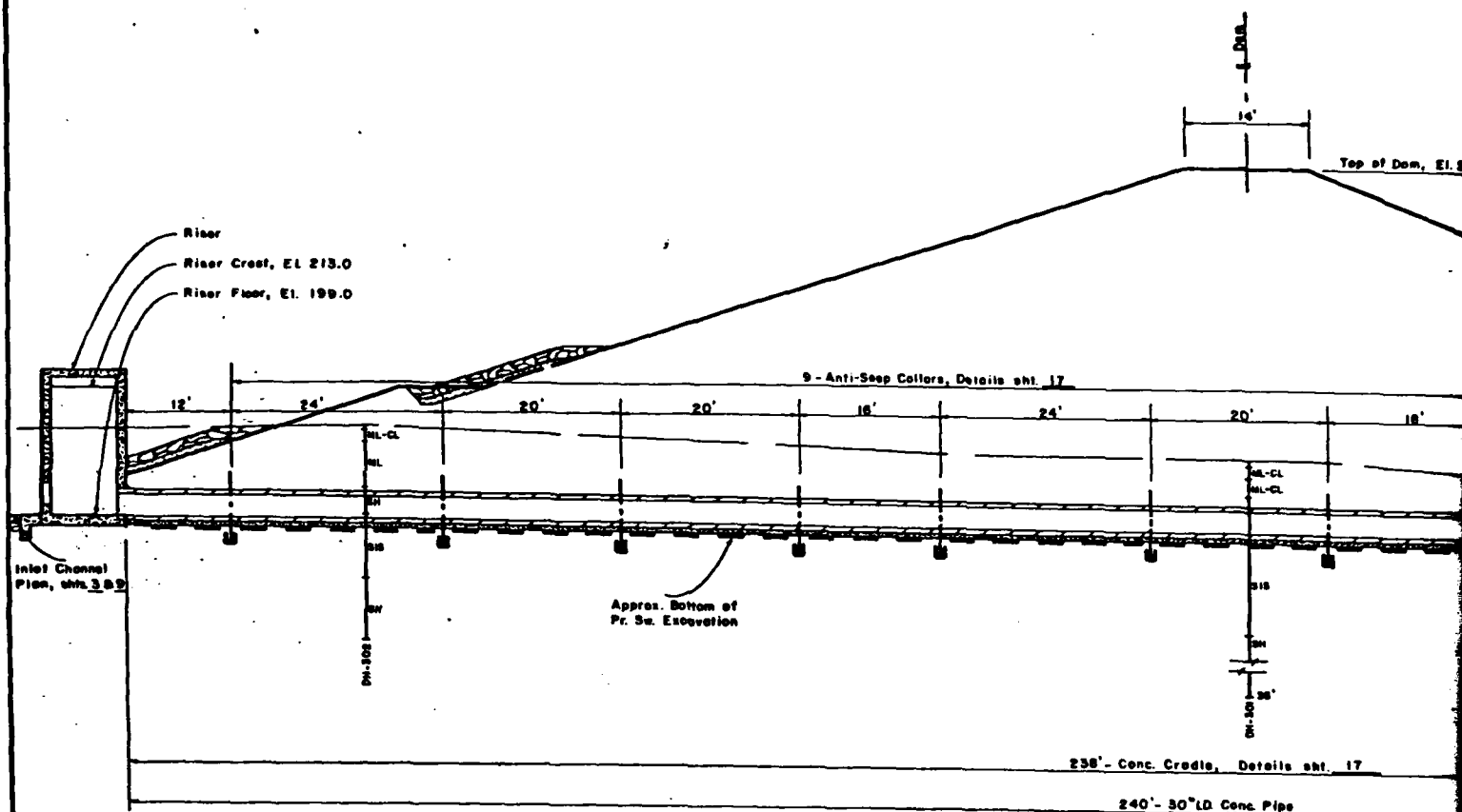
1. Outlet end of pipe to be finished so that no metal is exposed.
2. Pipe layout data to be furnished by the Engineer.
3. Inlet channel and outlet channel - final line and grade shall be determined by the Engineer.
4. Rock riprap bedding shall meet gradation limits for coarse drain fill. (sht. 17)

NOTE: HANDWRITTEN ADDITIONS
TAKEN FROM AS BUILT DRAWINGS

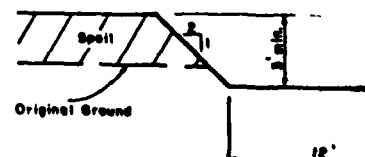
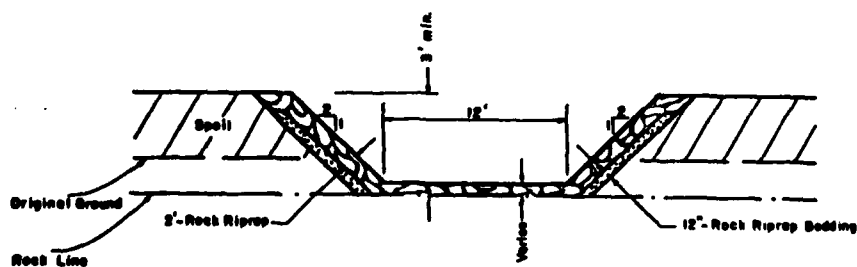
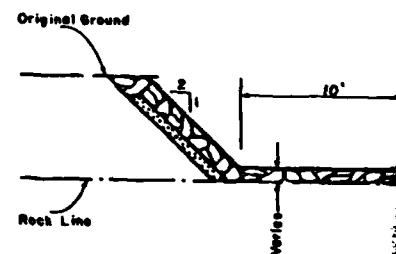
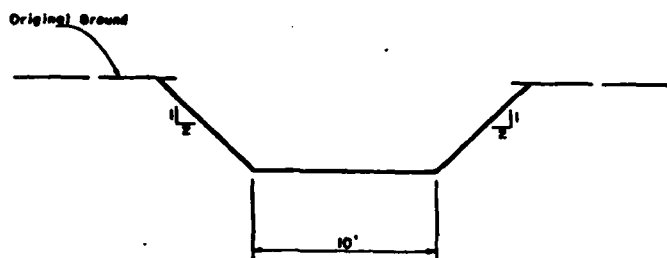
NOT TO SCALE

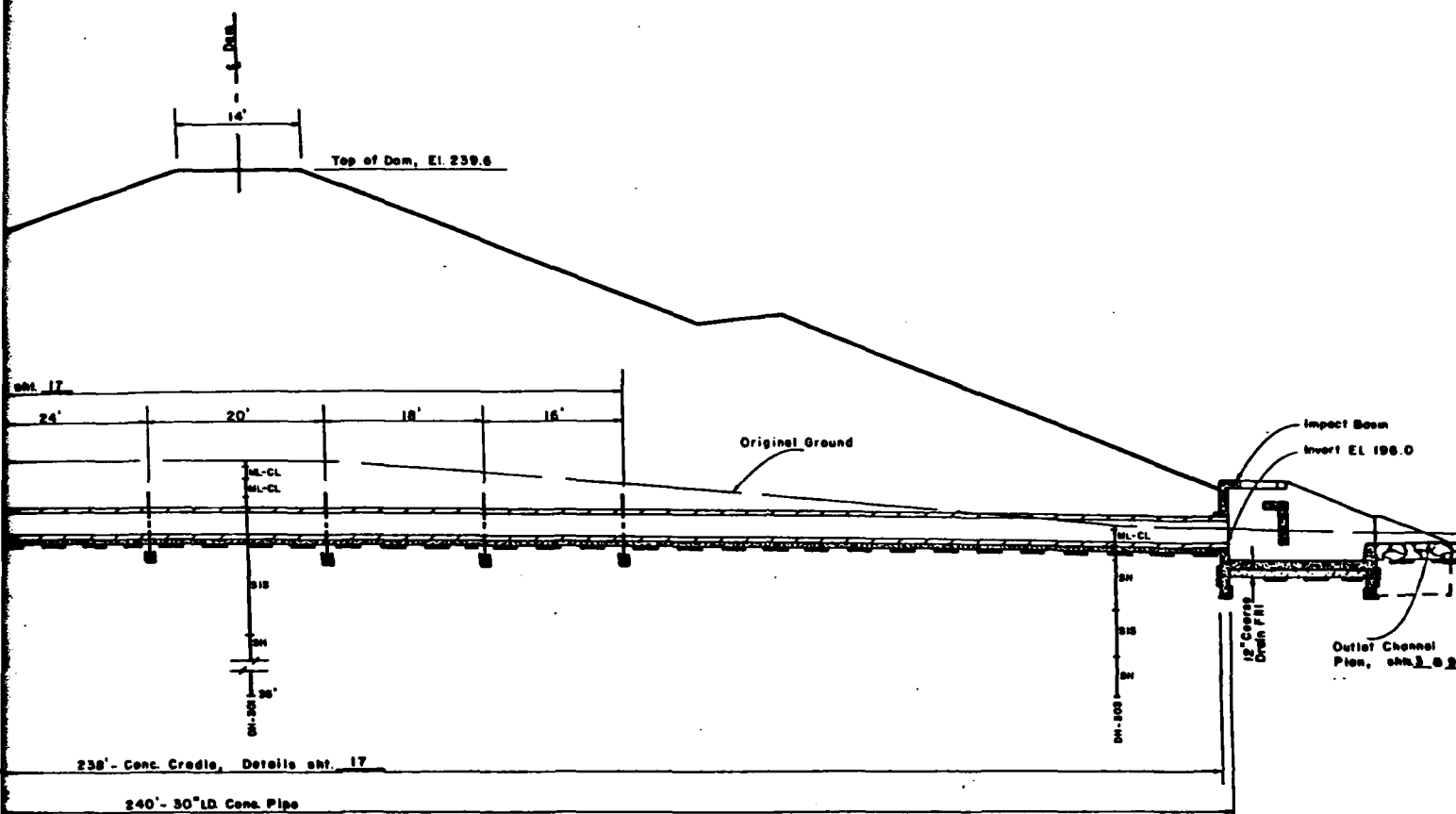
NESHAMINY CREEK WATERSHED	
FLOODWATER RETARDING DAM PA-621	
BUCKS COUNTY, PENNSYLVANIA	
PRINCIPAL SPILLWAY (PLAN)	
U. S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
Designed by John Eastman	Scale 1" = 20'
Drawn by CRISE	Sheet 1 of 1
Traced by	PA-621-P
Checked by John Eastman	

PLATE 9



PROFILE ALONG 1
10 5 20 10
SCALE IN FEET

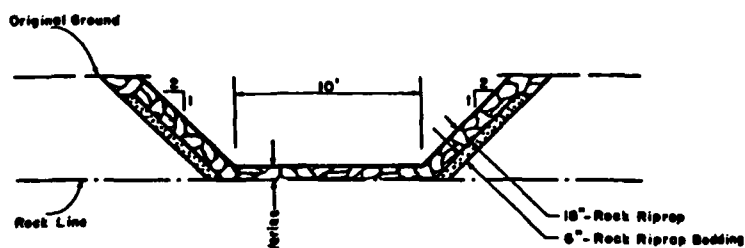




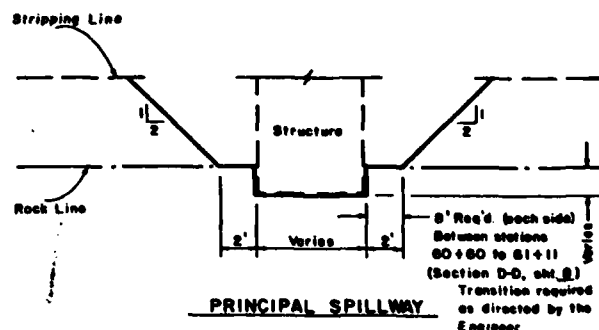
PROFILE ALONG 1

10 5 2 0 10

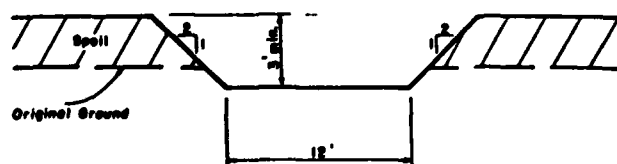
SCALE IN FEET



INLET CHANNEL
Rock Riprap Section



PRINCIPAL SPILLWAY



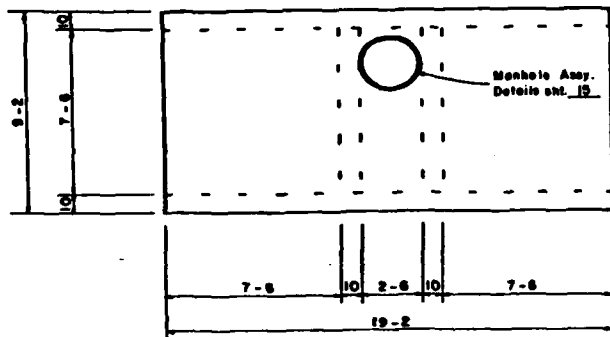
OUTLET CHANNEL

PLATE 10

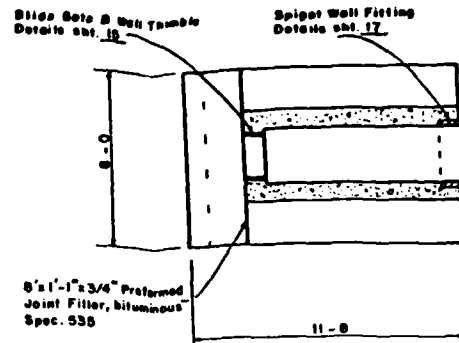
NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA
PRINCIPAL SPILLWAY (PROFILE)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

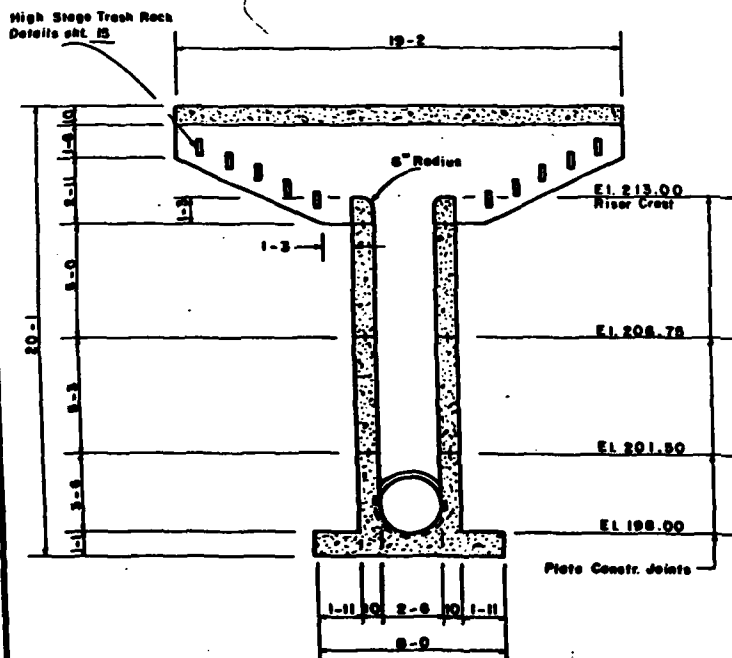
Designed by <i>John Southworth</i>	Checked by <i>CRISE</i>
Drawn by <i>CRISE</i>	Reviewed by <i>John Southworth</i>
PA-621-P	



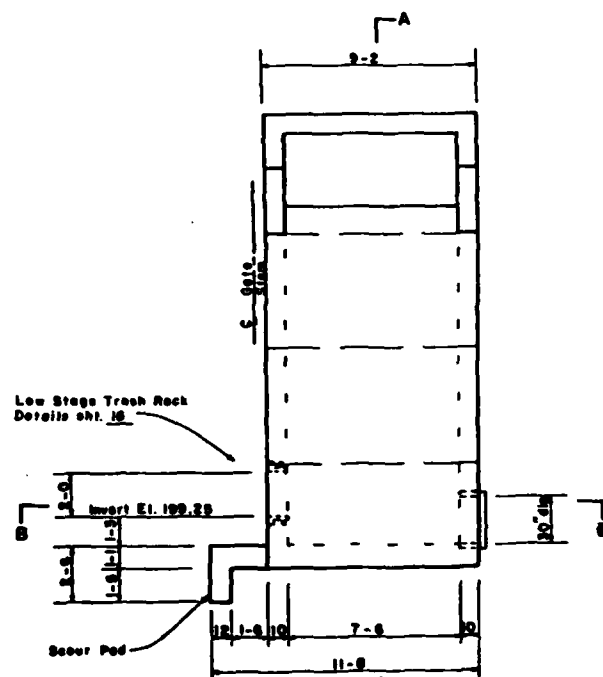
PLAN-TOP



SECTION B-B



SECTION A-A



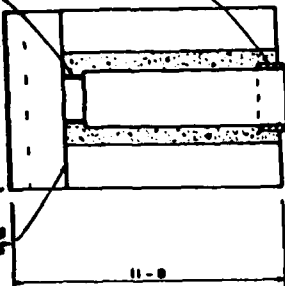
SIDE ELEVATION

QUANTITIES

STEEL:			
5 Bar	3,008.75 Lin. Ft.	3,158.1 Lbs.	
6 Bar	344.5 Lin. Ft.	817.4 Lbs.	
7 Bar	306.0 Lin. Ft.	629.6 Lbs.	
Total		4,595.0 Lbs.	
TOTAL CONCRETE		24.3 Cu Yds	

1. Bar
2. Rod
3. Yds
4. Feet
5. Lbs

Spigot Wall Fitting
Details shi. 17



SECTION B-B

1/4" x 6" structural steel plate,
to conform to Spec. S81
Continuous thru constr. joint.
Splices shall be either:
1. Butt welded
2. Lapped 3" and belted
3. Lapped 3" and fillet welded

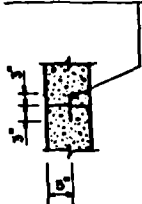
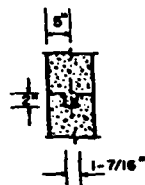
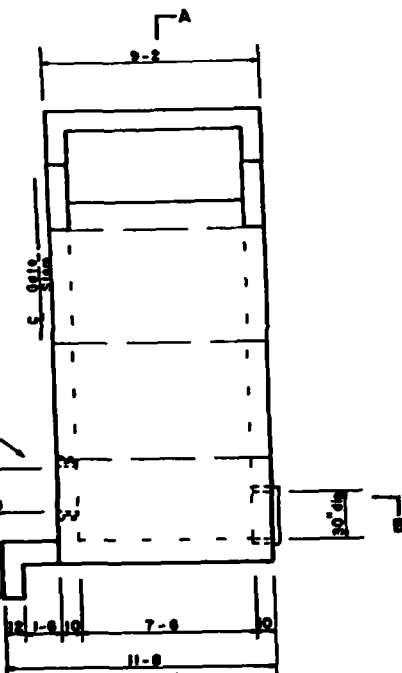


PLATE
CONSTR. JOINT

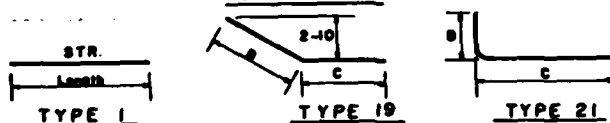


CONSTR. JOINT



LA
SIDE ELEVATION

BAR TYPES



CONSTRUCTION NOTES

1. Bar dimensions are out to out of bar.
2. Radius of bends equals 3 bar diameters for sizes equal to or less than #7.
3. The 2" and 3" dimensions from face of concrete to steel are clear distances.
4. Portland Cement type I-A or I with an air-entraining admixture shall be used.
5. All exposed edges of concrete to have a 1" chamfer unless otherwise noted.

STEEL SCHEDULE

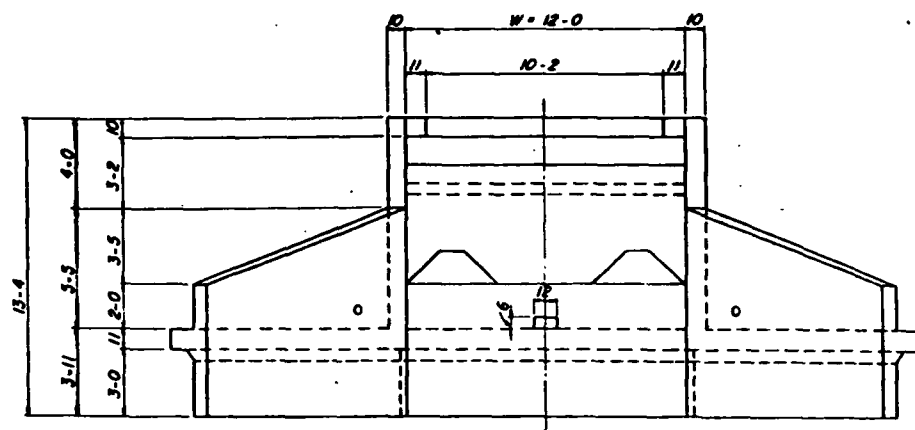
Mark	Size	Quantity	Length	Type	B	C	Total Length
B1	6	10	7-6	1			75-0
B2	5	9	8-9	1			78-9
B3	7	34	9-0	21	3-1	5-11	306-0
B4	5	8	8-9	1			70-0
B5	5	9	7-6	1			67-6
B6	5	2	3-0	1			6-0
B7	5	5	6-9	21	1-0	5-9	33-9
B8	6	3	6-9	21	1-0	5-9	20-3
B9	5	14	6-9	21	1-0	5-9	94-6
B10	6	10	8-3	1			82-6
B11	5	4	3-3	1			13-0
B12	6	3	2-3	1			6-9
B13	5	3	2-3	1			6-9
B14	5	10	5-9	21	0-6	5-3	57-6
B15	5	18	8-0	21	2-9	5-3	144-0
B16	5	10	7-6	1			75-0
B17	5	9	4-0	21	2-0	2-0	36-0
B18	5	9	3-0	21	1-6	1-6	27-0
B19	6	7	4-0	1			28-0
R1	5	6	12-0	1			72-0
R2	6	16	8-3	1			132-0
R3	5	10	3-3	1			32-6
R4	5	6	12-0	1			72-0
R5	5	40	8-0	21	2-9	5-3	320-0
R6	5	10	8-3	1			82-6
R7	5	10	3-3	1			26-0
R8	5	28	8-0	21	2-9	5-3	224-0
R9	5	14	11-0	1			154-0
R10	5	14	11-3	1			157-6
T1	5	4	7-0	1			28-0
T2	5	4	12-6	1			50-0
T3	5	4	18-0	1			72-0
T4	5	4	18-9	1			75-0
T5	5	8	8-6	19	6-9	1-9	68-0
T6	5	8	2-6	1			20-0
T7	5	8	3-0	1			24-0
T8	5	8	3-9	1			30-0
T9	5	8	4-3	1			34-0
T10	5	8	4-9	1			38-0
T11	5	16	5-0	1			80-0
T12	5	6	8-9	1			52-6
T13	5	32	8-9	1			280-0
T14	5	4	5-0	1			20-0
T15	5	12	18-9	1			225-0
T16	5	8	7-9	1			62-0

1 9 1 3 3 1 9
SCALE IN FEET

NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA
RISER STRUCTURAL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by _____
Drawn by CRIBB
Title _____
PA-621-P

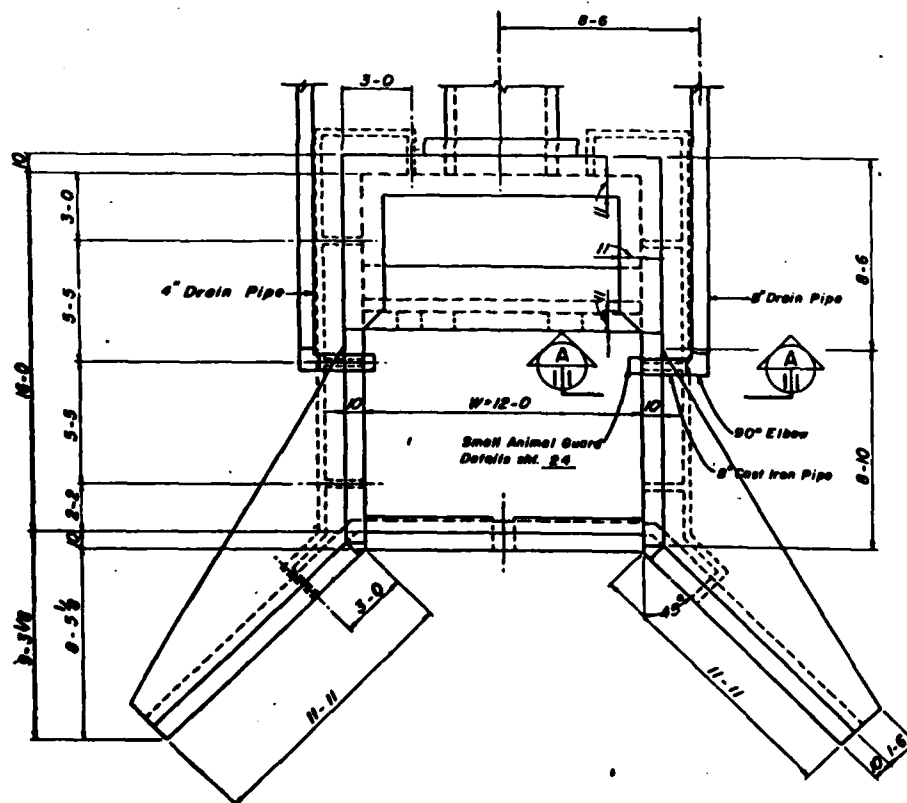


DOWNSTREAM ELEVATION

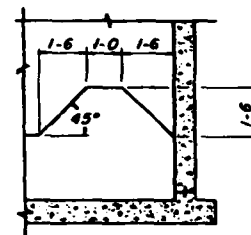
1/2" Expansion joint material Type I Spec. 535

Note: Last section of conduit to be laid horizontal

Concrete cradle
Compressible material (Styrofoam) (Completely around cradle)

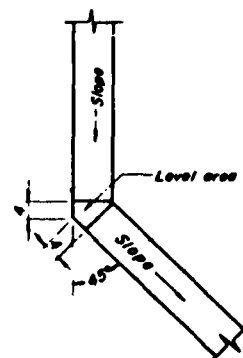


PLAN



SECTION A-A

NOT TO SCALE



SECTION B-B

PLAN - JUNCTION SIDEWALL AND WINGWALL NOT TO SCALE

CUTOFF WALL

STANDARD IMPACT BASIN

DESIGN CONSTANTS $f'_c = 4000$ psi $f'_s = 1600$ psi
s.s. $I_s = 20,000$ psi

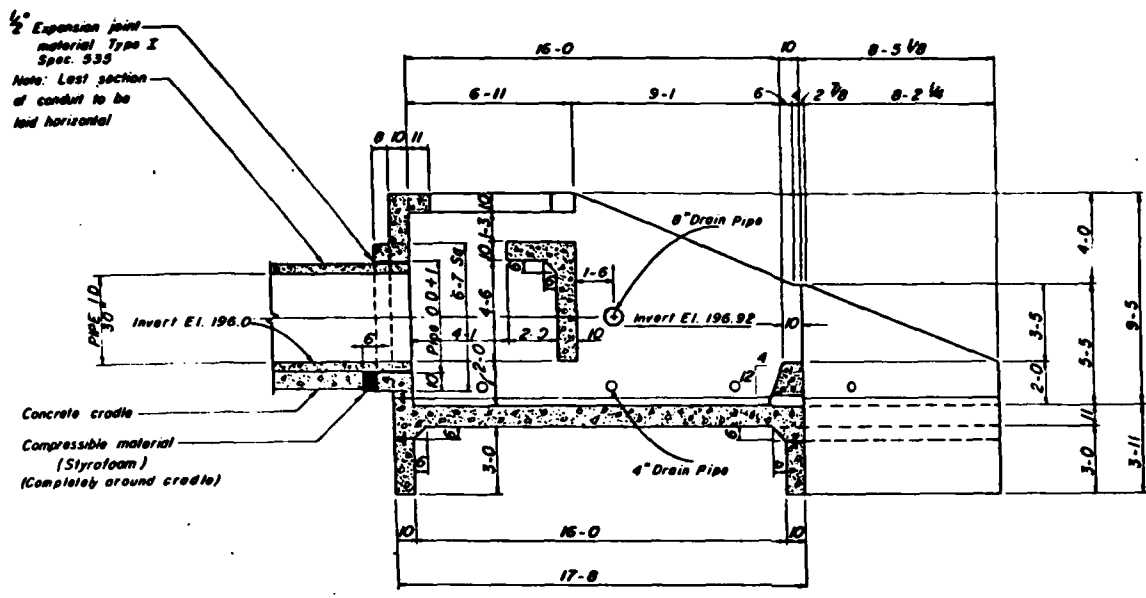
STANDARD DRAWING NO ES-4120

DATE 1-70 SHEET 1 OF 5

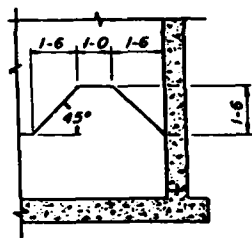
CAR. RONDE
Consulting Engineer

634 Ridgeway Rd Lake Oswego, Ore

1 0 5 10
SCALE IN FEET
EXCEPT AS NOTED

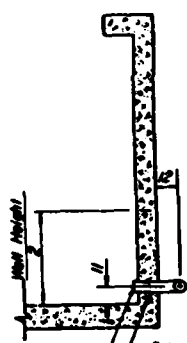


SECTION ON CENTERLINE



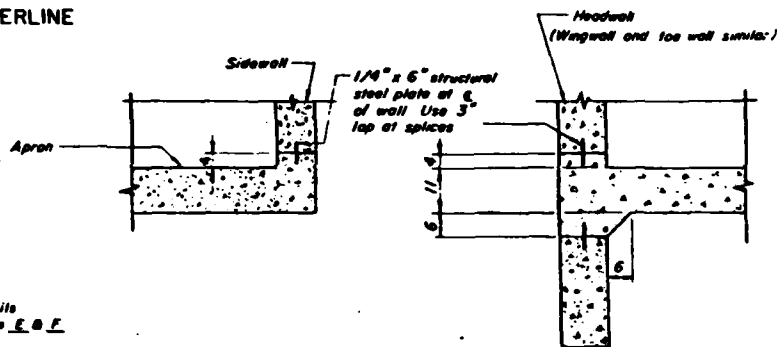
SECTION A

NOT TO SCALE



SECTION THROUGH DRAIN & FILTER

NOT TO SCALE



CONSTRUCTION JOINT DETAILS

NOT TO SCALE

For Construction Notes see sheet 11.

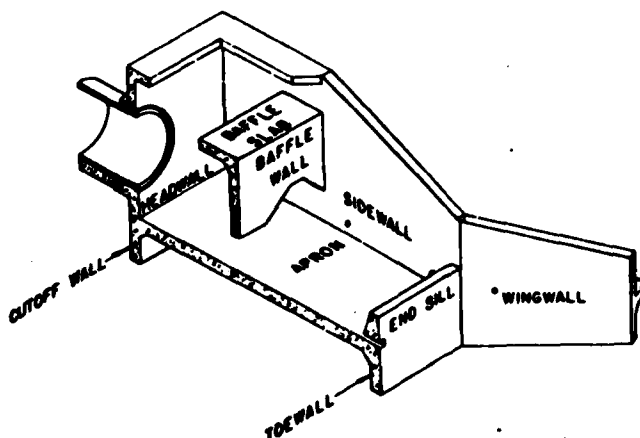
QUANTITIES

Formwork (Contact area)	1630 Sq Ft
Reinforced Concrete	37.2 Cu Yds
Reinforcing Steel	5561 lbs
Drainage	
4" Drain Pipe shall be PVC, Class 200, with Standard Dimension Ratio = 13.5	
Drain Pipe, 4"	89 Lin Ft
Animal Screens (shd 12)	10
Tees for and abt tee branch w/plug	6
Elbows 90°	8
Elbows 45°	2
Joints 1/4" x 6" Structural steel plate	720 lbs

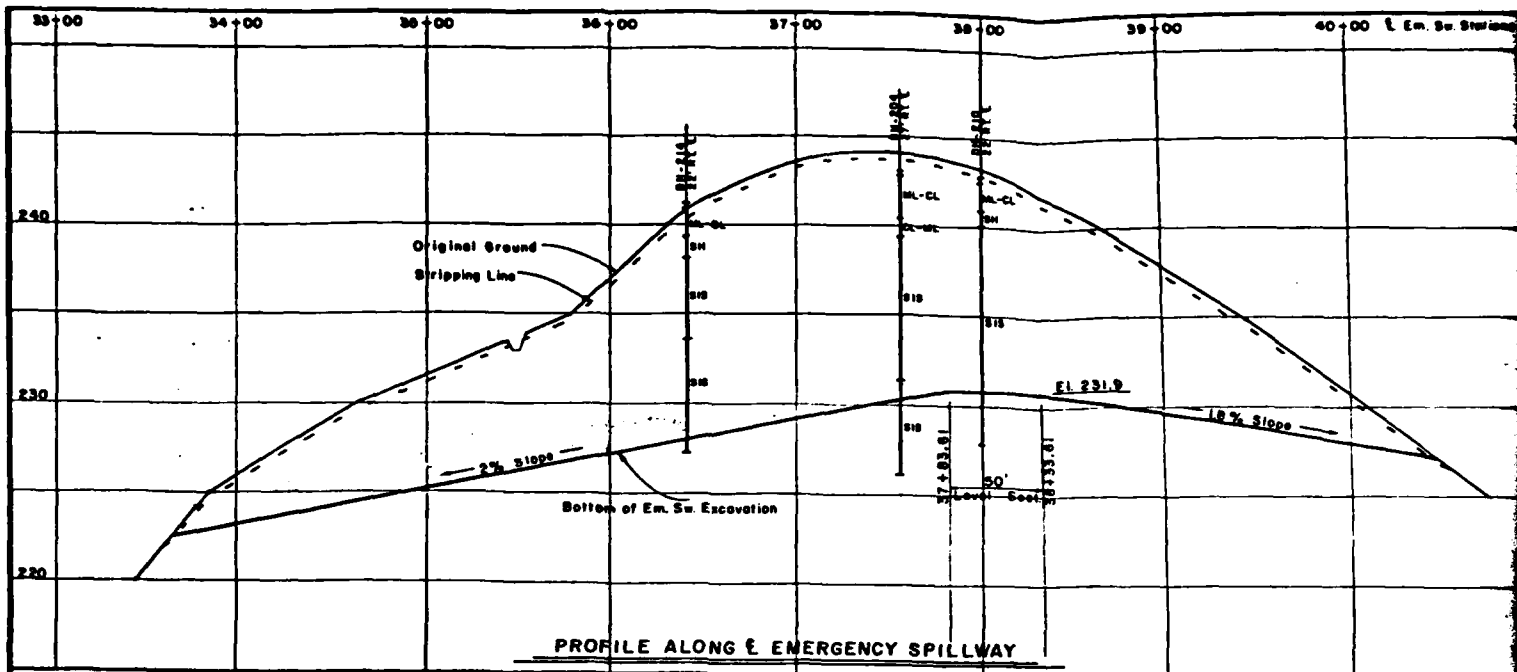
NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA
IMPACT BASIN

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
Drawn		
Checked		
Project		
Sheet	PA-621-P	

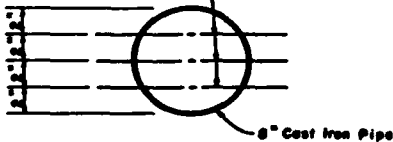


ISOMETRIC VIEW

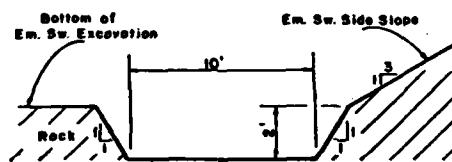
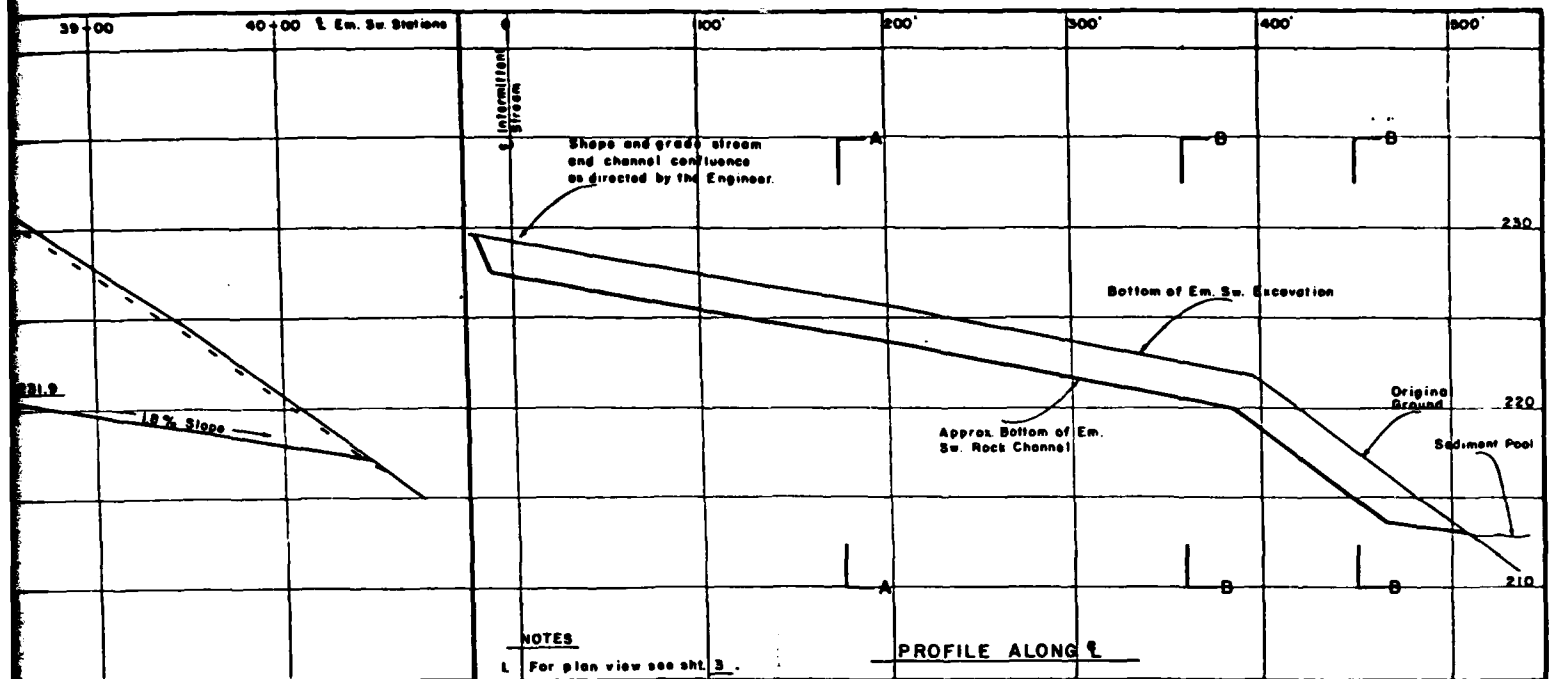


1/2" dia. stainless steel bolts with
hex nuts & lock washers, 10" long,
placed horizontally, ASTM A-276.

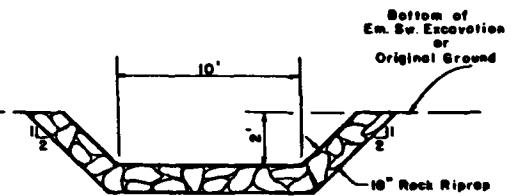
Notes:
Drill holes for bolts
2" from end of pipe.



SMALL ANIMAL GUARD
R - REQUIRED



SECTION A-A



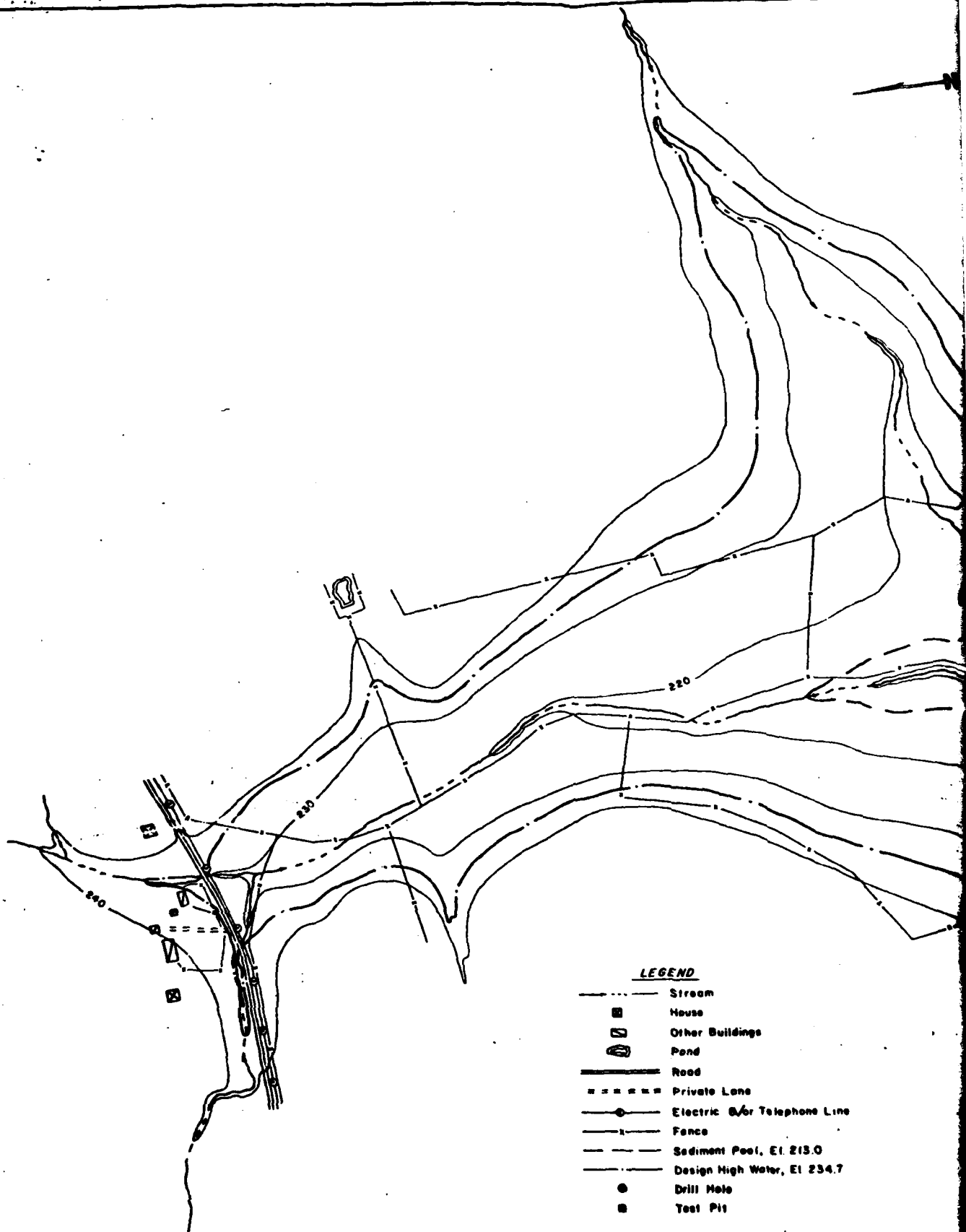
SECTION B-B

EMERGENCY SPILLWAY ROCK CHANNEL

NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA
MISCELLANEOUS

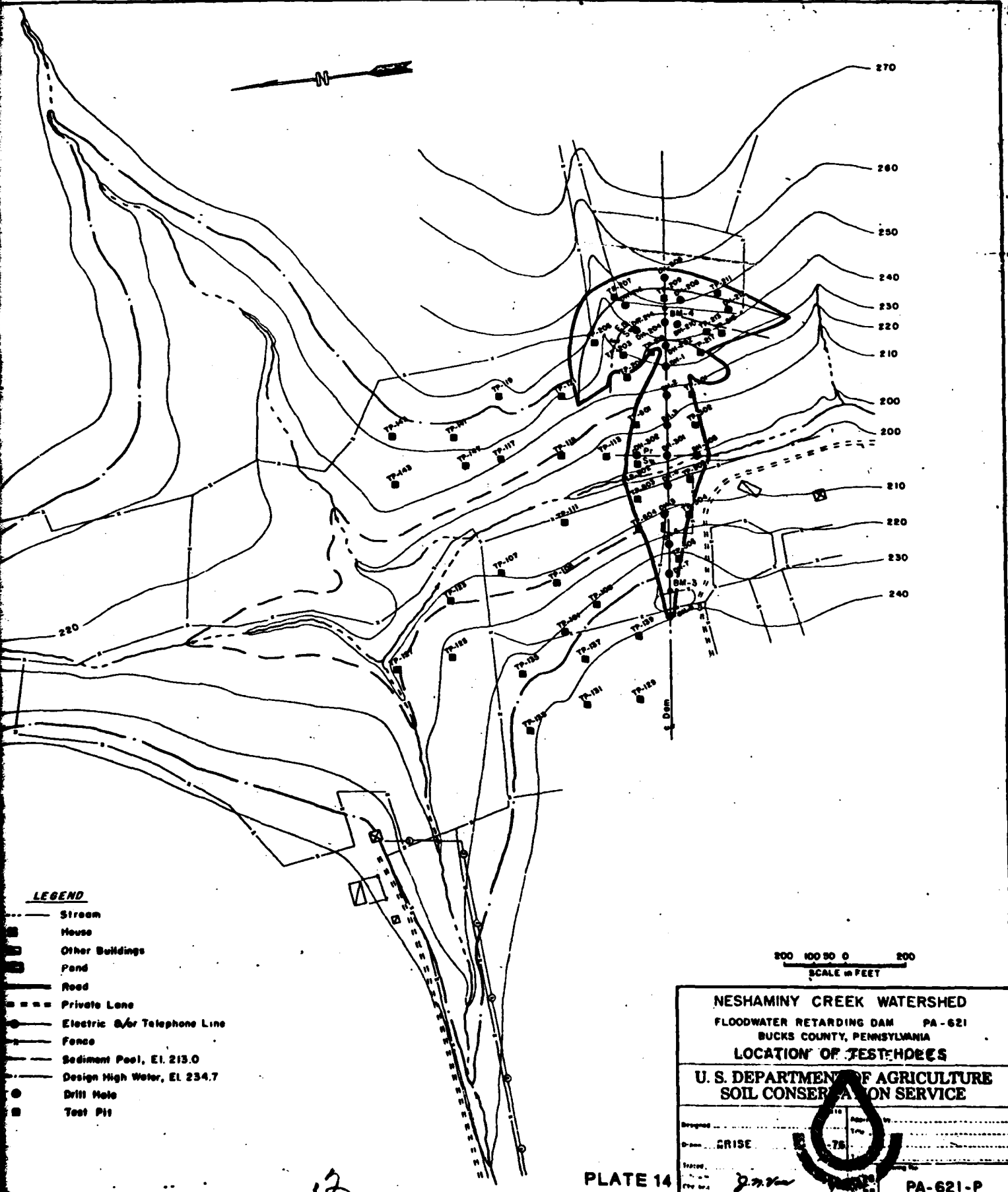
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by *John S. Smith* 10
Drawn *CRISE* 78
Checked *John S. Smith* 11
PA-621-P



LEGEND

- Stream
- House
- Other Buildings
- Pond
- Road
- Private Lane
- Electric &/or Telephone Line
- Fence
- Sediment Pool, El. 213.0
- Design High Water, El. 234.7
- Drill Hole
- Test Pit



LEGEND

- Stream
- House
- Other Buildings
- Pond
- Road
- Private Lane
- Electric & Telephone Line
- Fence
- Sediment Pool, El. 213.0
- Design High Water, El. 234.7
- Drift Hole
- Test Pit

200 100 50 0 200
SCALE in FEET

NESHAMINY CREEK WATERSHED

FLOODWATER RETARDING DAM PA-621

BUCKS COUNTY, PENNSYLVANIA

LOCATION OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	_____	Approved	_____
Drawn	GRISE	Typed	_____
Traced	_____	Checked	_____
By	J. J. [Signature]	Date	1975
		PA-621-P	

PLATE 14

BM-1, ELEV. 229.3, 12+00, CENTERLINE
 LOGGED BY: JOE VAN 4-6-71
 DRILLING EQUIPMENT: SKID RIG

HOLE DEPTH FROM TO	DESCRIPTION OF MATERIALS	UNIF. SOIL CLASS. SYMB.	STANDARD PENETRATION			SAMPLES		
			TYPE BIT	NO.	TYPE	FROM FT.	TO FT.	% REC.
0.0 0.4	TOPSOIL		SPT	1	JAR	0.0	1.5	80
0.4 2.3	GRAVEL, SILTY, RED, WEA. SHALE	GM	"	2	"	1.5	2.3	50
2.3 5.4	SHALE, SANDY, HARDNESS-3, RED		TRI			2.3	5.4	30
5.4 15.0	SILTSTONE, SHALY, RED, HARDNESS-3 TO 4, VERTICAL & ANGULAR FRACTURES TO 12.7', CL SEAMS AT 11.5 & 11.7'		SPT	3	JAR	5.4	5.4	100
15.0 26.7	SILTSTONE, SHALY, RED & GRAY MOTTLED, MED. TO THICK BEDDED, DENSE, CROSSBEDDED, WEA. JOINT AT 16.8' & 19.6' WITH STAINS, HEAVY FRACTURING FROM 19.6'-22.3', GRAY, THIN BEDDED FROM 22.3'-22.7', FROM 22.7'-26.7' GRAY & BANDED WITH SOME RED SHALE, RQD-57 PERCENT		TRI			5.4	6.0	100
26.7 30.0	SILTSTONE, SHALY, THICK BEDDED, DENSE, HARDNESS-4 WITH LT. GRAY MISTRAUSIONS, (ARGILLITE), RQD-64 PERCENT		DM		NEM	6.0	9.5	100
30.0	BOTTOM OF HOLE - WL (4-8-71) 5.4'		"		"	9.5	12.5	85
			"		"	12.5	15.0	100
			"		"	15.0	19.0	75
			"		"	19.0	22.7	72
			"		"	22.7	26.5	92
			"		"	26.5	30.0	100

BM-2, ELEV. 239.3, 13+00, CENTERLINE
 LOGGED BY: JOE VAN 4-5-71
 DRILLING EQUIPMENT: SKID RIG

HOLE DEPTH FROM TO	DESCRIPTION OF MATERIALS	UNIF. SOIL CLASS. SYMB.	STANDARD PENETRATION			SAMPLES		
			TYPE BIT	NO.	TYPE	FROM FT.	TO FT.	% REC.
0.0 0.5	TOPSOIL		SPT	1	JAR	0.0	1.5	70
0.5 2.0	CLAY, SILTY, 10 PERCENT SAND, TRACE OF GRAVELS, LOW PLASTIC, RED	CL	"	2	"	1.5	3.0	70
2.0 3.8	SHALE, RED, WEA., SOFT, DRY, FORMS CL WHEN MOIST + WATER STOOD IN HOLE		"	3	"	3.0	3.8	80
3.8 5.0	SHALE BOULDER + DRILLED THROUGH; VERY SANDY		TRI			3.8	5.0	90
5.0 35.0	SILTSTONE, SHALY, HARDNESS-3, MEDIUM TO THICK BEDDED, RED W/GRY MOTTLES TO 10.2', VERTICAL FRACTURES FROM 6.7 TO 9.0', VERY BROKEN AT 16.5', 18.0' AND 18.6', CALCITE IN ANGULAR FRACTURE AT 22.0', GRAY W/ RED FROM 30.1-35.0', SOME BANDING, RQD-66 PERCENT		SPT	4	"	5.0	5.5	100
35.0	BOTTOM OF HOLE - WL (4-8-71) 6.4'		TRI			5.5	6.0	100
			DM		NEM	6.0	6.7	100
			"		"	6.7	12.0	100
			"		"	12.0	18.1	100
			"		"	18.1	25.0	100
			"		"	25.0	29.0	100
			"		"	29.0	35.0	100

BM-3, ELEV. 208.6, 14+00, CENTERLINE
 LOGGED BY: JOE VAN 4-3-71
 DRILLING EQUIPMENT: SKID RIG

HOLE DEPTH FROM TO	DESCRIPTION OF MATERIALS	UNIF. SOIL CLASS. SYMB.	STANDARD PENETRATION			SAMPLES		
			TYPE BIT	NO.	TYPE	FROM FT.	TO FT.	% REC.
0.0 0.5	TOPSOIL		SPT	1	JAR	0.0	1.5	80
0.5 2.5	SILT, CLAYEY, 10 PERCENT FINE SAND, SLIGHT PLASTIC, VERY MOIST, RED-BRN	ML-CL	"	2	"	1.5	3.0	90
2.5 3.0	SILT, DRY, WEA. SHALE		"	3	"	4.0	5.5	80
3.0 4.0	BOULDER - DRILLED THROUGH FLAT BOULDER	ML	"	4	"	5.5	7.0	70
4.0 7.0	SHALE, WEA., RED, SOFT, W/ SHALE (15 PERCENT), FRAGS., DRY, WHEN WET IS LOW PLASTIC CL, 20-30 PERCENT SHALE FRAGS. FROM 6.0' - 7.2'		"	5	"	7.0	7.4	50
7.0 15.5	SILTSTONE WITH LAMINATED SHALE; RED & GRAY, HARDNESS-3, THIN TO MEDIUM BEDDED, WEA. SANDSTONE, THIN BEDDED FROM 8.5' TO 9.0', VERY WEA. SHALE FROM 11.7' TO 11.9' BROKEN, VERT. FRAC. 12.9'-13.2', WATER ERODED VERT. JOINT FROM 13.5' TO 15.5', MED. BEDDED 13.5'-15.5', SOME CROSS BEDDED, RQD-55 PERCENT		TRI			7.4	8.0	80
15.5 26.7	SHALE, SILTY, RED, MED. TO THICK BEDDED, SOLID, DENSE, WITH SHALY SILTSTONE STREAKS, HARDNESS-3 TO 4, 3" TO 9" PIECES, WATER ERODED JOINTS AT 21.3' & 21.3', SHALY SILTSTONE 21.0' TO 23.5', GRAY, W/RED CROSSBEDDING FROM 23.9' TO 26.0', VERY BROKEN FROM 25.3' TO 25.8', RQD-46 PERCENT		DM		NEM	8.0	10.6	100
26.7 35.0	SHALE, DRY W/ SILTSTONE STREAKS, THIN TO MEDIUM BEDDED, HARDNESS-3 TO 4, SOME FRACTURING W/ CALCITE (THIN), VERY BROKEN AT 32.5', (ARGILLITE), RED SILTY SHALE FROM 34.5' TO 35.0', RQD-56 PERCENT		"		"	10.6	12.1	100
35.0	BOTTOM OF HOLE - WL (4-3-71) 3.6'		"		"	12.1	13.2	100
			"		"	13.2	15.5	95
			"		"	15.5	19.0	100
			"		"	19.0	27.5	100
			"		"	27.5	32.5	100
			"		"	32.5	35.0	100

BM-4, ELEV. - 201.0, 15+00, CENTERLINE
 LOGGED BY: JOE VAN 4-1-71
 DRILLING EQUIPMENT: SKID RIG

HOLE DEPTH FROM TO	DESCRIPTION OF MATERIALS	UNIF. SOIL CLASS. SYMB.	STANDARD PENETRATION			SAMPLES		
			TYPE BIT	NO.	TYPE	FROM FT.	TO FT.	% REC.
0.0 0.5	TOPSOIL		SPT	1	JAR	0.0	1.5	75
0.5 1.3	SILT, CLAYEY, 10 PERCENT FINE SAND, SLIGHTLY PLASTIC, GRAY-BRN	ML-CL	"	2	"	1.5	2.3	80
1.3 2.3	GRAVEL, CLAYEY, RED-BRN SHALE GRAVELS W/ 35 PERCENT PLASTIC FINES - REFUSAL AT 2.3', FINE SANDSTONE		TRI			2.3	2.8	100
2.3 2.8	SILTSTONE, RED, HARDNESS-3, COBBLE	GC	"		"	2.8	3.6	100
2.8 12.0	SILTSTONE, SHALY, CROSS BEDDED, THIN TO MEDIUM BEDDED, WATER-ERODED BEDDING PLANES, HARDNESS-3, 5.0'-6.2', THIN BEDDED, WATER ZONE, HARDNESS-2, ONE-FOURTH INCH CLAY SEAM AT 7.8', SOFT WATER ERODED SEAM AT 6.9', ONE INCH VERTICAL FRACTURE AT 8.9', SOFT WATER ERODED ZONE FROM 8.0'-8.9', GRAY FROM 7.7', FROM 10.3' TO 12.0' SILTSTONE IS THIN BEDDED WITH SHALE STREAKS, RED TO GRAY, RQD-37 PERCENT		DM		NEM	3.6	9.0	100
12.0 14.0	SILTSTONE, SHALY, SOLID, HARDNESS-3, 1" GRAY SHALE STREAK AT 13.5', GRAY W/RED, WATER ERODED BEDDING PLANE AT 12.0', RQD-55 PERCENT		"		"	9.0	14.0	100
14.0 22.3	SILTSTONE, SHALY, RED, DENSE, HARDNESS-3, 2" VERT. FRACTURED AT 17.0', WATER ERODED SEAM AT 14.0', VERT. FRACTURED AT 19.8' (3" W/ CALCITE IN FRAC.) VERY SOLID CORE, SOME MARLINE VERT. FRAC., RQD-65 PERCENT		"		"	14.0	19.5	100
			"		"	19.5	23.5	100
			"		"	23.5	26.5	100

CONTINUED

BM-4 CONT'D

HOLE DEPTH FROM TO	DESCR
22.3 25.2	SHALE
25.2 34.0	SHALE
34.0 36.5	SHALE
36.5	BOTTO

BM-5, ELEV. 210.7
 LOGGED BY: JOE VAN
 DRILLING EQUIPMENT:

HOLE DEPTH FROM TO	DESCR
-----------------------	-------

0.0 1.5	TOPSO
1.5 2.5	SILT,
2.5 21.8	SILTS
	SEVER
	AT 13
	FROM
	TOP OF
	SHALY
21.8 39.0	SILTS
	BROKE
	FROM
	GRY W
39.0 40.0	SHALE
40.0	BOTTO

BM-6, ELEV. 240.7
 LOGGED BY: JOE VAN
 DRILLING EQUIPMENT:

HOLE DEPTH FROM TO	DESCR
-----------------------	-------

0.0 0.2	TOPSO
0.2 2.6	SILT,
2.6 6.0	SHALE
6.0 9.3	SILTS
	ANGUL
	SLIGHT
9.3 25.0	SILTS
	VERTIC
	ON ST
	23.2'
25.0	BOTTO

BM-301, ELEV. 205.4
 LOGGED BY: JOE VAN
 DRILLING EQUIPMENT:

HOLE DEPTH FROM TO	DESCR
-----------------------	-------

0.0 0.5	TOPSO
0.5 2.0	SILT,
	1.5"-1
2.0 4.0	SILT,
	W/SH
4.0 21.4	SILTS
	24.0'
	SOME
	21.8'
	RQD-3
	VERT.
	SILTY
21.4 34.1	SHALE
	RED &
	IS GR
	BROKE
	29.8'
	GRY &
	ONE &
34.1 35.0	SHALE
	RED,
35.0	BOTTO

NOTE - ALL SOIL AND

DN-4 CONT'D

HOLE DEPTH
FROM TO DESCRIPTION OF MATERIALS

SAMPLES
FROM TO %
FT. FT. REC.

22.3 25.2 SHALE, SLT. ARGILLITE, HARDNESS-3-4, GRAY W/RED, 1" VERT. FRAC. AT 22.3'. THIN BEDDED, VERY SANDY AT 27' & 28'. RED SHALE TO 25.2'
THIN TO MEDIUM BEDDED, LIMY AT 23.5', RQD-52 PERCENT.
25.2 34.0 SHALE, SILTY, DARK GRAY TO BROWN TO GRAY (ARGILLITE), HARDNESS-3 TO 4, SOME THIN CALCITE PARTINGS, VERT. FRAC. FROM 26.5'-26.8',
THIN BEDDED, BANDED WITH SILTSTONE STREAKS, VERT. FRAC. AT 30.3' AND 31.0' TO 31.3', SOFT AND BROKEN 31.8' TO 32.7', RQD-52 PERCENT.
34.0 36.5 SILTSTONE, RED, SHALY, DENSE, HARDNESS 3 TO 4, SOFT WEATHERED, SHALY ZONE AT 34.3', RQD-62 PERCENT
36.5 BOTTOM OF HOLE. WL (4-6-71) 2.5'

DN-5, ELEV. 210.7 17+00, 9' U.S.
LOGGED BY: JOE VAN 4-5-71
DRILLING EQUIPMENT: SKID RIG

HOLE DEPTH
FROM TO DESCRIPTION OF MATERIALS

SAMPLES

0.0 1.5 TOPSOIL WITH GRAVEL & COBBLES
1.5 2.5 SILT, CLAYEY, SLIGHT PLASTIC, TRACE MOISTURE, WEA. SHALE, CASING AT 3.0', 10 PERCENT SAND
2.5 21.8 SILTSTONE, SHALY, RED OR SILTY SHALE, HARDNESS-3, MEDIUM BEDDED, SEVERAL VERT. & ANGULAR FRAC. FROM 5.0' TO 16.0', WORM HOLE POROSITY AT 13.0', WATER ERODED JOINT AT 13.4' AND 17.8' WITH STAIN, GRAY DENSE FROM 13.0' TO 15.3', AFTER 14.7' CORE PULLED SMALL ARTESIAN FLOW OVER TOP OF CASING, WATER ERODED JOINTS AT 20.1'-20.5', RED TO 2.8', VERY SHALY AT 21.0', RQD-43 PERCENT.
21.8 39.0 SILTSTONE, GRAY W/RED SHALY BANDING & CROSS-BEDDING, THIN BEDDED & BROKEN FROM 24.8' TO 25.5', ANGULAR FRACTURING WITH CALCITE LININGS FROM 28.5' TO 31.0' & 32.6' TO 33.4', RED FROM 29.7' TO 33.6', HARDNESS-3 TO 4, RED & GRAY SHALY SILTSTONE FROM 33.6' TO 37.0' (ARGILLITE)
39.0 40.0 SHALE, HARDNESS-2, MED. BEDDED, GRAY, DENSE.
40.0 BOTTOM OF HOLE. WL (4-9-70) 6.2'

DN-8, ELEV. 240.7' 20+40, CENTERLINE
LOGGED BY: JOE VAN 4-7-71
DRILLING EQUIPMENT: SKID RIG

HOLE DEPTH
FROM TO DESCRIPTION OF MATERIALS

SAMPLES
FROM TO %
FT. FT. REC.

0.0 0.2 TOPSOIL
0.2 2.6 SILT, CLAYEY, SLIGHT PLASTIC, RED, WET, 10 PERCENT SAND
2.6 6.0 SHALE, SANDY, WEA., RED, HARDNESS-2
6.0 9.3 SILTSTONE, SHALY, WEA., HARDNESS-2, MED. BEDDED, BROKEN AT 8.0', ANGULAR FRAC. AT 7.4', SOME VUGGY POROSITY, CL SEAM AT 8.3', SOME SLIGHT STAIN FROM 8.0'-9.0', GRAY TO BROWN, SOME RED, RQD-18 PERCENT
9.3 25.0 SILTSTONE, HARDNESS-3 TO 4 (ARGILLITE), MEDIUM TO THICK BEDDED, DENSE, VERTICAL FRAC. 11.1' TO 12.3', RED, SOME GRAY MOTTLED, POSSIBLE SLIGHT OR STAIN IN JOINTS AT 13.2', VERT. FRAC. 18.2'-22.8' ANGULAR JOINT AT 23.2', RED W/GRAY, DENSE, SOLID, FROM 21.5'-25', RQD-52 PERCENT.
25.0 BOTTOM OF HOLE - WL (4-9-71) 1.4'

DN-101, ELEV. 205.4 15+00, CENTERLINE
LOGGED BY: JOE VAN 4-8-71
DRILLING EQUIPMENT: SKID RIG

HOLE DEPTH
FROM TO DESCRIPTION OF MATERIALS

SAMPLES
FROM TO %
FT. FT. REC.

0.0 0.5 TOPSOIL
0.5 2.0 SILT, CLAYEY, 15 PERCENT FINE SAND, MOIST, BROWN, SOME GRAVEL 1.5'-2.0', ALLUVIUM, SLIGHT PLASTIC
2.0 4.0 SILT, SLIGHT PLASTIC, 15 PERCENT SAND, TRACE MOISTURE, WEA. SHALE, W/SHALE GRAVELS FROM 3.0' TO 4.0', TAN, YELLOW, GRAY, RESIDUAL
4.0 21.4 SILTSTONE, SHALY, BOULDER TO 4.7', CROSS-BEDDED, RED TO 8.0', TO 14.0' GRAY BANDED, HARDNESS-3, THIN BEDDED, BROKEN 13.3'-13.7', SOME POSSIBLE SLIGHT OIL STAINING JOINT FROM 8.0'-9.0', FROM 14'-21.4', HARDNESS-3 TO 4, THICK BEDDED, GRAY & RED MOTTLED, RQD-57 PERCENT, SOME STAINING FROM 15.2'-15.9' WITH ERODED JOINTS, VERT. FRAC. 14.5'-15.5', 16.5'-18.8' RED SHALE, HARDNESS-2 W/ SILTY STREAKS.
21.4 34.1 SHALE, SILTY, MED. BEDDED, RED TO 22.4', FROM 22.4'-23.4', GRAY W/ RED & CROSS BEDDING (ARGILLITE), HARDNESS-3 FROM 24.8'-34.1', SHALE IS GRAY, THIN TO MED. BEDDED, CALCAREOUS, HARDNESS-3, HARDNESS-4, BROKEN LIMY SHALE FROM 28.0'-28.8' W/ VERT. FRAC. THIN BEDDED & BROKEN LIMY SHALE 29.2'-29.9', WITH CL SEAM IN ANGULAR FRAC. AT 29.8' THIN BEDDED AND SANDY, SLIGHT CALCAREOUS, HARDNESS-2 PLUS, GRAY SHALE FROM 31.5'-33.5', THIN BEDDED, WITH CALCITE PARTINGS, ONE SOLID PIECE 33.5'-34.0', RQD-43 PERCENT.
34.1 35.0 SHALE, SILTY, THIN BEDDED, HARDNESS-2, WEA. WITH CALCITE PARTINGS, RED, RQD-32 PERCENT.
35.0 BOTTOM OF HOLE. WL (4-12-71) 7.5'

NOTE - ALL SOIL AND ROCK CLASSIFICATIONS WERE DETERMINED BY VISUAL-MANUAL METHOD.

PLATE 15

NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA
LOGS OF TEST HOLES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
Drawn		Field
Tested		Field
Checked	Short	Drawing No
	7/20	PA-621-P

AD-A091 486

WOODWARD-CLYDE CONSULTANTS PLYMOUTH MEETING PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM, NEWTOWN DAM (NDS I.D. NUMBER P-ETC(U)
AUG 80 M F BUCK, J H FREDERICK DACW31-80-C-0018

UNCLASSIFIED

2

100-0000



END

DATE

FILED

19

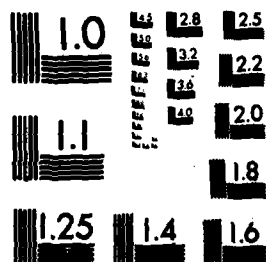
DTIC

NL

CLASSIFIED

2 OF 3

AD A
091486



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

LEGEND

TEST HOLE NUMBERING SYSTEM

Centerline of Dam	1 - 99
Borrow area	101 - 199
Emergency spillway	201 - 299
Centerline of outlet structure	301 - 399
Stream channel	401 - 499
Relief wells	501 - 599
	601 - 699
	701 - 799

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

GW	Well graded gravels; gravel-sand mixtures
GP	Poorly graded gravels
GM	Silty gravels; gravel-sand-silt mixtures
GC	Clayey gravels; gravel-sand-clay mixtures
SW	Well graded sands; sand-gravel mixtures
SP	Poorly graded sands
SM	Silty sands; sand-silt mixtures
SC	Clayey sands; sand-clay mixtures
ML	Silts; silty, very fine sands; sandy or clayey silts
CL	Clays of low to medium plasticity; silty, sandy or gravelly clays
CH	Clays of high plasticity; fat clays
MH	Elastic silts; micaceous or diatomaceous silts
OL	Organic silts and organic silty clays of low plasticity
OH	Organic clays or silts of medium to high plasticity

BEDROCK SYMBOLS

B	Basalt	Sc	Schist
Gn	Gneiss	Sh	Shale
Gr	Granite	Sis	Siltstone
Ls	Limestone	Sl	Slate
Ma	Marble	Ss	Sandstone

SAMPLES

DS	Disturbed
US	Undisturbed

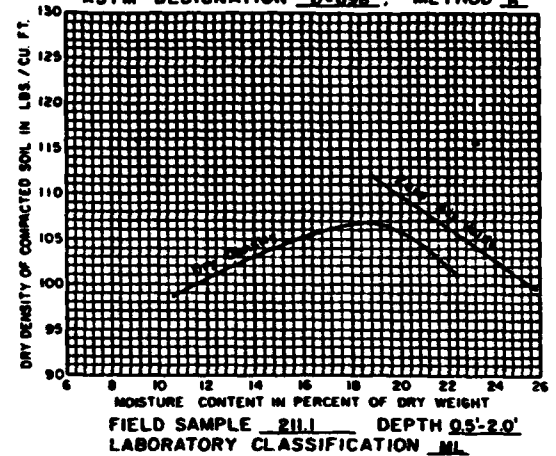
NOTE:

All soil and rock classifications were determined by visual examination, except where otherwise noted.

COMPACTION CURVE

LABORATORY SAMPLE NO. 72W2084

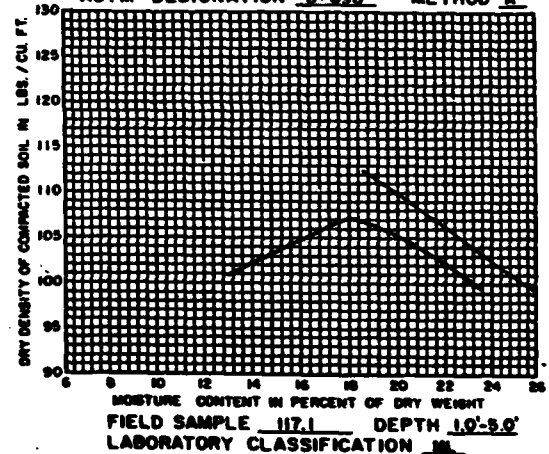
ASTM DESIGNATION D-698 METHOD A



COMPACTION CURVE

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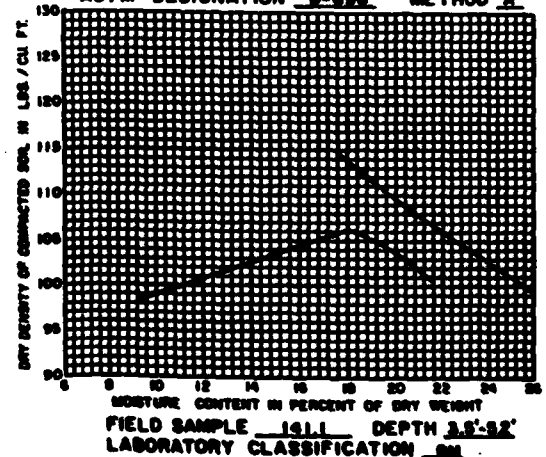
ASTM DESIGNATION D-698 METHOD A



COMPACTION CURVE

LABORATORY SAMPLE NO. 72W2087

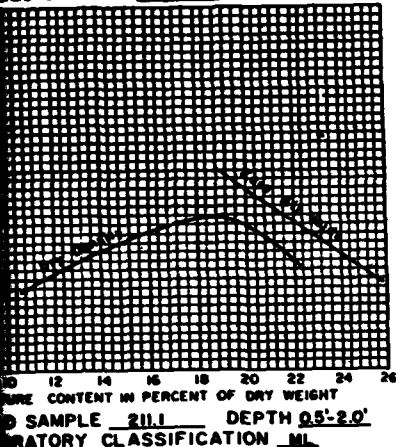
ASTM DESIGNATION D-698 METHOD A



COMPACTION CURVE

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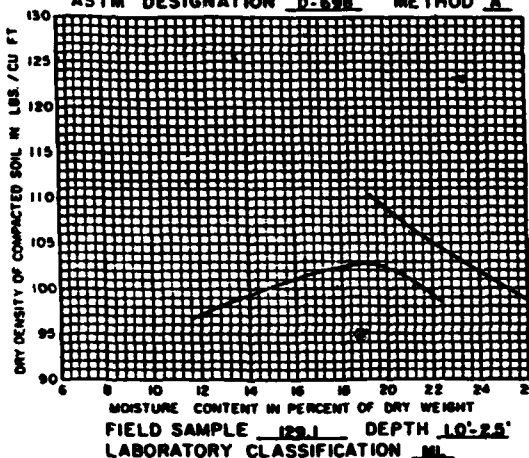
DESIGNATION D-698 METHOD A



COMPACTION CURVE

LABORATORY SAMPLE NO. 72W2082

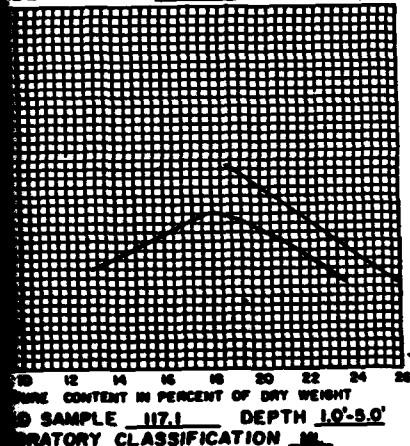
ASTM DESIGNATION D-698 METHOD A



COMPACTION CURVE

LABORATORY SAMPLE NO. 72W2083

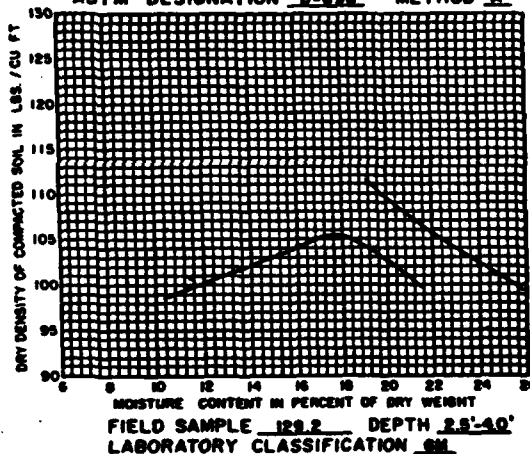
DESIGNATION D-698 METHOD A



COMPACTION CURVE

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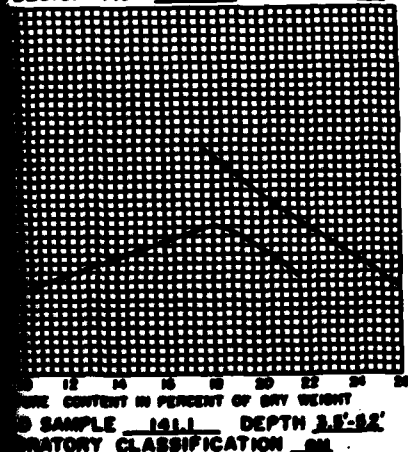
ASTM DESIGNATION D-698 METHOD A



COMPACTION CURVE

LABORATORY SAMPLE NO. 72W2087

DESIGNATION D-698 METHOD A



NESHAMINY CREEK WATERSHED
FLOODWATER RETARDING DAM PA-621
BUCKS COUNTY, PENNSYLVANIA
COMPACTION DATA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date	9-75	Approved by	
Checked	CRICE	Tested	
Drawn		Field	
Plotted		Lab	
Reviewed		PA-621-P	

PLATE 16

APPENDIX

F

**SITE GEOLOGY
NEWTOWN DAM
(SCS PA 621 DAM)**

SCS PA 621 Dam is located in the Triassic Lowland Section of the Piedmont Physiographic Province. As shown in Plate F-1, the site is underlain by the Stockton Formation of Triassic age. Information contained in the state files describes the bedrock as silty shale and shaly and sandy siltstone that strikes east-west and dips 10 to 20 degrees to the north. This is consistent with the observed N70°E strike and 11 degree north dip (upstream) of bedrock exposed on the left side of the emergency spillway. High angle rock jointing strikes near east-west (parallel to dam centerline) and north-south (perpendicular to dam centerline). A potential for seepage under the dam exists due to the jointed and blocky character of the bedrock.

