STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

DAVID C. CALLAGHAN
Director

July 27, 1981

The Honorable A. James Manchin
Secretary of State
Capitol Complex
Charleston, West Virginia 25305

Dear Secretary Manchin:

The following is submitted to you pursuant to the requirements of Chapter 29A, Article 3 of the Code of West Virginia, as amended.

NOTICE OF FINAL AGENCY ACTION

The Reclamation Commission, created by Article 6, Chapter 20, hereby declares its intention to adopt and does hereby adopt these rules and regulations as final rules and regulations within the meaning and purview of the Code of West Virginia, Chapter 29A, Article 3, Section 10, as amended 1977. These rules and regulations were open to public comment for more than thirty (30) days. The notice of the public hearing was filed in the Office of the Secretary of State on January 19, 1981, and a public hearing was held on the 23rd of February, 1981.

Any amendments necessitated by public comment have not changed the main purpose of any of these regulations as they were initially proposed on January 19, 1981. Additions to these rules and regulations have been underlined and deletions have been enclosed in brackets.

RESPONSE TO PUBLIC COMMENT

Attached to the rules and regulations to be submitted today as final rules and regulations are responses to the major public comments submitted during the public comment period. Also, a transcript of the public hearing held on February 23, 1981, will be retained on file with the Department of Natural Resources.

FILED IN THE OFFICE OF
SECRETARY OF STATE
THIS DATE 7/27/81

CERTIFICATE OF PRESENTATION

The attached rules and regulations proposed for promulgation will be presented to the West Virginia Legislative Rule Making Committee as a courtesy to that Committee even though by Supreme Court decision these rules and regulations are exempt from review by the Committee. Presentation to the Committee will occur simultaneously with the submission of this letter to the Office of the Secretary of State.

Very truly yours,

David C. Callaghan
Director
Department of Natural Resources

DCC:DMA:cr

FILED IN THE OFFICE OF
SECRETARY OF STATE
THIS DATE

STATE OF WEST VIRGINIA

OFFICE OF THE SECRETARY OF STATE

CHARLESTON 25305

A. JAMES MANCHIN
SECRETARY OF STATE

STATE REGISTER FILING

I, DAVID C. CALLAGHAN, CHAIRMAN,
Title or Position

RECLAMATION COMMISSION, hereby submit to record in
Department or Division

the State Register on 8 1/2 x 11" paper two (2) copies of

( ) proposed rules and regulations concerning topics of material not covered by existing rules and regulations;

(X) proposed rules and regulations superseding rules and regulations already on file;

( ) notice of hearing;

( ) findings and determinations;

( ) rules and regulations; or

(X) other - specify (Notice of final Agency action & Response to Public Comments).

FILED IN THE OFFICE OF SECRETARY OF STATE THIS DATE 7/27/81

This filing pertains to

Chapter 20
Article 6D
Series VII
Section 1-11
Page No. 1-48

( ) proposed rules and regulations are required to go to Legislative Rule Making Committee;

(X) proposed rules and regulations are excluded from Legislative Rule Making Committee;

7/27/81
Date Submitted

D C Callaghan
Signature of Person Authorizing this Filing

David C. Callaghan, Director
Department of Natural Resources

David C. Callaghan, Chairman
Reclamation Commission

Walter N. Miller, Director
Department of Mines

Walter N. Miller, Member
Reclamation Commission

David Robinson, Member
Reclamation Commission

James E. Pitsenbarger, Member
Reclamation Commission

RECLAMATION COMMISSION RESPONSE TO PUBLIC COMMENTS RECEIVED ON REGULATIONS DEVELOPMENTS PURSUANT TO 20-6D OF THE CODE OF WEST VIRGINIA

1. Several commenters indicated that they did not have enough time to adequately review the regulations.

   The Commission finds that the comment period followed those that are mandated by the W. Va. Administratvie Procedures Act and therefore concludes that the comment period was adequate and within the limits established by the Administrative Procedures Act.

2. One commenter felt that the regulations did not adequately distinguish between regular "primary" blasting and secondary "boulder breaking" blasting.

   The Commission finds Section 20-6D-11a(4)of the Act adequately expresses the legislative distinction between regular and secondary blasting.

3. One commenter objected to Section 4.03 of the regulations as requiring notification of many persons who may not be near the blasting operations.

   The Commission finds that a very clear legislative mandate exists for Section 4.03 whereby all adjacent property owners or residents must be notified of impending blasting prior to commencement of mining operations.

   Further public protection from blasting operations is contained in Section 4.06 which requires a maximum 1 hour notice to be given to all persons involved when blasting is to be conducted within 500 feet of any occupied dwelling.

   Section 4.06 requires notice each time blasting is to be conducted under the 500 foot criteria while Section 4.03 envisions a one time written notification prior to commencement of mining operations.

4. One commentor objected to Section 6.03 treatment of toxic materials as unnecessary with regard to mining of other materials.

   The Commission finds that mining of any minerals within the confines of this state's borders can under certain circumstances expose toxic producing material which must be adequately handled in order to prevent or reduce the threat of water pollution.

   The Commission also recognizes the possibly confusing wording used in the first sentence of this section and has accordingly deleted the first 8 words "All exposed mineral seams remaining after mining and".

5. One commenter indicated that Section 6 of the regulations does not contain a requirement to achieve approximate original contour as referenced to in 6.04.

The Commission finds in reviewing this section that Section 6.01 references the approximate original contour requirements contained in the Act therefore validating the reference made in 6.04.

6. One commenter felt that the reference to "waste materials from a coal preparation or conversion facility be deleted from Section 6A.03 because these regulations no longer apply to coal.

The Commission finds that occasions may arise where waste materials from coal preparation or conversion facilities may potentially be disposed of in pits formed by mining under the auspices of Chapter 20 Article 6D. In recognition of these potentials the Commission feels the authority to regulate these activities is essential.

7. One commenter felt that the exemtion for limestone, sandstone and sand operations contained in 6E.08 be expanded to indicate these operations would also be exempt from Section 6 of the Regulations.

The Commission finds in reviewing this comment and Section 6 that certain portions of Section 6 apply to exempted operations including permanent overburden disposal sites and therefore rejects the comment.

8. A commenter recommended certain language additions to Section 5A.02 and also a wavier to these requirements under certain circumstances. changes or the additions of a waiver to this section.

The Commission finds that Section 5A.02 is cirtical in controlling erosion and sedimentation problems and has proven successful from a historical perspective in controlling possible adverse conditions from other mineral operations.

The Commission there rejects the commenter's request for language changes or the additions of a waiver to this section.

9. One commenter suggested the daily monitoring requirement in Section 5C.01 be dropped in light of the fact that this section requires monitoring frequencies to be in compliance with the Federal Water Pollution Control Act.

The Commission in reviewing this section has determined the reference to the Federal Water Pollution Control Act concerns total suspended solids and the regulations have been changed to reflect this clarification.

10. One commenter suggested that the reference to "prospecting" contained in Section 11 of the Regulations be deleted.

In reviewing the Act the Commission finds no reference to prospecting and the reference in the regulations was accordingly deleted.

WEST VIRGINIA SURFACE MINING RECLAMATION REGULATIONS

Department of Natural Resources
Mining and Reclamation of Minerals Other Than Coal

Chapter 20-6D

INDEX

WEST VIRGINIA SURFACE MINING RECLAMATION REGULATIONS

Department of Natural Resources
Mining and Reclamation of Minerals Other Than Coal

Chapter 20-6D
Series VII
(1981)

Subject: Rules and regulations pertaining to surface mining and reclamation operations for minerals other than coal establishing general and specific requirements for definitions, permits, preplans, haulageways or access roads, blasting, drainage system, method of operation, grading, backfilling and revegetation, modifications, state and federal compliance and validity of regulations and exceptions.

SECTION 1. GENERAL

1.01. Scope -These regulations establish general and specific rules for surface mining and reclamation operations for minerals other than coal including requirements for definitions, permits, preplans, haulageways or access roads, blasting, drainage system, method of operation, grading, backfilling and revegetation, modifications, state and federal compliance and validity of regulations and exceptions.

1.02. Authority - These regulations are issued under the authority of Article 6D, Chapter 20, Code of West Virginia, as amended.

1.03. Effective Date - These regulations were promulgated on the 24th day of September, 1981.

1.04. Filing Date - These regulations were filed in the Office of the Secretary of State on the 27th day of July, 1981.

SECTION 2. DEFINITIONS: UNLESS THE CONTEXT IN WHICH USED CLEARLY REQUIRES A DIFFERENT MEANING, AS USED IN THESE REGULATIONS OR AS REFERRED TO IN ARTICLE 6, CHAPTER 20, CODE OF WEST VIRGINIA, AS AMENDED:

2.01. Acidity shall mean the capacity of water to donate protons. The symbol pH referring to the degrees of acidity or alkalinity. On this scale, pH of 1 is the strongest acid, pH of 14 is the strongest alkali, pH of 7 is the point of neutrality.

2.02. Acid-producing materials shall mean mineral compounds which will, when acted upon by water and air, cause acids to form.

2.03. Acid-producing overburden shall mean material that may cause spoil which upon chemical analysis, shows a pH of 3.5 or less.

2.04. Active surface mine operation shall mean an operation where land is being disturbed or mineral is being removed.

2.05. Area surface mining shall mean open-cut or multiple-cut mining carried out on level to gently-rolling topography, which does not produce a bench.

2.06. Backfill shall mean to place material back into an excavation and return the area to a predetermined slope.

2.07. Base of highwall shall mean the intersection of the vertical plane with the horizontal plane at any point in the overburden, spoil or mineral.

2.08. Bench shall mean the result of surface mining in areas where the average slope or the original ground has an inclination of more than thirty per cent (30%) from the horizontal, being: (a) the leveled surface of an excavated area measured horizontally at any point in the overburden, spoil, or mineral between the base of the highwall and outer point of original fill bench; or (b) a working base extending from the base of a highwall on which excavating equipment can set, move and operate.

2.09. Bench width shall mean the width of the bench as measured horizontally from the base of the highwall to the outer point of the original fill bench.

2.10. Completion of mining shall mean an operation where no mineral has been removed or overburden removed for a period of two consecutive months, unless the operator, within thirty (30) days of receipt of the director's notification declaring completion, submits sufficient evidence that the operation is in fact not completed.

2.11. Contour surface mining shall mean the removal of overburden and the mining of a mineral that normally approaches the surface at approximately the same elevation, generally a contour bench resulting.

2.12. Cross-drain shall mean a ditch constructed to carry away excessive drainage from a main collecting point or ditch.

2.13. Cut shall mean an excavation made by excavating equipment to remove overburden in a single progressive line.

2.14. Cut-fill shall mean overburden removed from an elevated portion of a road or bench and deposited in a depressed portion in order to maintain a desired grade.

2.15. Deep mining or underground mining shall mean removal of the mineral being mined without the disturbance of the surface as distinguished from surface mining.

2.16. Director and/or his authorized agent shall mean the Director of the Department of Natural Resources, the Chief of the Division of Reclamation, Assistant Chiefs of the Division of Reclamation and all duly authorized supervisors, inspectors and inspectors in training.

2.17. Diversion ditch shall mean a machine-made waterway used for collecting ground water or a ditch designed to change the actual or normal course of ground and/or surface water.

2.18. Drainage plan or system shall mean the proposed method of collection, treatment, and discharge of all waters within the affected drainage area, as defined by the approved pre-plan.

2.19. Field indicator shall mean any approved apparatus or equipment used in the field to measure pH, iron, turbidity or such other parameters as may be required.

2.20. Fill bench shall mean that portion of a bench formed by spoil or overburden which has been deposited on or over the original slope.

2.21. Georgia Type V-Ditch shall mean a ditch for the collection and removal of ground and surface water, constructed on the solid bench area, with the opposing slopes being constructed in such a manner so as to permit the total area to be traversed by farm equipment.

2.22. Haulageway or access road shall mean any road constructed, improved, or maintained by the operator which ends at the pit or bench and which is located within the permit area. A bench may serve as a haulageway, but a haulageway cannot serve as a bench.

2.23. Highwall shall mean the vertical or near vertical wall consisting of the exposed strata after excavating operations.

2.24. Mineral shall mean a layer, vein, seam, bed or deposit; a stratigraphic part of the earth.

2.25. Mineral face shall mean the exposed vertical cross-section of the natural seam or deposit being mined and generally forming the base of the highwall left by excavating operations in surface mining.

2.26. Monument shall mean a permanent marker consisting of metal or wood used to identify the permit area being mined under a surface mining permit, consisting of a two-inch pipe driven three feet into the earth with a minimum of four feet exposed and a 2' X 3' sign affixed to the top of the pipe with company name and permit number permanently affixed. Any suitable equivalent substitute may be approved.

2.27. Natural drainway shall mean any water course or channel which carries water to the tributaries and rivers of the watershed. The United States Geological Survey classification of perennial or intermittent streams shall be considered as natural drainways.

2.28. Operation shall mean the permit area indicated on the approved map submitted by the operator.

2.29. Outer spoil or outer slope shall mean the disturbed area extending from the outer point of the bench to the extreme lower limit of the disturbed land.

2.30. Overburden shall mean the earth, rock and other materials lying in the natural state above a mineral deposit before or after excavation.

2.31. Pit shall mean that part of the surface mining operation from which the mineral is being actively removed.

2.32. Reclamation shall mean the process of converting disturbed land to a stable form for productive use.

2.33. Regrade or grade shall mean to change the contour of any surface by the use of leveling or grading equipment.

2.34. Sand shall mean individual rock or mineral fragments having a diameter less than 2.00 mm but greater than .02 mm.

2.35. Seepage water shall mean any water entering the ground from the surface through capillary action, cracks, faults or any other natural modes of entry, and finding its way to the surface again.

2.36. Slope shall mean the angle of repose from the horizontal plane of spoil banks or ridges of overburden material made in the surface mining operation; the angle of a hill or mountain. A gentle slope shall mean 0% to 10%; moderate to steep slope shall mean 10% to 45%; extremely steep slope shall mean 45% and over.

2.37. Soil shall mean any earthen material excluding bedrock.

2.38. Solid bench shall mean that portion of the bench surface formed by earth or rock strata which has not been removed, as distinguished from fill bench.

2.39. Spoil shall mean all overburden material removed or displaced by excavating equipment, blasting or any other means.

2.40. Stabilize shall mean to settle, or fix in place by mechanical or vegetative means, including the planting of trees, grasses, vines, shrubs, or legumes.

2.41. Stoniness shall mean a characteristic of earth, overburden or spoil reflecting its relative proportion of sizable aggregate content as opposed to its sand, loam, or fine aggregate content. Sites too stony to hand plant with seedlings shall be classified as extremely stony; those having less stone but too much stone for tillage shall be classified as stony; tillable sites shall be classified as non-stony.

2.42. Storm water shall mean any water flowing over or through the surface of the ground caused by precipitation; generally, surface run off.

2.43. Surface water shall mean that water, from whatever source, which is flowing on the surface of the ground.

2.44. Suspension of permit shall mean an act of the director or the Reclamation Commission or an authorized agent of the director or Reclamation Commission with legal justification temporarily nullifying the validity of a permit insofar as the mining and removal of the mined minerals are concerned.

2.45. Water analyses shall mean those water analyses performed by or for the operator using the analytical procedures set forth in Standard Methods, Thirteenth Edition, or employing such other field testing methods which have been approved by the Division of Water Resources.

SECTION 3. HAULAGEWAYS.

3.01. Location - The location of the proposed haulageway shall be identified on the site by visible markings at the time the reclamation and mining plan is pre-inspected and prior to commencement of construction.

3.02. Grading - The grading of a haulageway shall be such that:

a. No sustained grade shall exceed 10%;

b. The maximum pitch shall not exceed 15% for 300 feet;

c. There shall not be more than 300 feet of maximum pitch grade for each 1,000 feet of road constructed;

d. The surface shall be insloped toward the ditch line at the minimum rate of 1/2 inch per foot of surface width or crowned at the minimum rate of 1/2 inch per foot of surface width as measured from the center line of the haulageway.

3.03. Curves - The grade on switchback curves shall be reduced to less than the approach grade and should not be greater than ten per cent (10%).

3.04. Cut Slopes - Cut slopes should not be more than 1:1 in soils or 1/4:1 in rock.

3.05. Ditches - A ditch shall be provided on both sides of a through-cut and on the inside shoulder of a cut-fill section, with ditch relief cross-drains being spaced according to grade. Water shall be intercepted before reaching a switchback or large fill and led off. Water on a fill or switchback shall be released below the fill, not over it.

3.06. Culverts - Ditch relief culverts shall be installed according to the following provisions:

a.

Road Grade in Per Cent	Spacing of Culverts in Feet
2 - 5	300 - 800
6 - 10	200 - 300
11 - 15	100 - 200

b. The culvert shall cross the haulageway at a 30 degree angle downgrade;

c. The inlet end shall be protected by a headwall of suitable material and the outlet end shall be placed below the toe of the fill with an apron of suitable material provided for the outflow to spill on;

d. The culvert shall be covered by compacted fill to a depth of one foot or half the culvert diameter, whichever is greater.

3.07. Culvert Openings - Culvert openings installed on haulageways should not be less than one hundred (100) square inches in area, but, in any event, all culvert openings shall be adequate to carry storm run off and shall receive necessary maintenance to function properly at all times.

3.08. Natural Drainway - Minor alterations and relocations of natural drainways as shown on the reclamation plan will be permitted if the natural drainway will not be blocked and if no damage is done to the natural drainway or to adjoining landowners.

3.09. Stream Crossings -Drainage structures shall be required in order to cross a stream channel. They shall be such so as not to affect the flow of the stream. Consideration will be given to the time of year the stream is crossed and length of time the stream channel is used, but in no event, and under no condition will the flow of the stream be affected or the sediment load of the stream increased during construction and/or use.

3.10. Removal of Drainage Structures -No bridges, culverts, stream crossing, etc., necessary to provide access to the operation, may be removed until reclamation is completed and approved by the director. The same precautions as to water quality are to be taken during removal of drainage structures as those taken during construction and use.

3.11. Stabilization of Slopes -All fill and cut slopes shall be stabilized after the construction of a haulageway.

3.12. Haulageway Surfacing -Haulageways shall not be surfaced with any acid-producing or toxic material or with any material which will produce a concentration of suspended solids in surface drainage.

3.13. Tolerance -All grades referred to in this section shall be subject to a tolerance of two per cent (2%) grade. All linear measurements referred to in this section shall be subject to a tolerance of ten per cent (10%) of measurement. All angles referred to in this section shall be measured from the horizontal and shall be subject to a tolerance of five per cent (5%).

3.14. Water Bars - Water bars of the ditch and earth berm or log type shall be installed according to the following table of spacings in terms of per cent of haulageway grade prior to the abandonment of a haulageway.

Percent of Haulageway	Spacing of Water Bars in Feet
2	250
5	135
10	80
15	60
20	45
Above 20	25

3.15. Dust Control - Reasonable means shall be employed to prevent loss of haulageway surface material in the form of dust.

3.16. Abandonment of Haulageway - Upon abandonment of a haulageway, the haulageway shall be seeded and every effort made to prevent erosion by means of culverts, water bars or other devices.

SECTION 4. BLASTING.

4.01. Assessment - Any assessment as set forth in Section 11a, Article 6D, Chapter 20 of the Code of West Virginia, as amended, shall be paid within 10 days after receipt of said assessment notice.

4.02. Sign - A sign permanently affixed at or near the permanent monument shall describe "warning, blasting area." The sign shall be a minimum of 2' X 3' with legible letters to be erected at the time mining operations begin.

4.03. Written Notification - Prior to mining operations, written notification of blasting shall be given by certified mail to all residents, owners or other persons who are adjacent to any part of the proposed operation. The United States Post Office Department certified receipt of notification shall be maintained with the blasting log.

4.04. Blasting Time - Blasting shall be limited to the hours between sunrise and sunset. Blasting on Sunday is strictly prohibited.

4.05. Approaches to Area - All approaches to the blast area shall be guarded against unauthorized entry prior to and immediately after blast.

4.06. Blasting warning - When blasting is to be done within five hundred (500) feet of any occupied dwelling, the operator or his authorized representative shall notify all persons involved that a blast is to be detonated, stating the approximate time of same. A minimum of one hour notification must be given prior to detonation.

4.07. Blasting Prohibited - The director or his authorized agent may prohibit blasting in specific areas where it is deemed necessary for the general safety of the area.

SECTION 5. DRAINAGE SYSTEM.

5.01. Drainage Plan - There shall be submitted with the application for surface mining a drainage plan which will show the proposed method of drainage on and away from the area of land to be disturbed. Said plan shall indicate the directional flow of water, constructed drainways, natural waterways used for drainage, streams or tributaries receiving or to receive this discharge, location of sediment dams and other silt retarding structures, location of all water test sites, treatment and all other data as may be required.

5.02. Natural Drainways - Natural drainways in the area of land disturbed by surface mining operations shall be kept free of overburden except where over-burden placement has been approved. Such drainways shall be identified on the maps submitted with the application. Surface mining operations will be prohibited 50 feet on either side of a natural drainway. Overburden placement and haulageways across natural drainways will be constructed so as not to affect the flow of the stream, or materially increase the sediment load in the stream.

5A. Constructed Drainways.

5A.01. Ditch Above Highwall - All surface water which drains into the pit shall be effectively intercepted on the uphill side of the highwall by suitable and adequate diversion ditches and conveyed by adequate channels or other suitable means of discharge to natural drainways outside the disturbed area. The director may, in the exercise of his sound discretion, when not in conflict with Article 6D, Chapter 20, Code of West Virginia, as amended, waive this regulation.

5A.02. Ditch on Bench - Drainage ditches will be constructed on the excavated solid bench in order to carry off storm, surface or seepage water. The breaking point for ditches on the bench will fall at or near the midpoint between natural or constructed drainways. In no case shall water be discharged over a spoil slope. Removal of water from the bench shall be accomplished by use of adequate pipe, a rock riprap flume, asphalt or concrete chutes, or by grading a channel to nonerosive rock.

5A.03. Ditch Below Spoil Slope - All surface water draining off the spoil slopes will be intercepted by suitable and adequate diversion ditches which will carry the water to suitable treatment ponds before discharge into a natural drainway. These ditches will be located within twenty-five (25) feet of the anticipated toe of the spoil slope. If at any time spoil material interferes with the flow of water in these ditches, that material shall be cleaned out immediately. The director may, in the exercise of his sound discretion, when not in conflict with Article 6D, Chapter 20, Code of West Virginia, as amended, waive this regulation.

5B. Sediment

5B.01. Sediment Control - Embankment type sediment dams or excavated sediment ponds will be constructed in appropriate locations in order to control sedimentation. All such impoundments shall have a minimum capacity to store .125 acre-ft./acre of disturbed area in the watershed. This disturbed area will include all land affected by previous operations that is not presently stabilized and all land that will be affected throughout the life of the permit. Design criteria and construction specifications for embankment type sediment dams, excavated ponds and other water retarding structures will be found in the "Technical Handbook for Surface Mining."

5C. Water Quality

5C.01. Water Quality Control - All reasonable measures shall be taken to intercept all surface water by the use of diversions, culverts and drainage ditches of other methods to prevent water from entering the pit area. All water accumulation into the pit shall be removed as rapidly as possible with due recognition to water quality requirements. All water discharges from the permit area are to be monitored daily by the operator and a written record of the testing dates and analytical data shall be kept current and made available for inspection. A monthly compilation of the foregoing information will be submitted monthly to the Chief of the Reclamation Division. Any treatment works necessary to meet "adequate treatment" shall be approved by the director. Discharge from the permit area shall not in any case violate Federal or State water quality standards or effluent limitations. The monitoring frequency for suspended solids shall be governed by the standards set forth in the NPDES Program under the Federal Water Pollution Control Act as amended, 33 U.S.C. 1251 et. seq. and the rules and regulations promulgated thereunder.

Water tests shall be taken before surface mining operations begin and the results of these tests will be shown on the "drainage plan" map. The location for these preliminary tests will be:

1. On natural drainways above proposed surface mining operations;
2. On natural drainways below proposed surface mining operations at or near the affected drainage area boundary;
3. On natural drainways upstream from the mouth of a natural drainway affected by surface mining.

5C.02. Treatment Facilities for Drainage from Surface Mine Operations - The Chief of the Division of Reclamation or his duly authorized agent shall conduct such investigation as it is deemed necessary and proper in order to determine whether or not any such permit should be granted or denied. In making such investigation and determination as to any such application, the chief of the division of reclamation shall consult with the chief of the division of water resources. Such cooperation shall include, but not be limited to, a written recommendation approving or disapproving the granting of the permit and the reason or reasons for such recommendation.

5D. Seeding

5D.01. Seeding of Drainage System - All areas disturbed in the installation of the drainage system shall be seeded and mulched after construction in accordance with section 7 of these regulations.

5E. Technical Handbook for Surface Mining

5E.01. Technical Handbook for Surface Mining - Design criteria and construction specifications for embankment type sediment dams, excavated sediment ponds, stone check dams, log and pole structures, diversion ditches, outlets and other water control structures are to be found in the "Technical Handbook for Surface Mining" published by the Department of Natural Resources.

SECTION 6. METHOD OF OPERATION

6.01. Operator Responsibility - In planning and executing surface mining operations, the operator shall have, at all times, proper regard for all backfilling and regrading requirements, imposed by Article 6D, Chapter 20, Code of West Virginia, as amended, and all rules and regulations adopted pursuant thereto, and all provisions of the approved pre-plan.

6.02. Topsoiling or Other Material Suitable for the Post Mining Land Use - These materials shall be removed in a separate layer and distributed over the backfilled area, or if not utilized immediately, segregated and stockpiled in a separate location as specified in the pre-plan. Topsoil not immediately utilized shall be protected from wind and water erosion. Any material used for topsoiling must be capable of supporting and maintaining the approved post mining land use.

6.03. Treatment of Toxic Material - [All exposed mineral seams remaining after mining and] Any acid-forming, toxic-forming, combustible materials, or any other waste materials that are exposed, shall be covered with a minimum of four (4) feet of nontoxic and noncombustible material; or test, treat and blend material to provide materials suitable to prevent water pollution. If necessary, this material shall be treated to neutralize toxicity in order to prevent water pollution and sustained combustion and/or to minimize adverse effects on plant growth and land uses. Where necessary to protect against upward migration of salts, exposure by erosion, to provide an adequate depth for plant growth, or to otherwise meet local conditions, the director shall specify thicker amounts of cover using non-toxic material. Acid-forming or toxic-forming material shall not be buried or stored in proximity to a drainage course so as to cause or pose a threat of water pollution.

delete within brackets

6.04. Small Depressions - The requirement of this section to achieve approximate original contour does not prohibit construction of small depressions if they are approved by the director to minimize erosion, conserve soil moisture or promote revegetation. These depressions shall be compatible with the approved post-mining land use.

6.05. Bench Surface - The surface of the regraded bench shall be graded so as to permit the use of farm implements and machinery.

6.06. (Reserved)

6.07. Final Graded Slopes - Final graded slopes shall mean slopes backfilled and graded to eliminate the highwall which does not exceed the angle of repose or such lesser slope as is necessary to assure stability.

6.08. Grading Outer Spoil - All outer spoil shall be graded so as to blend into the adjoining undisturbed lands.

6.09. Regrading or Stabilizing Rills and Gullies - Any rills or gullies deeper than nine (9) inches forming in areas that have been regraded and the topsoil replaced but where vegetation has not yet been established will be deemed unacceptable and any such rills or gullies shall be filled, graded, or otherwise stabilized and revegetated. Rills or gullies of lesser size shall also be stabilized if they will be disruptive to the approved postmining land use or may result in additional erosion and sedimentation:

6.10. Inactive Status - Inactive operation status will be considered for a period not to exceed one (1) year from date of approval providing that prior written approval is obtained from the director.

6.11. Keeping Operation Current - Grading, backfilling and water management practices as approved in the plans shall be kept current as follows:

a. Should the operation include only stripping (no augering or highwall mining), the grading and backfilling shall follow the mineral removal by a period not to exceed sixty (60) days or 3,000 linear feet.

b. Should the operation include stripping and highwall mining, the highwall mining shall follow the stripping within sixty (60) days, or a reasonable time as prescribed by the director. Grading and backfilling shall follow the highwall mining by not more than thirty (30) days or 1,000 linear feet.

c. Should the particular site conditions or weather make adherence to these guidelines impractical the period of time or the distance required to be current may be reasonably extended.

6A. Requirements for Special Land Use Purposes

6A.01. Alternative Plans - Alternative plans for restoration of the disturbed area may be submitted to the director. If such restoration will be consistent with the purpose of Article 6D, Chapter 20, Code of West Virginia, as amended, and if such plans are approved by the director and complied with within such time limits as may be determined by him as being reasonable for carrying out such plans, the backfilling and grading requirements heretofore contained, may be modified.

6A.02. Water Impoundments - Prior to the construction of an impounding area for the storage of water after mining, approval must be obtained from the director for such impountment. The Division of Water Resources will cooperate with the Division of Reclamation in reviewing all portions of any plan for water impoundments as they relate to water quality and will give its recommendations therefore, to the Division of Reclamation. This plan will include but not be limited to the following:

a. Location of the impounding area:

b. Dimensions of the area as to capacity and depth (average, maximum and minimum);

c. Plot plan of impoundment area;

d. Source of water entering the impoundment;

e. Quality of the water entering the impoundment;

f. Quality of water leaving the impoundment and mechanism of discharge;

g. Mineral or seams mined or involved with impoundment;

h. Chemical characteristics of the soils and underlying strata in the impoundment area as they relate to acid production;

i. Safety aspects considered such as spillway overflow, emergency spillway, access to area; and

j. Consent of the landowner for such impoundment with submission on specified forms.

6A.03. Sanitary Landfills - Where waste materials from a coal preparation or conversion facility or from other activities conducted outside the permit area such as municipal wastes, garbage, etc., are used for fill material, plans for such use shall be approved by the director. Such plans for sanitary landfills and/or solid waste disposal areas shall be accompanied by the written approval of the Division of Water Resources and where appropriate, the State Department of Health.

6B. Steep Slope Mining

6B.01. Applicability - On surface mining operations where the natural slope exceeds twenty degrees (20°), the provisions of this section in addition to other applicable provisions of these regulations, shall apply. On lesser slopes that require measures to protect the area from disturbance as determined

by the director based on consideration of soils, climate, method of operation, geology, and other regional characteristics, the provisions of this section, in addition to other applicable provisions of these regulations, shall also apply. These provisions do not apply where mining is done on a flat or gently rolling terrain with an occasional steep slope through which the mining proceeds and leaves a plain or predominately flat area.

6B.02. Downslope Placement - Spoil or debris including that from clearing and grubbing, shall not be placed on the downslope except as provided for in section 6D. or 6E. of these regulations.

6B.03. Highwall Elimination - The highwall shall be eliminated and the disturbed area graded. Land above the highwall shall not be disturbed unless the director finds that the disturbance will facilitate compliance with the requirements of this section.

6B.04. Stabilization - The material used to backfill and eliminate the highwall shall be sufficiently compacted or otherwise mechanically stabilized so as to insure stability of the backfill. Woody materials may be buried in the backfilled area only when the burial does not cause or add to instability.

6C. Mountaintop Removal

6C.01. Applicability - Where the mountaintop removal technique is applied, the provisions of this section in addition to other applicable provisions of these regulations, shall apply.

6C.02. Outcrop Barrier - An outcrop barrier of sufficient width shall be retained where necessary to prevent slides and erosion. Where no outcrop exists due to previous mining, this requirement will be waived.

6C.03. The Final Graded Slopes - The final graded top plateau slopes on the mined area shall be less than 5 horizontal to 1 vertical so as to create a level plateau or gently rolling configuration and the outslopes of the plateau shall not exceed 2 horizontal to 1 vertical except where approved by the director, but in no case shall the minimum static safety factor be less than 1.5.

6C.04. Drainage -The resulting level or gently rolling contour shall be graded to drain inward from the outslope except at specific points where it drains over the outslope in protected channels.

6D. Disposal of Spoil or Toxic Forming Materials or Permanent Overburden Disposal Sites by Methods Other Than Valley or Head-of-Hollow Fills

6D.01. Applicability - Spoil or toxic forming materials not required to achieve the approximate original contour or to be placed in permanent disposal sites shall be transported to and placed in a controlled manner in disposal areas other than the mine workings or excavation only if all the provisions of this section are met.

6D.02. Location of Disposal Sites - The disposal areas shall be within the permit area and they must be approved by the director as suitable for construction of fills. The disposal area shall be located on the most moderate slopes and naturally stable areas available. Where possible, fill materials suitable for disposal shall be placed upon or above a natural terrace, bench, or berm, if such placement provides additional stability and prevents mass movement.

6D.03. Certification - Certification of the fill shall be as follows:

a. The fill shall be designed using recognized professional standards and certified by an approved registered professional engineer or other approved professional specialist;

b. The fill shall be inspected for stability by an approved registered professional engineer or other approved professional specialist after completion of the first 50-foot lift, to assure removal of all organic material and topsoil, placement of under-drainage systems, and proper construction in accordance with the approved pre-plan. The approved registered professional engineer or other approved professional specialist, shall also provide a certified report upon completion of the fill that the fill has been constructed as designed in the approved pre-plan, and

c. Where fills are placed on slopes less than twenty degrees (20°) a certification shall not be required.

6D.04. Stabilization - Where the slope in the disposal area exceeds 2.8 horizontal to 1 vertical (36 per cent) or where necessary to achieve a static safety factor of 1.5, measures such as keyway cuts, rock toe buttresses or other techniques shall be used. All organic material shall be removed from the disposal area and the topsoil must be removed and segregated before the overburden is placed in the disposal area. Suitable organic material may be used as mulch or may be included in the topsoil. The spoil or toxic forming materials shall be transported and placed in a controlled manner, concurrently compacted as necessary to insure long-term mass stability and prevent mass movement. The fill shall be drained and graded to allow surface and subsurface drainage to be compatible with the natural surroundings.

6D.05. Drainage - The disposal area shall not contain springs, natural water cources or wet weather seeps unless lateral drains are constructed from the wet areas to the under drains in such a manner that infiltration of the water into the fill shall be prevented. The drains shall be designed and constructed of

course rock. If no filter is designed for the under drain, sufficient capacity shall be provided to allow for partial plugging of the drain. No rock shall be used in under drains if it tends to disintegrate or if it is acid-forming or toxic-forming.

6D.06. Construction - Construction of the fill shall be as follows:

a. All areas upon which the fill is to be placed shall first be progressively cleared of all trees, brush, shrubs, and other organic material. This material shall be removed from the fill area;

b. Depositing and compacting the fill in layers shall begin at the toe of the fill. The layers shall be constructed approximately parallel with proposed finish grade. All material shall be deposited in uniform horizontal layers and compacted with haulage equipment.

c. The thickness of the layers shall not exceed four feet;

d. The outer slope shall be no steeper than 2 horizontal to 1 veritcal. A 20-foot wide bench shall be installed at a maximum of every 50 feet in vertical height of the fill with a 3% to 5% slope toward the fill area, normal to such, and a 1% slope toward a rock rip-rap channel or natural drainway; and

e. When construction of each lift (maximum of every 50 feet in vertical height) of the fill is completed, topsoil or other suitable material which will support vegetation shall be spread over the completed slope and bench. The slopes and benches shall then be seeded and mulched immediately in accordance with the approved revegetation plans.

6E. Disposal of Spoil Materials in Valley or Head-of-Hollow Fills

6E.01. Applicability - Spoil not required to achieve the approximate original contour or being placed in permanent overburden disposal sites shall be transported to and placed in a controlled manner; spoil to be disposed of in natural valleys must be placed in accordance with the following requirements.

6E.02. Location of Spoil Areas - The disposal areas shall be within the permit area and they must be approved by the director as suitable for construction of fills. The disposal area shall be located on the most moderate slopes and naturally stable areas available. Where possible, fill materials suitable for disposal shall be placed upon or above a natural terrace, bench, or berm, if such placement provides additional stability and prevents mass movement.

6E.03. Certification - Certification of the fill shall be as follows:

a. The fill shall be designed using recognized professional standards and certified by an approved registered professional engineer or other approved professional specialist; and

b. The fill shall be inspected for stability by an approved registered professional engineer or other approved professional specialist after completion of the first 50-foot lift, to assure removal of all organic material and topsoil, placement of under-drainage systems, and proper construction in accordance with the approved pre-plan. The approved registered professional engineer or other approved professional specialist, shall also provide a certified report upon completion of the fill that the fill has been constructed as designed in the approved pre-plan.

6E.04. Stabilization - Where the slope in the disposal area exceeds 2.8 horizontal to 1 vertical (36 per cent) or where necessary to achieve a static safety factor of 1.5, measures such as keyway cuts, rock toe buttresses or other techniques shall be used. All organic material shall be removed from the disposal area and the topsoil must be removed and segregated before the overburden is placed in the disposal area. Suitable organic material may be used as mulch or may be included in the topsoil. The spoil shall be transported and placed in a controlled manner, concurrently compacted as necessary to insure long-term mass stability and prevent mass movement. The fill shall be drained and graded to allow surface and subsurface drainage to be compatible with the natural surroundings.

6E.05. Drainage - The disposal area shall not contain springs, natural water courses or wet weather seeps unless lateral drains are constructed from the wet areas to the under drains in such a manner that infiltration of the water into the fill shall be prevented. If springs, natural water courses or wet weather seeps are encountered, a system of under drains shall be constructed from each spring or seepage area as lateral drains to the rock core. If no filter is designed for the under drain, sufficient capacity shall be provided to allow for partial plugging of the drain. No rock shall be used in under drains if it tends to disintegrate or if it is acid-forming or toxic-forming.

6E.06. Construction - Construction of the fill shall be as follows:

a. All areas upon which the fill is to be placed shall first be progressively cleared of all trees, brush, shrubs, and other organic material. This material shall be removed from the fill area. No more than 3.0 acres, excluding roadway for construction of fill, shall be cleared in the valley fill site until the first lift is completed;

b. A rock core shall be progressively constructed as the layers are brought up through the valley fill. The rock core shall be a minimum of 16 feet in width and composed of rock with a minimum dimension of 12 inches. The rock core shall consist of no more than 10% fines as determined by visual inspection (fines being a material with a dimension of less than 12 inches);

c. Depositing and compacting the fill in layers shall begin at the toe of the fill. The layers shall be constructed approximately parallel with proposed finish grade. All material shall be deposited in uniform horizontal layers and compacted with haulage equipment.

d. The thickness of the layers shall not exceed four feet;

e. During and after construction, the top of the fill shall be graded to drain back to the head of the fill on a slope no greater than 3%. A drainage pocket shall be maintained at the head of the fill at all times to intercept surface runoff. Maximum size of the drainage pocket shall be 10,000 cubic feet;

f. The outer slope shall be no steeper than 2 horizontal to 1 vertical. A 20-foot wide bench shall be installed at a maximum of every 50 feet in vertical height of the fill with a 3% to 5% slope toward the fill area, normal to such, and a 1% slope toward a rock rip-rap channel or natural drainway; and

g. When construction of each lift (maximum of every 50 feet in vertical height) of the valley fill is completed, topsoil or other suitable material which will support vegetation shall be spread over the completed slope and bench excluding the rock core. The completed slope and bench shall then be seeded and mulched immediately in accordance with the approved revegetation plans.

6E.07. Variance - Where it can be demonstrated that other design criteria are justified, certain requirements of this section may be waived. The basis for justification are, but not limited to, land use potential, inavailability of durable rock, and site stability.

6E.08. Limestone, sandstone and sand mining operations unless otherwise specified in the Act or these rules and regulations shall be exempt from bonding and reclamation requirements.

SECTION 7. REVEGETATION AND STANDARDS FOR EVALUATING VEGETATIVE COVER.

7.01. Approval of Private Revegetation Contractor - In the event the operator contracts with a private contractor to carry out the planting, the private revegetation contractor shall first submit to the director a written resume of his past experience and training. On the basis of such resume, he shall be adjudged qualified or not, as the case may be, and so notified by the director in writing. Should experience warrant, a private revegetation contractor may be adjudged disqualified and so notified by the director in writing.

7.02. Objective in Revegetation - The objective in revegetation is to quickly establish a vegetative cover on all disturbed areas to minimize erosion, provide economic benefits, and restore aesthetic appeal. Plants that will give a quick permanent cover and enrich the soil shall be given priority. A temporary or permanent cover should be established by the end of the first growing season and a permanent cover by the end of the second growing season. All plants shall be considered a tool in achieving stabilization and an appropriate land use objective. Provided that limestone, sandstone, and sand mining operations shall be exempt from revegetation requirements unless otherwise specified.

7.03. Reference Areas - Success of revegetation shall be measured on the basis of reference areas approved by the director.

7A. Seeding and Planting

7A.01. Seasonal Feasibility - Appropriate vegetation shall be planted, seeded, aerial-seeded, or hydro-seeded in accordance with accepted agricultural and reforestation practices when the season is favorable for seed germination and plant survival except as otherwise specified in these regulations.

7A.02. Minesoil Characteristics - Surface mining of minerals and removal of overburden results in minesoil which varies greatly in fertility, acidity and stoniness. These three characteristics, together with steepness of slope, shall be used in determining characterization for the purpose of establishing vegetation. Premining overburden sampling and analysis or previous experience and correlation data, shall be submitted with the pre-plan for all acid-producing seams. The plan shall identify toxic strata and provide planned handling and final placement for acid strata. Overburden analysis to be in accordance with standard procedures outlined in Environmental Protection Agency Manual No. 600/2-78-054 (Field & Laboratory Methods Applicable to Overburdens and Minesoils) or other approved methods by the Department of Natural Resources. Minesoil classification shall be in accordance with Table 6.

7A.03. Minesoil Analysis - Tests for minesoil acidity, expressed as pH, shall be taken at points distributed uniformly over the disturbed area. Minesoil tests may be made with accepted field indicators or other approved techniques. Minesoils with chemical characteristics that could restrict vegetation establishment and growth shall be analyzed by an approved soils laboratory. The results of these tests shall be filed with the final planting plan.

7A.04. Function of Annual and Biennial Cover Crops - On areas where excessive erosion is likely to occur, rapid establishment of vegetative cover shall be required. Seeding of annuals and biennials on such areas shall be considered as a means for achieving temporary vegetative cover only and not acceptable in the achievement of permanent cover. See Table 5.

7A.05. Development of Planting Plan - Planting plans will be a part of the premining and reclamation plan. The mining plan and the projected configuration after mining will be the basis for classifying the area as follows:

a. A prediction of the minesoil class and the basis for the same;

b. Treatment to neutralize acidity;

c. Mechanical seed bed preparation;

d. Rate and analysis of fertilization;

e. Rates and types of mulch;

f. Perennial vegetation including herbaceous and woody plants where appropriate, rate and species;

g. Areas to be planted or seeded to trees and shrubs;

h. Land use objective;

i. Maintenance schedule if appropriate; and

j. Identify who will conplete revegetation treatments.

Seeding will be concurrent with the operation as mining and backfilling progresses.

7A.06. Development of Final Planting Plan - A final planting plan shall be prepared and submitted to the director for his approval within thirty (30) days after the grading and backfilling of the operation have been approved.

7B. Plant Material Selection and Treatment

7B.01. Specifications - All planting plans for woody vegetation will include provisions for herbaceous cover using a suitable mixture from Table One. The following specifications should govern the selection and establishment of seeds and plants used in the revegetation of surface minesoil and based upon the following capability class:

a. On favorable minesoil material, prepared for perennial cover crop use, non-stony and with pH 5.5 or higher, one of the following mixtures should be used:

1. Seed mixtures #1, 2, 3, 4, or 5 from Table One, of these regulations should be applied where annual maintenance treatment is assured. Mixture #4 should be applied where the graded portion of minesoil is to be used as a firebreak or occasionally as a haulageway.

2. Establishment of grass, legume or perennial grass cover crop should require the following treatment: (i) Innoculation of legume seed with proper strain;

(ii) Triple innoculation rate if hydro-seeded;

(iii) Protection of seeded minesoil area from grazing livestock;

(iv) Application of lime to pH 6.0 for mixture #4, to pH 6.5 to 7.0 for all other mixtures.

(v) Application of fertilizer will be based on a minesoil test for lime, phosphorus, and potash from a soils lab or will be a minimum of 200 lbs., ammonium nitrate and 200 lbs. triple super phosphate or equivalent;

(vi) Preparation of seed bed by harrowing, discing or other approved methods; and

(vii) Completion of fall seeding for legumes should be completed by September first.

3. Maintenance of cover crop should be carried out by the operator or his assignee until the cover crop is adjudged by the director to be satisfactorily established and may require the following treatment:
   (i) Maintain pH 6.5 - 7.0 for Mixture 1;
   (ii) Maintain pH 6.0 - 6.5 for Mixture 2, 3, 4 and 6;
   (iii) Maintain pH 5.5 - 6.0 for Mixture 4;
   (iv) Topdress every two years with 400 lbs. per acre 0-20-20 for Mixture 5.

b. On favorable minesoil material prepared for woodland and wildlife use, any one mixture from Table Two of this regulation, along with proportions and treatment prescribed for it, should be selected for use in the direct seeding of herbaceous species and planting of trees and seedlings.
   1. Establishment of plant growth for woodland cover should require:
      (1) Spring planting of seedlings not later than May 1st and preferably before April 15th; and
      (ii) Spacing of shrubs and all trees in a pattern eight feet by eight feet apart of 680 trees per acre.
   2. Establishment of crown vetch-rye grass or Serecia-tall Fescue mixtures for wildlife cover may be done in accordance with section 7B.01 (a)(2) of this regulation.

c. On moderately favorable minesoil material, prepared for woodland and wildlife use, with pH 5.5 and above, graded but stony, on moderate to steep slopes, non-stony and stony, one of the mixtures with specified proportion and treatment from Table Three, of this regulation should be used.

1. Overseeding on moderate to steep slopes on tree planting sites shall be carried out on minesoil in order to prevent siltation, establish ground cover and minimize erosion. Seed one of the mixtures from Table One.
2. Establishment of plant growth shall require innoculation of legume seed with proper strain, and shall be protected from grazing by livestock. Triple innoculation rate if hydroseeding.

d. On favorable minesoil material prepared for woodland and wildlife use, which includes all extremely steep and/or stony minesoil, one of the mixtures with specified proportions and treatment from Table Three of this regulation should be used.
   1. Establishment of plant growth should require:
      (i) Broadcasting Mixture 1 and 3 before May 1st and frost seeding mixture 2 by early March.
      (ii) Black locust seed must be seventy percent (70%) or more viable. All legumes must be innoculated and must be protected from grazing by livestock. Triple innoculation rate if hydroseeding. Mixture No. 1 of Table Three, should be used for extremely stony areas when tested acidity indicated a pH of 4.0 or better.

e. Other species of trees, shrubs, grasses, legumes or vines may be approved by the director.

7C. Mulch

7C.01. Mulch Specifications - Mulch shall be used on all disturbed areas. Annual grains such as oats, rye, wheat, etc. may be used instead of mulch when it is shown to the satisfaction of the director that the substituted grains will provide adequate stability and that they will be replaced by species approved for the postmining use.

Approved materials and minimum rates to be applied are as follows:

Material	Rate/Acre
Straw or Hay	1 - 2 tons - material may be anchored with asphalt emulsion or other techniuques approved by the director
Wood fiber or wood cellulose products	1,000 lbs.
Shredded bark	50 cubic yards

The following materials may be used with wood fiber or wood cellulose on a limited basis upon approval by the director or his duly authorized agent.

Material	Rate/Acre	Minimum Rate/Acre for Wood Fiber or Wood Cellulose
Genaqua 743	25 gallons	500 lbs.
Curason AK or HA	25 gallons	500 lbs.
Aerospray 70	25 gallons	500 lbs.

Any other suitable materials including latex or plastic compounds may be approved by the director.

7D. Standards for Evaluating Vegetative Cover

7D.01. Final Planting Report - A planting report shall be prepared by the operator and filed with the director on the prescribed form when the planting of a permit area is completed. All planting reports shall be certified by the operator or by the party with which the operator contracted for planting.

7D.02. Time for Inspection - The operator shall review all areas he has under bond prior to the recognized spring and fall planting seasons. The operator shall cause those areas deficient of vegetative cover to be retreated, graded, seeded, planted, mulched, limed, or whatever, to establish a satisfactory stand of vegetation.

7D.03. Standards for Perennials - Standards for legumes and perennial grasses shall require at least an eighty percent (80%) ground cover. Substandard areas shall not exceed one-fourth (1/4) acre (100' X 100') in size nor total more than twenty percent (20%) of the area seeded. The ground cover of living plants on the revegetated area shall be equal to the ground cover of living plants of the approved reference area for a minimum of two growing seasons. The ground cover shall not be considered equal if it is less than ninety percent (90%) of the ground cover of the reference area for any significant portion of the mined area.

7D.04. Standards for Woody Plants with Perennials - Standards for woody plants with legumes and perennial grasses overseeded shall require a sixty percent (60%) establishment of ground cover of legumes and perennial grasses, and 400 trees (included volunteer tree species) and/or planted shrubs per acre, comprising a staisfactory vegetative ground cover as determined by the director. Substandard areas shall not exceed one-fourth (1/4) acre (100' X 100') in size not total more than twenty percent (20%) of the area seeded or planted. The ground cover of living plants on the revegetated area shall be equal to the ground cover of living plants of the approved reference area for a minimum of two growing seasons. The ground cover shall not be considered equal if it is less than ninety percent (90%) of the ground cover of the reference area for any significant portion of the mined area.

7D.05. Final Inspection Report - In no instance shall the official vegetative cover evaluation be carried out until the planting and seeding concerned has survived two growing seasons or a minimum of 18 months. A final inspection report shall be prepared and filed following inspection to determine that the above evaulative standards have been complied with. If acceptable, the director may then cause the remainder of the bonds to be released.

TABLE ONE

USE: HAY, PASTURE OR OTHER WHERE HERBACAOUS COVER IS DESIRED

1.	Alfalfa	20 lbs.
	Orchardgrass	10 lbs.
2.	Birdsfoot Trefoil	10 lbs.
	Tall Fescue	15 lbs.
3.	Birdsfoot Trefoil	10 lbs.
	Orchardgrass	10 lbs.
4.	Sericea (Hulled)	20 lbs.
	Red Top	3 lbs.
	Tall Fescue	15 lbs.
5.	Crown Vetch	15 lbs.
	Tall Fescue	20 lbs
	**Weeping Lovegrass	3 lbs.
6.	Crown Vetch	15 lbs.
	Rye Grass	15 lbs.
	**Weeping Lovegrass	3 lbs.

* APPROVED SEED MIXTURES FOR OVERSEEDING TREE AND SHRUB SEEDLINGS

7.	Tall Fescue	30 lbs.
	Sericea	15 lbs.
8.	Tall Fescue	20 lbs
	Rye Grass	10 lbs.
	Sericea	15 lbs.
9.	Tall Fescue	20 lbs
	**Weeping Lovegrass	3 lbs.
	Sericea	15 lbs.

FOR ELEVATIONS ABOVE 2500'

10.	Tall Fescue	20 lbs
	Red Top	4 lbs.
11.	Tall Fescue	20 lbs
	**Weeping Lovegrass	3 lbs.
12.	Tall Fescue	20 lbs
	Sweet Clover	10 lbs.

* Establishment of vegetation includes liming to pH range 5.5 - 7.0. Application of fertilizer shall be based on soil test results from a soils laboratory. Without a soil test, apply 600 lbs. 10-20-10 or equivalent, and protection from grazing during the seedling state.

** Red Top may be substituted for Weeping Lovegrass for late summer and fall seedings at a rate of 3 lbs. per acre.

TABLE TWO

APPROVED WOODLAND PLANT MIXTURES
(Nursery Grown Seedlings)

1.	Black Locust (3000') White Pine	Plant in bands 6 rows or more in width Black Locust not to exceed 50%
2.	Black Locust (3000') Virginia Pine	Plant in bands 6 rows or more wide Black Locust not to exceed more than 50%
3.	Scotch Pine White Pine Red Pine (above 2000') Virginia Pine (below 2500')	Use mixture of two or more if available Plant in bands 6 rows or more
4.	Black Locust (below 3000') Tulip Poplar (below 3000') Sycamore (below 2500') Red Oak	Use up to one-half locust with one or more of hardwood species. Plant in bands 6 or more rows in each species
5.	Autumn Olive and adapted pine or hardwoods	Where owner's interest is wildlife improvement, plant in bands of 3 to 6 rows preferable with pines or in blocks of one-fourth acre spaced 600' apart
6.	European Black Alder (below 2500') Sycamore Indigo Bush Autumn Olive	Use these plants where protection from grazing is impractical or protection will not be maintained. For wildlife habitat improvement use 3 to 6 row bands where two or more species are planted.
7.	European Black Alder	Use European Black Alder where pH is near 5.5
8.	Black Locust	Use only on steep erodible outslopes.
9.	Sweet Crab Apple* Washington Hawthorne*	On bench of areas where owners primary interest is wildlife habitat improvement, plant in clumps of 12 spaced 10' to 12' apart. Clumps should be spaced 200' to 300' apart, planted in between with pine, Indigo Bush or Autumn Olive.
10.	Blackberry*	Plant on bench spaced 6 x 6 in blocks 100 plants per block.
11.	Grey Dogwood* Silky Cornell*	On bench near water impoundments spaced 8 x 8.

*Should be planted only on the more favorable sites. Preferably a north or northeastern aspect with a pH of 5.5 or above.

TABLE THREE

* APPROVED MIXTURES
HERBACEOUS AND WOODY SPECIES FOR DIRECT SEEDING

1.	Tall Fescue	30 lbs.	
	Sericea	15 lbs.	
	Black Locust**	3 lbs.	
2.	Tall Fescue	20 lbs	
	Rye Grass	10 lbs.	
	Sericea	15 lbs.	
	Black Locust**	3 lbs.	
3.	Tall Fescue	20 lbs	
	Weeping Lovegrass	3 lbs.	
	Sericea	15 lbs.	
	Black Locust**	3 lbs.	
4.	Tall Fescue	30 lbs.	Better suited to higher
	Birdsfoot Trefoil	10 lbs.	elevations above 2500'
	Black Locust**	3 lbs.	
5.	Tall Fescue	20 lbs	Better suited to higher
	Red Top	3 lbs.	elevations to 2500'
	Birdsfoot Trefoil	10 lbs.	
	Black Locust**	3 lbs.	

* Application of fertilizer shall be based on soil test results from a soils laboratory. Without a soil test, apply a minimum of 200 lbs. ammonium nitrate and 200 lbs. triple super phosphate. Equivalent amounts of nitrogen and phosphorus is acceptable.

** Black Locust seed may be omitted on the bench areas or where erosion is not a serious problen, or at elevations above 2000', 1/4 lb./acre Virginia Pine; 1/4 lb/acre White Pine, and 3 lbs./acre Japonica Intermedia may be substituted for Black Locust.

TABLE FOUR

* APPROVED MIXTURES FOR WATERWAYS, DIVERSIONS
DRAINAGE STRUCTURES, HAULAGEWAYS, HIGHWALL ACCESS, ETC.

1.	Tall Fescue	50 lbs.
	Birdsfoot Trefoil	10 lbs.
	Red Top	3 lbs.
2.	Perennial Rye Grass	20 lbs.
	Tall Fescue	30 lbs.
	Birdsfoot Trefoil	10 lbs.
	Red Top	3 lbs.
3.	Tall Fescue	40 lbs.
	Crown Vetch	15 lbs.
	Red Top	3 lbs.
4.	Tall Fescue	50 lbs.
	Crown Vetch	15 lbs.
5.	Tall Fescue	30 lbs.
	Reed Canarygrass	20 lbs.
	Red Top	3 lbs.

NOTE: Weeping lovegrass at 3 lbs. per acre may be substituted for Red Top for spring and early summer seedlings on well drained areas.

* Application of fertilizer shall be based on soil test results from a soils laboratory. Without a soil test, apply a minimum of 200 lbs. ammonium nitrate and 200 lbs. triple super phosphate. Equivalent amounts of nitrogen and phosphorus fertilizer is acceptable.

TABLE FIVE

* ANNUAL AND BIENNIAL COVER CROPS FOR TEMPORARY COVER

	Suggested Rates of Application - Pounds in Acres	Seeding Season
- Grasses -		
Balbo Rye	30 - 60	Fall
Abruzzi Rye	30 - 60	Fall
Wheat	30 - 60	Fall
Oats	30 - 60	Fall
Japanese Millet	10 - 15	Summer
Millets - German, Foxtail	10 - 15	Summer
Sudan Grass - Sorghum Hybrid	10 - 20	Summer
Pearl Millet	10 - 20	Summer
Sudan Grass	10 - 20	Summer
Annual Rye Grass	10 - 15	Spring or Fall
- Legumes -		
Kobe Lespedeza	5 - 10	Summer
Korean Lespedeza	5 - 10	Summer
Hairy Vetch	20 - 40	Fall
Sweet Clover	10 - 20	Summer
- Forbs -		
Buckwheat	30 - 60	Summer

* Application of fertilizer shall be based on soil test results from a soils laboratory. Without a soil test, apply a minimum of 200 lbs. ammonium nitrate and 200 lbs. triple super phosphate. Equivalent amounts of nitrogen and phosphorus fertilizer is acceptable.

TABLE SIX

CLASSIFICATION OF MINESOILS WITHIN SOIL TAXONOMY

Minesoils of all ages are now being grouped under the category called spolents. This means recognition that these highly disturbed or manmade soils deserve the same attention, classification and management as other soils.

1. Fieldcrest is a family of minesoils containing a mixture of rock types. It has an acid but not extremely acid profile. Texture is loamy; mineralogy is mixed and fertility is medium. These are probably the most widespread minesoils in West Virginia.

2. Postoak is a minesoil family containing a dominance of mudstone material. It is near neutral in profile reaction; fine loamy textures and relatively fertile.

3. Widen minesoils are dominated by carbon rich coarse fragments or mine waste. They are acid in reaction but respond well to liming and revegetation.

4. Brandonville minesoils are dominated by shaly (fissile) coarse fragments. They are loamy in texture, have mixed mineralogy, are moderately acid and moderately fertile.

5. *Valley Point minesoils are dominated by sandstone coarse fragments. They are coarse loamy in texture, have siliceous mineralogy, low fertility and are extremely acid. These minesoils provide stable roadways and building sites.

6. *Birdcreek minesoils are similar to Valley Point soils but are acid instead of extremely acid.

7. Killarm minesoils contain a mixture of rock types. The profile is neutral in reaction. Texture is medium loamy. Mineralogy is mixed and fertility (except nitrogen) is relatively high.

8. Overfield minesoils contain a mixture of rock types. The profile is extremely acid (pH is below 4 at 10 inches). Texture is medium loamy. Mineralogy is mixed. Fertility is medium but acid related toxicity must be remedied by topsoiling or massive liming in order to get desirable plant growth.

9. Shawneetown minesoils have less than 10% rock fragments in the profile. The reaction is neutral; texture is fine loamy; mineralogy is mixed and fertility is relatively high except for nitrogen. These minesoils are suitable for cultivated cropping, but may not be present in mappable units in West Virginia.

10. Pursglove minesoils are like Widen except that they are extremely acid and require covering with favorable material or massive liming for satisfactory revegetion.

*Soils 5 and 6 frequently occur together in complex patterns. These ten spolents cover most but not all minesoils in West Virginia. Other named minesoils have been identified and described and can be classified on request.

SECTION 8. BOND AND PERMIT REQUIREMENTS

8.01. Scale for Reclamation Plan Map - The scale required for all maps and plans prepared for submission with an application for a surface mining permit shall be as follows:

a. Scale of U.S. geological survey topographic 15-minute quadrangle shall be enlarged to approximately 660 feet to the inch;

b. Scale on a U.S. geological survey topographic 7.5-minute quadrangle shall be enlarged to 500 feet or less to the inch;

c. Scale on aerial photograph shall be 660 feet or less to the inch;

d. Scale on the Progress, Alternative Plan and Final Maps shall be of the same scale of the approved Pre-Plan Map.

8.02. Scale for Progress and Final Maps - The scale required for progress maps and final maps shall be not less than 400 feet to the inch nor more than 660 feet to the inch, 500 feet to the inch being preferred.

8.03. Scale Approval - Written permission from the director shall be required prior to the submission of maps drawn to any scale other than set forth by regulation.

8.04. Map Size - All maps and plans shall be submitted on standard print pager, 24 inches by 36 inches or less. If supplementary maps or plans are attached, match lines shall be used.

8.05 Color Code - A color code shall be used in preparing all maps to indicate critical features of the permit area as follows:

a. Red shall indicate mineral to be romoved;

b. Yellow shall indicate the total disturbed land;

c. Blue shall indicate water and drainage;

d. Brown shall indicate special uses;

e. Green shall indicate regrading.

8.06. Approval of Person to Prepare a Complete Reclamation and Mining Plan - Any person preparing a complete reclamation and mining plan for the area of land to be disturbed as required by the provisions of Article 6D, Chapter 20, Section 9, Code of West Virginia, as amended, or by the regulations, shall first submit to the director a written resume of his past experience and training. A written test may also be administered. On the basis of such resume and written test, he shall be adjudged qualified or not as the case may be, and so notified by the director in writing.

8.07. Approval of Private Contractor - In the event the operator contracts with a private contractor to carry out the planting, the private contractor shall first submit to the director a written resume of his past experience and training. On the basis of such resume, he shall be adjudged qualified or not as the case may be, and so notified by the director in writing.

8.08. Permit or End of Strip Marker - A two-inch (2') pipe shall be driven into the earth with a minimum of three feet (3') exposed to permanently mark the beginning and ending points of the area under permit. It shall be identified by painting the exposed portion of the pipe red. Any suitable substitute may be approved. The assigned permit number shall be permanently affixed to the permit marker or end of strip marker.

SECTION 9. OTHER MINING OPERATIONS ON SURFACE MINED AREAS.

9.01. Director's Approval - Reclamation plans for other mining operations to be carried out on a surface mined area on which the regrading, backfilling or revegetation have not been completed, shall require prior approval by the director.

9.02. Application Requirements - Application for approval of such reclamation plans shall be accompanied by the following:

a. Application form to be prescribed by the director;

b. A map of the surface mining permit area, showing the portion of land to be disturbed by the other mining operations, including haulageways;

c. A performance bond or equivalent as provided in Section 16, Article 6D, Chapter 20, Code of West Virginia, as amended, the requirement for the first acre or fraction thereof of disturbed lands being one thousand dollars ($1,000) and for each additional acre or fraction thereof of disturbed land an additional one thousand dollars ($1,000);

d. Written permission for other mining operations from the owner of the surface rights and/or the owner of the mineral rights of the controlling parts of the same.

9.03. Applicability of Code and Regulations - All requirements for backfilling, regrading, revegetation and bond release procedures as set forth in Article 6D, Chapter 20, Code of West Virginia, as amended, and in Sections 8 and 9 of the regulations of the Reclamation Commission shall apply with equal force to the reclamation of disturbed areas from other mining operations.

SECTION 10. MODIFICATIONS

Should the director determine that modifications are necessary because of geologic structure, topography, particular watershed or permit conditions, the director may at his discretion with the approval of the commission, make such modifications if the same are in conformity with Article 6D, Chapter 20, Code of West Virginia, as amended.

SECTION 11. STATE AND FEDERAL COMPLIANCE

The issuance of [a prospecting or] surface mining permit pursuant to Article 6D, Chapter 20, Code of West Virginis, as amended, and any rules and regulations promulgated thereunder authorizes the operations covered by said permit, but does not release the permit holder from any other legal duties imposed by the laws of this State or these United States.

delete within brackets

ENVIRONMENTAL PROTECTION AGENCY EFFLUENT GUIDELINES AND STANDARDS FOR MINERAL MINING AND PROCESSING

(40 CFR 436, 40 FR 48652, October 16, 1975; Amended by 41 FR 23552, June 10, 1976; 42 FR 35843, July 12, 1977; 43 FR 9809, March 10, 1978; 44 FR 76793, December 28, 1979)

PART 436—MINERAL MINING AND PROCESSING POINT SOURCE CATEGORY

AUTHORITY: Sec. 306, Federal Water Pollution Control Act, as amended.

AUTHORITY: Sec. 301, 304 (b) and (c) Federal Water Pollution Control Act, as amended (33 U.S.C. 1251, 1311, 1314 (b) and (c), 86 Stat. 816 et seq., Pub. L. 92-500) (the Act), unless otherwise noted.

SOURCE: 40 FR 48657, Oct. 16, 1975, unless otherwise noted.

Subpart A—Dimension Stone Subcategory

§ 436.10 [Reserved]

Subpart B—Crushed Stone Subcategory

§ 436.20 Applicability; description of the crushed stone subcategory.

The provisions of this subpart are applicable to the mining or quarrying and the processing of crushed and broken stone and riprap. This subpart includes all types of rock and stone. Rock and stone that is crushed or broken prior to the extraction of a mineral are elsewhere covered. The processing of calcite, however, in conjunction with the processing of crushed and broken limestone or dolomite is included in this subpart.

§ 436.21 Specialized definitions.

For the purpose of this subpart:

(a) Except as provided below, the general definitions, abbreviations and methods of analysis set forth in Part 401 of this chapter shall apply to this subpart.

(b) The term "mine dewatering" shall mean any water that is impounded or that collects in the mine and is pumped, drained or otherwise removed from the mine through the efforts of the mine operator. However, if a mine is also used for treatment of process generated waste water, discharges of commingled water from the facilities shall be deemed discharges of process generated waste water.

(c) The term "10-year 24 hour precipitation event" shall mean the maximum 24 hour precipitation event with a probable re-occurence interval of once in 10 years. This information is available in "Weather Bureau Technical Paper No. 40," May 1961 and "NOAA Atlas 2," 1973 for the 11 Western States, and may be obtained from the National Climatic Center of the Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

(d) The term "mine" shall mean an area of land, surface or underground, actively mined for the production of crushed and broken stone from natural deposits.

(e) The term "process generated waste water" shall mean any waste water used in the slurry transport of mined material, air emissions control, or processing exclusive of mining. The term shall also include any other water which becomes commingled with such waste water in a pit, pond, lagoon, mine, or other facility used for treatment of such waste water.

§ 436.22 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can affect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either moreor less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) Subject to the provisions of paragraphs (b) and (c) of this section, the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

(1) Discharges of process generated waste water pollutants from facilities that recycle waste water for use in processing shall not exceed the following limitations:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
pH	Within the range 6.0 to 9.0.	

[436.22(a)(1) table amended by 44 FR 76793, December 28, 1979]

(2) [Revoked]

[436.22(a)(2) revoked by 44 FR 76793, December 28, 1979]

(2) Mine dewatering discharges shall not exceed the following limitations:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
pH	Within the range 6.0 to 9.0.	

[436.22(a)(3) redesignated 436.22(a)(2) and table amended by 44 FR 76793, December 28, 1979]

(b) Any overflow from facilities governed by this subpart shall not be subject to the limitations of paragraph (a) of this section if the facilities are designed, constructed and maintained to contain or treat the volume of waste water which would result from a 10-year 24-hour precipitation event.

(c) In the case of a discharge into receiving waters for which the pH, if unaltered by man's activities, is or would be less than 6.0 and water quality criteria in water quality standards approved under the Act authorize such lower pH, the pH limitation for such discharge may be adjusted downward to the pH water quality criterion for the receiving waters. In no case shall a pH limitation outside the range 5.0 to 9.0 be permitted.

Subpart C—Construction Sand and Gravel Subcategory

§ 436.30 Applicability; description of the construction sand and gravel subcategory.

The provisions of this subpart are applicable to the mining and the processing of sand and gravel for construction or fill uses, except that on-board processing of dredged sand and gravel which is subject to the provisions of 33 CFR Part 230 and Part 230 of this chapter will not be governed by the provisions of this subpart.

§ 436.31 Specialized definitions.

For the purpose of this subpart:

(a) Except as provided below, the general definitions, abbreviations and methods of analysis set forth in Part 401 of this chapter shall apply to this subpart.

(b) The term "mine dewatering" shall mean any water that is impounded or that collects in the mine and is pumped, drained, or otherwise removed from the mine through the efforts of the mine operator. This term shall also include wet pit overflows caused solely by direct rainfall and ground water seepage. However, if a mine is also used for treatment of process generated waste water, discharges of commingled water from the mine shall be deemed discharges of process generated waste water.

(c) The term "10-year 24 hour precipitation event" shall mean the maximum 24 hour precipitation event with a probable re-occurrence interval of once in 10 years. This information is available in "Weather Bureau Technical Paper No. 40," May 1961 and "NOAA Atlas 2," 1973 for the 11 Western States, and may be obtained from the National Climatic Center of the Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

(d) The term "mine" shall mean an area of land, surface or underground, actively mined for the production of sand and gravel from natural deposits.

(e) The term "process generated waste water" shall mean any waste water used in the slurry transport of mined material, air emissions control, or processing exclusive of mining. The term shall also include any other water which becomes commingled with such waste water in a pit, pond, lagoon, mine or other facility used for treatment of such waste water. The term does not include waste water used for the suction dredging of deposits in a body of water and returned directly to the body of waste without being used for other purposes or combined with other waste water.

§ 436.32 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can affect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protetcion Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) Subject to the provisions of paragraphs (b) and (c) of this section, the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

(1) Discharges of process generated waste water pollutants from facilities that recycle waste water for use in processing shall not exceed the following limitations:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
pH	Within the range 6.0 to 9.0.	

[436.32(a)(1) table amended by 44 FR 76793, December 28, 1979]

(2) [Revoked]

[436.32(a)(2) revoked by 44 FR 76793, December 28, 1979]

(2) Mine dewatering discharges shall not exceed the following limitations:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
pH	Within the range 6.0 to 9.0.	

[436.32(a)(3) redesignated 436.22(a)(2) and table amended by 44 FR 76793, December 28, 1979]

(b) Any overflow from facilities governed by this subpart shall not be subject to the limitations of paragraph (a)

of this section if the facilities are designed, constructed and maintained to contain or treat the volume of waste water which would result from a 10-year 24-hour precipitation event.

(c) In the case of a discharge into receiving waters for which the pH, if unaltered by man's activities, is or would be less than 6.0 and water quality criteria in water quality standards approved under the Act authorize such lower pH, the pH limitation for such discharge may be adjusted downward to the pH water quality criterion for the receiving waters. In no case shall a pH limitation outside the range 5.0 to 9.0 be permitted.

Subpart D—Industrial Sand Subcategory

§ 436.40 Applicability; description of the industrial sand subcategory.

The provisions of this subpart are applicable to the mining and the processing of sand and gravel for uses other than construction and fill. These uses include, but are not limited to, glassmaking, molding, abrasives, filtration, refractories, and refractory bonding.

§ 436.41 Specialized definitions.

For the purpose of this subpart:

(a) Except as provided below, the general definitions, abbreviations, and methods of analysis set forth in Part 401 of this chapter shall apply to this subpart.

(b) The term "mine dewatering" shall mean any water that is impounded or that collects in the mine and is pumped, drained, or otherwise removed from the mine through the efforts of the mine operator. This term shall also include wet pit overflows caused solely by direct rainfall and ground water seepage. However, if a mine is also used for the treatment of process generated waste water, discharges of commingled water from the mine shall be deemed discharges of process generated waste water.

(c) The term "10-year 24 hour precipitation event" shall mean the maximum 24 hour precipitation event with a probably re-occurrence interval of once in 10 years. This information is available in "Weather Bureau Technical Paper No. 40," May 1961 and "NOAA Atlas 2," 1973 for the 11 Western States, and may be obtained from the National Climatic Center of the Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

(d) The term "mine" shall mean an area of land actively mined for the production of sand and gravel from natural deposits.

(e) The term "process generated waste water" shall mean any waste water used in the slurry transport of mined material, air emissions control, or processing exclusive of mining. The term shall also include any other water which becomes commingled with such waste water in a pit, pond, lagoon, mine or other facility used for treatment of such waste water. The term does not include waste water used for the suction dredging of deposits in a body of water and returned directly to the body of water without being used for other purposes or combined with other wastewater.

§ 436.42 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can affect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) Subject to the provisions of paragraphs (b) and (c) of this section, the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart with the exception of operations using acid leaching, after application of the best practicable control technology currently available:

(1) With the exception of operation using HF flotation, discharges of process waste water pollutants from facilities that recycle waste water, for use in processing shall not exceed the following limitations:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed
TSS	45 mg/l.	25 mg/l.
pH	Within the range 6.0 to 9.0.	

(2) Except as provided in paragraphs (a) (1) and (3) of this section, there shall be no discharge of process generated waste water pollutants into navigable waters.

(3) Process generated waste water from facilities employing HF flotation shall not exceed the following limitations:

[Metric units kg/kkg of total product]
[English units lb/1,000 lb of total product]

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
TSS	0.046	0.023
Total fluoride	.006	.003
pH	Within the range 6.0 to 9.0.	

(4) Mine dewatering discharges shall not exceed the following limitations:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
TSS	45 mg/l.	25 mg/l.
pH	Within the range 6.0 to 9.0.	

(b) Any overflow from facilities governed by this subpart shall not be subject to the limitations of paragraph (a) of this section if the facilities are designed, constructed and maintained to contain or treat the volume of waste water which would result from a 10-year 24-hour precipitation event.

(c) In the case of a discharge into receiving waters for which the pH, if un-

altered by man's activities, is or would be less than 6.0 and water quality criteria in water quality standards approved under the Act authorize such lower pH, the pH limitation for such discharge may be adjusted downward to the pH water quality criterion for the receiving waters. In no case shall a pH limitation outside the range 5.0 to 9.0 be permitted.

Subpart E—Gypsum Subcategory

§ 436.50 Applicability; description of the gypsum subcategory.

The provisions of this subpart are applicable to the processing of gypsum.

§ 436.51 Specialized definitions.

For the purpose of this subpart:

(a) Except as provided below, the general definitions, abbreviations and methods of analysis set forth in Part 401 of this chapter shall apply to this subpart.

§ 436.52 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can affect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations. The following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

(a) For operations not employing wet air emissions control scrubbers there shall be no discharge of process generated waste water pollutants into navigable waters.

(b) Only that volume of water resulting from precipitation that exceeds the maximum safe surge capacity of a process waste water impoundment may be discharged from that impoundment. The height difference between the maximum safe surge capacity level and the normal operating level must be greater than the inches of rain representing the 10 year, 24 hour rainfall event as established by the National Climatic Center, National Oceanic and Atmospheric Administration for the locality in which such impoundment is located.

Subpart F—Asphaltic Mineral Subcategory

§ 436.60 Applicability; description of the asphaltic mineral subcategory.

The provisions of this subpart are applicable to the processing of bituminous limestone, oil-impregnated diatomite and oilsonite not primarily as an energy source.

§ 436.61 Specialized definitions.

For the purpose of this subpart:

(a) Except as provided below, the general definitions, abbreviations and methods of analysis set forth in Part 401 of this chapter shall apply to this subpart.

§ 436.62 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can affect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations. The following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

(a) Subject to the provisions of the following paragraphs of this section, there shall be no discharge of process generated waste water pollutants into navigable waters.

(b) Only that volume of water resulting from precipitation that exceeds the maximum safe surge capactiy of a process waste water impoundment may be discharged from that impoundment. The height difference between the maximum safe surge capacity level and the normal operating level must be greater than the inches of rain representing the 10 year, 24 hour rainfall event as established by the National Climatic Center, National Oceanic and Atmospheric Administration for the locality in which such impoundment is located.

Subpart G—Asbestos and Wollastonite Subcategory

§ 436.70 Applicability; description of the asbestos and wollastonite subcategory.

The provisions of this subpart are applicable to the processing of asbestos and wollastonite.

WEST VIRGINIA

DEPARTMENT OF NATURAL RESOURCES

DRAINAGE HANDBOOK for SURFACE MINING

DIVISION OF RECLAMATION

DRAINAGE HANDBOOK

FOR

SURFACE MINING

WEST VIRGINIA DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PLANNING AND DEVELOPMENT

AND

DIVISION OF RECLAMATION

Prepared by: Division of Planning and Development
and
Division of Reclamation
Department of Natural Resources

In cooperation with: Soil Conservation Service
United States Department of Agriculture

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SECTION 1

PRE-PLANNING

Extensive pre-planning is necessary if the conservation of soil and water resources in surface mined areas is to be effectively undertaken. Pre-planning must be done prior to the beginning of surface mining operations with the aim to eliminate or reduce some of the foreseeable problems associated with the specific area to be mined. The problems associated with surface mining are many and varied; however, the primary aim of pre-planning should be to arrive at a satisfactory method of site drainage. Reducing sedimentation loads and preventing acid water discharge are two very important items to consider when working on a comprehensive drainage plan.

Other problems inherent in surface mining that must be considered during the planning stage are land stabilization, geology, and water disposal. Consideration should be given to total environmental effects on air, wildlife, fish, plants, and aesthetics with a desire for improved land use upon completion of mining. Possible detrimental effects of surface mining can be controlled within reasonable time limits if careful pre-planning coupled with good mining practices and effective reclamation work is carried out.

In the following articles, some of the major problems and their possible solutions are discussed. Each should be considered during the pre-planning phase.

1.1 SEDIMENT CONTROL

Sediment is one of the greatest polluters of water and causes more offsite damages and problems than any other aspect of surface mining.

A number of factors influence erosion and sedimentation rates. Among these are (1) type of soil and cover, (2) erodibility of the soil, (3) degree of slope, (4) length of slope, (5) amount and rate of rainfall, (6) climate, (7) distance from source, and (8) degree of filtering between source and sampling point.

Short duration high intensity rains are responsible for much of the erosion. Cover is a very important factor. Well vegetated areas are seldom serious sediment producing sources. Cover is effective in absorbing the energy of rainfall and holding it long enough to infiltrate.

Steepness affects the potential that runoff has to transport sediment and the stability of the particles subject to erosion. The longer the slope, the more likely that runoff will develop rills and gullies thereby greatly increasing the erosion potential.

The physical properties of soil influence erodibility. Some of these properties are: texture, percentage of coarse fragments - especially on the surface-soil structure, mineralogy, amount and type of clay, organic content, and depth of soil. Coarse sands and stoney soils are generally least erosive and shallow fine grained cohesionless soils over impermeable bedrock are most erosive.

The sediment storage value of 0.125 acre-feet per acre of disturbed area is based on studies by the U. S. Forest Service and the Soil Conservation Service. As sediment ponds are intalled and monitored, more knowledge will be gained to provide a better basis for storage values. It is imperative that provisions for cleanout and maintenance of all sediment ponds be provided.

Considerations may be given to lower storage values where the method of mining eliminates the need for downslope protection. Access and available equipment for continuous maintenance is a prerequisite for this consideration.

There are various methods that may be used to eliminate sediment problems provided they are skillfully planned and applied.

1. Sediment dams or excavated sediment ponds shall be installed and maintained to remove sediment from streams and drainageways leaving the disturbed area.
2. The smallest practical area of land should be exposed at any one time

during the mining phase. This means progressive backfilling and reclamation. Exposure should be kept to the shortest practical period of time.

3. Final dressing and grading shall be done progressively and temporary vegetation and/or mulching shall be done where permanent vegetation is delayed.
4. Spoil material shall in all cases be kept out of the stream channel. Stream relocation should be voided if at all possible.
5. Adequate watertight conduits or bridges shall be used where haulage roads must cross natural drainways. Again, care shall be taken to insure that spoil does not get into the stream where such structures are built. Road banks shall be mulched or seeded as soon as construction progresses.
6. Diversions may be installed above the highwall to divert upland runoff around the disturbed area to a suitable crossing of the disturbed areas.
7. Rock-lined or other suitable structures shall be provided where necessary to convey concentrated flows down steep slopes.
8. Toe berms or other acceptable filter devices shall be constructed near the toe of spoil banks to slow down sheet flow and trap sediment before leaving the site. Vigorous vegetation shall be maintained on the berm.
9. Stone check dams and/or log and pole structures may be used to assist in sediment control. However, they will not be considered as substitutes for sediment dams, excavated sediment ponds or other approved storage structures.

The attached standard for sediment dams shall be used only for dams with drainage areas of 200 acres or less. Design assistance is available from the

U. S. Department of Agriculture, Soil Conservation Service for dams exceeding this limitation.

1.2 ACID WATER

The formation of acid water may accompany surface mining activities. The keys to acid formation are: pyrite or other acid-forming compounds, a continuous supply of oxygen, and water to pick up and carry out the acid. Remove one of the keys, oxygen for example, and acid generation normally is halted.

Control methods for the abatment of acid water shall be as follows:

1. Intercept groundwater that may flow into the pit by constructing diversion ditches above the highwall.
2. When acid-producing materials are encountered in overburden, these materials should be handled so as to prevent or minimize the production of acid mine drainage.
3. Water treatment impoundments can be constructed to trap acid water. Treatment may include chemical processes for the neutralization of the acid such as limestone spreaders, limestone drums, etc.

1.3 LAND STABILIZATION

Land stabilization as used here means long-term stability of soil and rock masses against slides, slips, and mud flows. It is only through a long period of time, including a full cycle of wet and dry periods, that true stability can realistically be judged. Unless good stability is established at the start, a poor environment will result for the establishment of grasses and plants and high erosion rates will continue resulting in sustained off-site damages. Stability is controlled by (1) bench width, (2) outer slope of spoil, (3) bench surface drainage, (4) bedrock lithology and stratigraphy, and (5) soil and rock content of the spoil.

Slips and landslides are caused by the top-heavy nature of a soil mass

and usually occur when the soil becomes saturated. Uncontrolled spoil placements result in the most unstable situation possible.

The outer slope of spoil has a direct affect on stability. Uncontrolled placement has resulted in slopes varying from about 65% to 100% depending upon the amount and kind of rock and moisture content of the intermixed soil. Based on a study in the Coal River Watershed, the maximum stable slope was found to be about 66%. However, this is in an area with predominantly sandstone bedrock. Areas with predominantly shale will require a flatter slope (50%) to insure stability.

Surface drainage of the bench and spoil by prompt removal of rainfall and runoff will aid in land stabilization. Minimizing the infiltration of rainfall will reduce the tendency of any spoil on a slope to slide. After water has entered the spoil remedial measures for drainage and stability are considerably more expensive. Water trapped on the bench will aggravate slides when the bench is a sandstone or limestone underlain by a shale layer or strata which forces the water to seep out under the cast over spoil.

1.4 GEOLOGY

The geology of the area must be known if a satisfactory plan is to be developed for water control and disposal, sediment pollution control, acid drainage control, and successful establishment of a productive vegetative cover. Geologic factors indicate (1) potential acidity, (2) potential slope stability, (3) potential stoniness of spoil, and (4) dip of coal strata. The strike and dip of the coal strata must be known in order to plan an effective drainage plan.

Drainage plans can be enhanced by taking advantage of the dip (or slope) of coal seams in determining which way to drain the benches. This also permits determining which natural drainways to use.

1.5 WATER DISPOSAL

Collection and delivery of water to a safe and stable outlet is an important aspect in developing a drainage plan. Water will always occur and provisions must be made to handle it at all times. Water disposal usually will be concerned with bench and diversion drainage and the methods of getting this water to a natural drainway.

Water in diversions shall be directed to an adequate outlet. The outlet may be a natural drainway, a vegetated area or some other stable watercourse.

Bench drainage is usually accomplished by waterways draining to an outlet in the direction of bench slope. In no case will the water be discharged over the bench crest unless protected against concentration by use of structural means (pipes, riprap, concrete, etc.). Such waterways shall be located away from the highwall sufficient to prevent future filling by plugging or wall sloughing. The waterway gradients must be flat enough to prevent gullying when located to settle out sediment before the water is released over the bench. The ponds should be constructed to be dry between runoff periods.

Lowering of water from the bench to the valley stream should be accomplished by using the natural drainways available. Since surface mining activities will be suspended 50 feet on either side of a natural drainway, unless valley fill is used, sediment problems should be minimized if haul roads are properly constructed along and across natural drainways. When a natural drainway is not available, structural means will be used. These are by use of pipe, a rock riprap flume, or by grading a channel to underlying rock that is non-erosive.

It must be recognized that all control measures are not equally effective at all sites. Diversions may work well at some locations but may be ineffective at others. Rock-lined chutes, ditches, or pipe drop spillways will be required at many places in lieu of natural or grassed waterways. The methods of controlling erosion and sediment from the outer slopes will vary.

Sediment ponds must be installed on all drainage ways carrying concentrated flows from the disturbed areas. Dry ponds are safer in that the fill and foundation are not subject to constant saturation, they provide for easier cleanout, and do not require a drain. However, they are not as effective as a wet pond in settling out silt-size particles during low flow periods. It must be recognized that ponds of the size which will normally be constructed will not retain the runoff long enough to settle out clay particles and colloidal material.

Where possible sediment ponds should be located before drainage ways reach the main stream. A good rule to remember is to locate them as close to the source as possible. Where feasible, they should be of the diversion type. This will keep sediment storage accumulations out of the main water-courses. After reclamation is complete the diversions can be closed and sediment deposits isolated from further flows. Land disburbed by previous surface mining operations that is not stabilized must be included when determining the disturbed area above sediment ponds.

All overburden materials subject to disturbance should be classified for potential acidity and a plan developed for handling and placing of materials which will result in enough suitable material at the finished surface to support the planned crop or vegetation. Massive rocks and acid-producing strata shall be placed where it is not a part of the finished surface.

The after-mining use possibilities of the area affected should be based upon capabilities of the disturbed area, compatibility with adjacent land uses, and the needs and desires of the landowner.

Water capable of supporting fish and other desirable aquatic life shall be the goal where impoundments occur or are made.

Good planning, design, installation, and maintenance of erosion and sediment control measures will provide for effective control at many sites.

However, it must be recognized that there are locations where the physical characteristics of the land are such that effective erosion and sediment control cannot be provided. This may be for either of the following reasons: (1) control measures are to expensive resulting in an uneconomical operation or (2) it is physically impossible to install the needed measures. When these conditions exist, consideration for surface mining may be denied.

1.6 CERTIFICATION OF DRAINAGE SYSTEM

The installation of the drainage system in accordance with the approved pre-plan shall be under the supervision of the engineer or person approved by the Director designing and submitting the same.

A certificate of approval shall be filed with the Reclamation Division by said party as to the construction of the drainage system in accordance with the approved pre-plan.

SECTION 2

SEDIMENT DAMS

EMBANKMENT TYPE

2.1 DEFINITION

A barrier or dam constructed across a waterway or other suitable locations to form a silt or sediment basin.

2.2 PURPOSE

To preserve the capacity of reservoirs, ditches, canals, diversions, waterways and streams and to prevent undesirable deposition on bottom lands, in channels or waterways, and other areas by providing basins for the deposition and storage of silt, sand, gravel, stone and other detritus.

2.3 SCOPE

This standard establishes the minimum acceptable quality for the design and construction of sediment dams located in predominantly rural or agricultural areas in West Virginia when:

1. Failure of the structure would not result in loss of life; in damages to homes, commercial or industrial buildings; main highways, or railroads; in interruption of the use of service of public utilities; or damage existing water impoundments; and
2. The contributing drainage area does not exceed 200 acres; and
3. The vertical distance between the lowest point along the ℄ of the dam at the upper toe and top of dam does not exceed 15 feet, and/or does not exceed 10 surface acres; and
4. The sediment dam conforms to all state and local laws and/or regulations pertaining to the storage of water. Structures which exceed 15 feet in vertical height from the natural bed of the watercourse to the top of the dam as measured from the upstream toe and/or those which have a surface area at the emergency spillway crest greater than 10 surface acres must be approved by the Director of

the Department of Natural Resources in accordance with Chapter 20, Article 5D of the Code of West Virginia (Dam Control Act).

2.4 DRAINAGE AREA AND SITE EVALUATION AND LIMITATIONS

The contributing watershed above the site shall have an adequate plan for providing protection against erosion of disturbed areas. This plan shall provide for rapid revegetation of the disturbed areas in order to stabilize the area as quickly as possible after it has been disturbed. It is required to prevent excessive sedimentation from exceeding the design capacity of the sediment dam. All areas disturbed during the mining operation in the watershed shall be revegetated according to West Virginia Division of Reclamation regulations.

Site condition shall be such that the following capacity requirements can be met.

2.4.1 SEDIMENT

The sediment pool shall have a minimum capacity (from the lowest elevation in the reservoir to the crest of the principal spillway) to store 0.125 acre-feet per acre of disturbed area in the drainage area. The disturbed area includes all land affected by previous mining operations (that is not presently stabilized) and all land that will be affected during the surface mining and reclamation work. The basin shall be cleaned out when the sediment accumulation approaches 60% of the design capacity. The design and construction drawings shall indicate the corresponding elevation. Clean to 100% pool prior to grade release.

2.4.2 STRUCTURES IN SERIES

When structures are built in series, the principal spillway and emergency spillway sizes for the lower structure shall be based on the total drainage area above the lower structure. The required storage for sediment for any structure shall be based on the disturbed area in the uncontrolled drainage

area above that structure. When an upstream structure exists, a lower structure in series must be designed considering failure of the upstream structure.

Construction must be completed on all downstream structures prior to construction of an upper structure in a series.

2.5 PRINCIPAL SPILLWAYS

2.5.1 CAPACITY

A drop inlet principal spillway will be required on all earth embankment structures. The crest of the principal spillway shall be located at the maximum elevation of the sediment pool.

The minimum size of the principal spillway and drop inlet shall be obtained from Table 1, Minimum Required Spillway Size, Appendix I, Page I-10, and shall be based on the total drainage area above the structure.

2.5.2 LAYOUT

The principal spillway shall be straight in alignment when viewed in plan. The outlet end must extend to an elevation approximately 6 inches above the stable channel bottom and a minimum of 6 feet beyond the toe of the embankment. An adequate outlet structure shall be provided, when needed, to prevent damage to the toe of the embankment. The minimum slope of the pipe conduit shall be 1 percent in order to insure free drainage.

2.5.3 PIPE CONDUITS

All conduits include steel, wrought-iron, cast iron, corrugated metal, asbestos cement, concrete and rubber-gasket vetrified clay.

2.5.3.1 ASBESTOS CEMENT, CONCRETE AND VITRIFIED CLAY

These right conduits must be lain in a concrete bedding. The maximum fill height over vitrified clay pipe cannot be more than 20 feet and it shall not be placed over more than 10 feet of compacted earth fill.

A. Bedding: Concrete bedding shall be placed beneath the pipe at a minimum thickness of 4 inches and extend up on the sides of the pipe for

at least 10 percent of the overall height of the conduit. The bedding shall have a base width equal to the outside diameter of the pipe.

B. Joints: Conduit joints are to be designed and constructed to remain watertight. A rubber gasket set in a positive seat which will prevent displacement is to be provided.

2.5.3.2 CORRUGATED METAL PIPE

A. Iron or Steel (Zinc-Coated): Corrugated metal pipe (iron or steel) conform to Federal Specification WW-P-405. It shall be close-riveted and asphalt-coated or helical corrugated with welded seam and can be used only where the pH of the normal stream flow is expected to be greater than 5.0 during the life of the structure. Where the pH of the normal stream flow is expected to be between 4.0 and 5.0 the pipe shall be close riveted asbestos-bonded, bituminous-coated, and have a paved invert. Corrugated metal pipe will not be used where the pH is expected to be less than 4. The minimum thickness of the pipe shall be 16 gage for conduits, 18 inches or less in diameter. For larger sizes, the minimum thickness shall be 14 gage.

Bituminous coating damaged by breaks, scuffs, or welding shall be repaired by the application of two coats of hot asphaltic paint or a coating of cold-applied bituminous mastic.

B. Aluminum: Corrugated aluminum shall conform to Federal Specification WW-P-402. It can be used only in soils having a pH greater than 5 and less than 9. The minimum thickness of the pipe shall be 14 gage.

C. Joints: All corrugated metal pipe shall be connected by a watertight flange-type connection or by a watertight connecting band specifically manufactured for a connecting band (band with rods and lugs). The

area between the pipe and connecting bands shall be treated with an asphalt cement during installation to assure a watertight joint.

2.5.3.3 STEEL

Steel pipe may be used where the pH of the normal stream flow during the life of the structure is expected to be 5.0 or greater. It shall be of standard strength and be connected by a watertight mechanical or welded joint.

2.5.3.4 WROUGHT-IRON OR CAST IRON

Iron pipe may be used under all soil and water conditions. It must be of standard thickness or greater and be connected by a watertight mechanical joint.

2.5.4 DROP INLET

The minimum size and height is given in Table 1, Appendix I, Page I-10. The drop inlet may be perforated to provide a gradual drawdown after each storm event.

2.5.4.1 PERFORATIONS

Metal drop inlets when perforated shall be done so throughout the top 2/3 of their length with 3/4-inch diameter holes spaced 8 inches vertically and 12 inches horizontally center to center. Nonmetal drop inlets shall be ported to permit draining the pond (such ports shall be similar to those described for the metal drop inlets).

2.5.4.2 BASE

The riser shall have a base attached with a watertight connection and shall have sufficient weight to prevent flotation of the riser. Two approved bases are: (1) a concrete base 18 inches thick with the riser imbedded 6 inches in the base. The base should be square with each dimension 1 foot greater than the riser diameter; (2) a 1/4-inch minimum thickness steel plate welded all around the base of the riser to form a watertight connection. The plate shall be square with each size equal to 2 times the riser diameter. The plate shall

have 2 feet of stone, gravel or tamped earth placed on it to prevent flotation.

2.5.5 DRAINPIPE

A metal drainpipe with a suitable valve or cap shall be provided when the drop inlet is not perforated. The minimum size shall be 3 inches and in no case shall it require longer than 5 days to drain the pond.

2.5.6 ANTI-SEEP COLLARS

All conduits through the embankment are to be provided with a minimum of three anti-seep collars, except when the embankment is 5 feet or less. When the embankment is 5 feet or less, two collars will be required. The collars will be at 15-foot intervals with the middle collar at the centerline of the dam. The anti-seep collars shall extend a minimum of 2 feet from the conduit in all directions. The collars and their connections to the pipe shall be watertight.

2.5.7 ANTI-VORTEX DEVICE

An anti-vortex device shall be installed on the principal spillway inlet.

1. It shall consist of a thin, vertical plate perpendicular to the centerline of the dam and firmly attached to the top of the riser. The plate dimensions shall be: length = diameter of the riser plus 12 inches; height = diameter of the horizontal conduit; or
2. It shall consist of a horizontal circular plate having a diameter 2 feet greater than the drop inlet and firmly mounted 1.5 feet above the crest of the inlet.

2.5.8 TRASH RACKS

A suitable trash rack will be provided where the drainage area will contribute trash to the reservoir.

2.6 EMERGENCY SPILLWAYS

Emergency spillways are provided to convey large flows safely past an earth embankment. They are usually open channels excavated in earth or rock or reinforced concrete.

2.6.1 CAPACITY

The crest elevation of the emergency spillway will be located at a minimum distance of 1.5 feet above the crest elevation of the principal spillway. The emergency spillway shall be designed to safely carry the expected peak rate of discharge from a 10-year frequency storm. There shall be one foot of freeboard between the maximum design flow elevation in the emergency spillway and the top of the dam. The 10-year frequency peak discharge shall be obtained from Figure 3, Appendix I, Page I-5, Emergency Spillway Peak Discharge. The spillway shall be proportioned to pass the peak discharge from Figure 2, at the safe velocity determined for the site. Table 4, Appendix I, Page I-11, Emergency Spillway Hydraulics, shall be used to proportion emergency spillways. Chart No. 1, Appendix I, Page I-1, Emergency Spillway Velocity Chart, shall be used in conjunction with these tables to proportion the emergency spillway.

2.6.2 LAYOUT

The emergency spillway shall be excavated in rock or in earth or may be constructed of reinforced concrete. It shall consist of an inlet channel, a control section, and an exit channel. The capacity and size of the emergency spillway shall be as outlined under CAPACITY. Minimum bottom width shall be 10 feet.

The inlet channel shall be level for a minimum distance of 20 feet upstream from the control section of the Hp in the emergency spillway is equal to or less than 2.5 feet. The level section shall extend 30 feet upstream from the control section if the Hp exceeds 2.5 feet.

The level part of the inlet channel shall be the same width as the exit channel and its centerline shall be straight and coincident with the centerline of the level section. The level section of the inlet channel shall be located so that the projected centerline of the dam will pass through it.

The centerline of the exit channel shall be straight and perpendicular to the control section extending downstream to a point opposite the downstream toe of the dam. Curvature may be introduced below this point if it is certain that the flowing water will not impinge on the embankment should the channel fail at the curve. The slope of the exit channel shall be determined from Chart No. 1, Appendix 1, Page I-1.

The layout will provide that the spillway when cut around the end of the dam in the abutment be in a natural ground (cut) to a depth equal to the maximum design flow for at least the level section and the exit channel to a point opposite the downstream toe of the dam. It is preferable that the flow be confined without the use of levees, but where site conditions are such that the exit channel will not contain the design flow, a levee or dike shall be constructed along the exit channel to a height above the exit channel equal to the depth of flow through the spillway at the control section. The levee shall have a minimum top width of 4 feet and side slopes not steeper than 2 horizontal to 1 vertical. The levee shall be constructed in accordance with the requirements for embankment.

The spillway shall be trapezoidal in shape and the side slopes shall not be steeper than 1/4 horizontal to 1 vertical in rock or 2 horizontal to 1 vertical in earth.

2.6.3 PERMISSIBLE VELOCITIES

2.6.3.1 EARTH EMERGENCY SPILLWAYS

The maximum allowable velocity in the exit channel shall be 5 feet per second for earth emergency spillways. This velocity must not be exceeded in the exit channel of the spillway from the control section to a point in the exit channel opposite the downstream toe of the dam or to a point downstream where a channel failure would not cause the flow to impinge on the toe of the dam. All earth spillways shall be vegetated with the most suitable permanent

grass vegetation for the site.

Spillways excavated in earth shall be protected through the level section and the exit channel with durable rock riprap when the exit channel velocity falls between 5 feet per second and 12 feet per second. The rock riprap will be placed in a 1.5 foot thick blanket through the bottom and sides of the level section and exit channel. Twenty-five percent of the rock shall be 18 inches or larger. The remaining seventy-five percent shall be well-graded material consisting of sufficient rock small enough to fill the voids between the larger rocks. SHALE SHALL NOT BE USED FOR RIPRAP.

2.6.3.2 ROCK EMERGENCY SPILLWAYS

The maximum allowable velocity shall be 14 feet per second for rock emergency spillways. A spillway shall be classed as a rock emergency spillway when durable bedrock occurs throughout the level section and in the exit channel to a point opposite the downstream toe of the dam. Durable bedrock is defined as a layer of continuous bedrock equal or greater in thickness than the depth of flow through the spillway at the control section.

2.6.3.3 CONCRETE EMERGENCY SPILLWAYS

This standard establishes the minimum acceptable quality for the design and construction of concrete emergency spillways through the embankment when:

*1. The contributing drainage area for the dam does not exceed 200 acres; or

*2. The 10-year frequency peak discharge does not exceed 660 c.f.s.; or

3.. The maximum vertical height of the dam or embankment as measured along the centerline of the embankment to the emergency spillway crest does not exceed 15 feet; or

4. The maximum outlet slope (downstream slope of embankment) does not exceed three horizontal to one vertical; or

5. The sediment control structure be of a temporary nature (life of mining operation only).

(* Items 1 and 2 may be neglected if the structure is an excavated pond with 3 feet or less of water to be impounded against the embankment).

The spillway shall be proportioned in accordance with the table on standard drawing. In any case the Q/B ratio shall not exceed 21.0. The spillway shall be constructed as detailed on the standard drawing. The fill beneath the spillway shall be thoroughly compacted.

2.7 EARTH EMBANKMENT

2.7.1 HEIGHT

The earth embankment shall be high enough to have one foot of freeboard between the maximum design flow elevation in the emergency spillway and the top of the dam.

2.7.2 TOP WIDTH

The minimum top width of earth embankments shall be 14 feet.

2.7.3 SIDE SLOPES

The side slopes of the settled embankment shall be no steeper than 3 horizontal to 1 vertical on the upstream side and 2 horizontal to 1 vertical on the downstream side.

2.7.4 CUTOFF TRENCH

The elevation of the top of a compacted cutoff will not be lower than the crest of the principal spillway. The cutoff trench should have a bottom width adequate to accommodate the construction equipment but shall not be less than 8 feet. The trench shall have a minimum side slopes of 1 to 1. The cutoff trench shall be located on the embankment centerline and be of sufficient depth to extend into a relatively impervious layer of soil or to bedrock.

2.7.5 SETTLEMENT ALLOWANCE

The design height of the embankment shall be increased by 5 percent to allow for settlement.

2.7.6 UTILITIES UNDER EMBANKMENTS

Utilities encountered at dam sites must be relocated away from the site according to the standard criteria and procedure of the utility company involved.

2.7.7 VEGETATIVE PROTECTION AGAINST EROSION

The embankment, spillways, borrow areas and other disturbed areas shall be mulched and vegetated immediately after construction in accordance with Reclamation rules and regulations for revegetation.

2.7.8 SAFETY

The embankment, pool area and vegetated spillway shall be fenced as needed to restrict accessibility for reasons of safety. All fences shall be constructed in accordance with good fencing practices. Warning signs of danger shall be installed where deemed necessary.

2.7.9 PLANS, DESIGN DATA AND SPECIFICATIONS

In addition to the "Proposed Drainage Map", there shall also be submitted the following items concerning sediment dams of the embankment type.

1. A "Structure Proportioning Computations Sheet" to be completed for each proposed dam.
2. Construction plans showing:
   a. A topographic map on a 1" = 50' scale and 4 feet contour intervals showing the reservoir area, embankment and the emergency spillway. Topographic map may be mapped using transit-stadia survey method but nothing with less accuracy.
   b. A profile view of the embankment along the ℄ of the principal spillway showing all pertinent dimensions, elevations, and principal spillway design.
   c. A profile view of the emergency spillway showing the entrance slope, level section and exit channel slope.

d. A cross-section view of the emergency spillway showing the bottom width, side slopes, and the type of material used.

e. A cross-section view taken along the centerline of the dam showing cutoff trench depth, original ground line, unsettled and settled dam heights, length of dam and other pertinent dimensions and elevations.

3. A "Stage-Area-Storage" computations sheet and Stage-Area-Storage curves.

4. Construction Specifications.

2.8 CONSTRUCTION SPECIFICATIONS FOR SEDIMENT DAMS - EMBANKMENT TYPE

2.8.1 SITE PREPARATION

The embankment site shall be cleared of all brush, trees, stumps, roots and other undesirable material. Sod and topsoil shall be stripped from the embankment site and borrow area and stockpiled for use on the emergency spillway and embankment. Brush, trees and other undesirable material shall be cleared from the sediment pool area.

2.8.2 CUTOFF TRENCH

A cutoff trench shall be excavated along the centerline of the embankment. The cutoff trench shall be excavated along the centerline of the embankment. The cutoff trench shall extend into both abutments to an elevation no lower than the crest of the principal spillway. It shall be of sufficient depth to extend into a relatively impervious layer of soil or to bedrock and shall be backfilled with the most impervious material available at the site. The trench shall be kept free of standing water during the backfilling operations. The cutoff trench should have a bottom width adequate to accommodate the construction equipment but shall not be less than 8 feet. The trench shall have minimum side slopes of 1 to 1. Compaction requirements shall be the same as those for the embankment.

2.8.3 EXCAVATION AND BACKFILL OF STREAM CHANNEL

Existing stream channels crossing the foundation area shall be deepened and widened as necessary to remove all stones, gravel, sand, stumps, roots and other objectionable material, and to accommodate compaction equipment. Such channels shall then be backfilled with suitable material as specified for earth embankments. The excavated channels shall be kept free of standing water during backfill operations.

2.8.4 PIPE CONDUIT

The pipe conduit shall be placed in a trench excavated in solid undisturbed ground or formed by compacted earth. The conduit shall be imbedded in a formed trench to a depth no less than 1/10 times the outside diameter of the pipe. Trench sides shall be sloped back no steeper than 1 to 1. Selected impervious backfill material shall be placed around the conduit in 4-inch layers and thoroughly compacted to at least the same density as the adjacent embankment.

Bedding for asbestos cement, concrete or vitrified clay pipe shall be concrete and will be placed beneath the pipe at a minimum thickness of 4 inches and extend up on the sides of the pope for at least 10 percent of the overall height of the conduit. The bedding should have a base width equal to the outside diameter of the pipe.

All pipe joints and anti-seep collar connections to the conduit shall be watertight.

2.8.5 EMERGENCY SPILLWAY

The emergency spillway shall conform to the lines, grades, bottom width and side slopes as shown on the plans.

2.8.6 BORROW AREAS

All borrow excavation will have side slopes no steeper than 2 horizontal to 1 vertical and shall be graded and left in such a manner as to provide suitable drainage.

2.8.7 SELECTION AND PLACEMENT OF EMBANKMENT MATERIALS

The most impervious material shall be used in the cutoff trench and center portion of the dam. When sandy gravelly material is encountered, it should be placed in the outer shell preferably in the downstream portion of the dam. The distribution and gradation of materials throughout the fill shall be such that there will be no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. Where it is necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the upstream and center portions of the dam. Very dry or wet material shall not be used. The fill material shall be free of all sod, roots, stones over 6 inches in diameter and other objectionable material. The moisture content of the material should be such that when kneaded in the hand, it will just form a ball that will not readily separate.

The embankment shall be brought up on uniform 6-8-inch layers of approximate uniform elevation over its entire area. Each layer shall be thoroughly compacted by making at least 4 complete passes with a tamping roller or by applying equal compactive effort with rubber-tired equipment.

2.8.8 PROTECTION AGAINST EROSION

The earth embankment, spillways and borrow areas above the sediment pool shall be mulched and vegetated in accordance with Reclamation rules and regulations for revegetation.

SECTION 3

EXCAVATED SEDIMENT PONDS

3.1 DEFINITION

A water impoundment made by excavating a pit or "dugout". The use of a 3-foot earth embankment is permissible to increase capacity. Ponds resulting from both excavation and embankment are classified as SEDIMENT DAMS, EXCAVATED TYPE, where the depth of water impounded against any embankment is 3 feet or less or where the outflow elevation through the exit or emergency spillway is less than 3 feet above the original ground. Consideration will be given to an increase in embankment height if design of spillways are based on a 50-year frequency storm.

3.2 PURPOSE

To preserve the capacity of reservoirs, ditches, canals, diversions, waterways and streams and to prevent undesirable deposition on bottom lands, in channels or waterways, and other areas by providing basins for the deposition and storage of silt, sand, stone, gravel and other detritus.

3.3 SCOPE

This standard establishes the minimum acceptable quality for the design and construction of excavated sediment ponds in predominantly rural or agricultural areas in West Virginia.

3.4 LOCATION

Excavated ponds fed by surface runoff may be located on almost any type of topography; however, they are most satisfactory in areas with relatively flat terrain. An excavated pond may be located in a natural or constructed drainway or preferably to one side of a natural or constructed drainway if the runoff can be directed into the pond.

Site conditions shall be such that the following capacity requirements can be met.

3.5 CAPACITY REQUIREMENTS

The excavated sediment pond shall have a minimum capacity (from the lowest elevation in the dugout to the crest of the exit channel or emergency spillway) to store 0.125 acre-feet per acre of disturbed area in the watershed. The disturbed area includes all land affected by previous operations that is not presently stabilized and all land that will be affected during the surface mining and reclamation work. The sediment pond shall be cleaned out when the sediment accumulation approaches 60% of the design capacity. The design and construction drawings shall indicate the corresponding elevation.

When excavated sediment ponds are constructed in series, the required storage for sediment for any pond shall be based on the uncontrolled drainage area above that pond. Construction must be completed on all downstream structures prior to construction of an upper structure in series.

3.6 SEDIMENT POND DIMENSIONS

Excavated sediment ponds may be constructed to any desired shape that will meet sediment capacity requirements. The width and depth of sediment ponds are not limited.

Side slopes of excavated sediment ponds shall be such that they will be stable and shall not be steeper than 2 horizontal to 1 vertical in earth and 1/4 horizontal to 1 vertical in rock.

3.7 ENTRANCE CHANNEL

The entrance channel shall not exceed 4:1 (25%), extending from the bottom of the excavated pond upstream to the original stream bed. The entrance channel shall be protected with a 1.5-foot layer of rock riprap which shall have 25% of the material 18 inches or larger and the remaining 75% well graded with sizes to fill the voids between the larger rocks. Minimum side slopes shall be 2 horizontal to 1 vertical and shall also be protected with rock riprap for a vertical height of 2 feet.

The minimum bottom width of entrance channels shall be 5 feet and shall never have a width less than that of the natural channel.

3.8 EXIT CHANNEL

Pipe principal spillway shall not be required for excavated ponds. The crest of the exit channel will be thoroughly protected with rock riprap to prevent erosion and scouring. The exit channel shall be located as far as possible from the inlet channel with a minimum distance of 50 feet. The minimum width of exit channels shall be 10 feet, but shall never have a width less than that of the natural stream channel. Minimum side slopes shall be 2 horizontal to 1 vertical and shall also be protected with rock riprap for vertical height of 2 feet.

3.9 EMBANKMENT AND EMERGENCY SPILLWAY

An earth embankment may be used to increase the capacity of an excavated sediment pond provided that the depth of water impounded against any embankment is less than 3 feet. An emergency spillway will be required when earth embankments are used. The design of the emergency spillway shall conform to that given under Emergency Spillways in Sediment Dams, Embankment Type.

The emergency spillway will be designed to safely carry the expected peak rate of discharge from a 10-year frequency storm when the contributing drainage area is from 0-200 acres (use Figure 2, Appendix I, Page I-4). The emergency spillway will be designed to safely carry the expected peak rate of discharge from a 25-year frequency storm when the contributing drainage area is from 200-500 acres (use Figure 3, Appendix I, Page I-5). When the contributing drainage area exceeds 500 acres, the expected peak rate of discharge shall be determined with the assistance of the U. S. Department of Agriculture, Soil Conservation Service or registered professional engineering design.

The earth embankment shall be high enough to have one foot of freeboard between the maximum design flow elevation in the emergency spillway and the

top of the embankment. The minimum top width shall be 14 feet. The side slopes will be no steeper than 3 horizontal to 1 vertical on the impoundment side and 2 horizontal to 1 vertical on the downstream or outside pond area.

The design height of the embankment shall be increased by 10 percent to allow for settlement. A cutoff trench will not be required.

Excavated ponds without emergency spillways shall have 2 feet of freeboard between the sediment pool elevation and the top of the exit channel.

3.10 UTILTIES UNDER EMBANKMENTS

Utilities encountered at dam sites must be relocated away from the site according to the standard criteria and procedure of the utility company involved.

3.11 DISPOSAL OF WASTE MATERIAL

The waste material from the excavated sediment pond may be spread, used in the embankment or removed from the site as conditions warrant.

The waste material, when not removed from the site, shall be placed in a manner that its weight will not endanger the stability of the pond side slopes and the rainfall will not wash the material back into the pond. Not less than 12 feet should be left between the toe of the waste material and the edge of the pond.

If the waste material is spread, it should be to a height of no more than 3 feet with the surface graded to a uniform slope away from the pond. The pond side slope of the spread material should be no steeper than 2 horizontal to 1 vertical.

If the waste material is to be used in an embankment, it shall be free of all sod, roots, stones over 6 inches in diameter, and other objectionable material.

3.12 SAFETY

The embankment, pool area and vegetated spillway shall be fenced as

needed to restrict accessibility for reasons of safety. All fences shall be constructed in accordance with good fencing practices. Warning signs of danger shall be installed where deemed necessary.

3.13 VEGETATIVE PROTECTION AGAINST EROSION

The waste material, spillway, embankment and any other area disturbed during construction shall be mulched and vegetated immediately upon completion of the pond in accordance with Reclamation rules and regulations for revegetation.

3.14 PLANS, DESIGN DATA AND SPECIFICATIONS

In addition to the "Drainage Map", there shall also be submitted the following items concerning excavated sediment ponds:

1. A "Structure Proportioning Computations Sheet" to be completed for each proposed pond.
2. Construction plans showing a plan view and a cross-section view with entrance and exit channels.
3. A cross-section view of the embankment and emergency spillway, if used.
4. Cross-sections plotted at 50-foot intervals from the centerline of the proposed sediment pond showing original ground line and the proposed excavation limits.
5. Construction Specifications.

3.15 CONSTRUCTION SPECIFICATIONS

3.15.1 SITE PREPARATION

The pond site and waste areas shall first be cleared of all woody vegetation. The limits of the excavation and spoil placement areas shall be staked, and the depth of cut from the ground surface to the pond bottom should be indicated on the stakes.

If an embankment is to be constructed, the embankment site shall be cleared of all brush, trees, stumps, roots and other undesirable material. Sod and

topsoil shall be stripped from the embankment site.

3.15.2 EXCAVATION

Excavation and placement of the waste material shall be done as near to the staked lines and grades as skillful operation of the equipment will permit. Side slopes of the excavated pond will be no steeper than 2 horizontal to 1 vertical in earth and 1/4 horizontal to 1 vertical to rock.

3.15.3 SELECTION AND PLACEMENT OF EMBANKMENT MATERIALS

If an embankment is constructed, the most impervious material will be used in the center portion. When sandy gravelly material is encountered, it shall be placed in the outer shell, preferably in the downstream portion of the embankment. The fill material shall be taken from approved designated borrow areas. It shall be free of roots, woody vegetation, oversized stones, rocks, or other objectionable material. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material should contain sufficient moisture so that it can be formed into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction.

Fill material will be placed in 6-8-inch layers and shall be continuous over the entire length of the fill. Compaction will be obtained by routing the hauling equipment over the fill so that the entire surface of the fill is traversed by at least one tread track of the equipment, or compaction shall be achieved by the use of a compactor. The embankment shall be constructed to an elevation 10 percent higher than the design height to allow for settlement if compaction is obtained with hauling equipment. If compactors are used for compaction, the overbuild may be reduced to 5 percent.

3.15.4 VEGETATIVE PROTECTION AGAINST EROSION

The waste material, spillway, embankment and any other area disturbed during construction shall be mulched and vegetated immediately upon completion of the pond in accordance with Reclamation rules and regulations for revegetation.

3.15.5 EROSION AND POLLUTION CONTROL

Construction operations will be carried out in such a manner that erosion and water pollution will be minimized. State and local laws concerning pollution abatement shall be complied with.

SECTION 4

GABION SEDIMENT DAM

4.1 DEFINITION

A barrier or dam composed of rock-filled wire baskets constructed across a waterway to form a silt or sediment basin.

4.2 PURPOSE

To preserve the capacity of reservoirs, ditches, canals, diversions, waterways and streams and to prevent undesirable deposition on bottom lands, in channels or waterways, and other areas by providing basins for the deposition and storage of silt, sand, gravel, stone and other detritus.

4.3 SCOPE

This standard established the minimum acceptable quality for the design and construction of gabion sediment dams located in predominantly rural or agricultural areas in West Virginia when:

1. Failure of the structure would not result in loss of life, in damages to homes, commercial or industrial buildings, main highways, or railroads, in interruption of the use of service of public utilities; and
2. The contributing area does not exceed 500 acres; and
3. The vertical distance between the lowest point along the centerline of the dam and the crest of the spillway does not exceed 10 feet.

4.4 DRAINAGE AREA AND SITE EVALUATION AND LIMITATIONS

The contributing watershed above the site shall have an adequate plan for providing protection against erosion of disturbed areas. This plan shall provide for rapid revegetation of the disturbed areas in order to stabilize the area as quickly as possible after it has been disturbed. It is required to prevent excessive sedimentation from exceeding the design capacity of the sediment dam. All areas disturbed during the mining operation in the watershed shall be revegetated according to West Virginia Division of Reclamation regulations.

4.4.1 SEDIMENT

The sediment pool shall have a minimum capacity (from the lowest elevation in the reservoir to the spillway elevation) to store 0.125 acre-feet per acre of disturbed area in the watershed. The disturbed area includes all land affected by previous operations that is not presently stabilized and all land that will be affected during the surface mining and reclamation work. The basin shall be cleaned out when the sediment accumulation approaches 60% of the design capacity. The design and construction drawings shall indicate the corresponding elevation.

4.4.2 STRUCTURES IN SERIES

When structures are built in series, the spillway size for the lower structure shall be based on the total drainage area above the lower structure. The required storage for sediment for any structure shall be based on the disturbed area in the uncontrolled drainage area above that structure.

When an existing upstream structure is not considered adequate or safe according to the specification herein, a lower structure in series must be designed considering failure of the upstream structure. This means that the sediment and spillway shall be based on the total drainage area above the lower structure.

Construction must be completed on all downstream structures prior to construction of an upper structure in a series.

4.5 EMERGENCY SPILLWAY

An emergency spillway will be required on all gabion structures and will be designed to safely carry the expected discharge from a 25-year frequency storm. The crest of the spillway shall be located at the maximum elevation of the sediment pool.

All spillways shall have a rectangular cross-section as viewed along the centerline of the structure.

There shall be 1/2 foot of freeboard between the maximum design flow elevation in the spillway and the top of the dam. The peak discharge shall be obtained from Figure 3, Appendix I, Page I-5, Emergency Spillway Design Peak Discharge. The spillway shall be proportioned to carry the peak discharge by the formula Q = CLh3/2, where Q is the peak discharge, L is the longitudinal length of the spillway, and h is height of the spillway opening minus 0.5 feet. C is a coefficient of discharge which may be found in Table 5, Appendix I, Page I-12.

In no case shall the total design head on the structure exceed 13.0 feet (the sum of maximum distance from the original ground to spillway elevation plus h must be less than or equal to 13.0 feet).

4.6 GABION CROSS-SECTION

In order to establish a uniform yet stable cross-section for this type structure, all gabion sediment dams shall have a step-like cross-section with a 12-inch gabion or a 3-foot thick rock mattress covering the downstream channel and embankment (see Figure 4, Appendix I, Page I-6).

See Figure 4, Appendix I, Page I-6, for acceptable gabion sediment dam cross-section of 3 feet 3 inches by 3 feet 3 inches.

The gabion or rock mattress shall extend out from the downstream toe of structure for the minimum distances shown in Figure 4. The bottom width of the mattress shall be equal to the length of the spillway and in line with it. The channel sides shall be covered by the mattress to a minimum vertical depth of 4 feet.

The upstream face of all gabion structures may be backfilled with material from the pool area. The backfill shall be on a slope of 3 horizontal to 1 vertical.

Cross-sections of additional width other than those shown and without backfill against the upstream face may be used if approved by the Division of Planning and Development of the Department of Natural Resources.

4.6.1 KEY-IN OF FOUNDATION

The gabion dam shall be keyed into the abutment with the channel or valley to a minimum depth of three feet at any point. The bottom of the gabion may be keyed into the channel bottom. After the gabion structure is in place, the key into the abutment shall be backfilled to the embankment's original contour with compactible material. The material shall be mechanically tamped in maximum lifts of 6 inches.

4.6.2 FILLING AND BINDING GABION WIRE BASKETS

The gabion baskets shall be filled with durable limestone, river rock or sandstone of 3-7 inches in size. The stone shall be hand or machine placed in the baskets in such a manner as to prevent sagging or bulging of the basket or baskets. All edges of the baskets must be secured or bounded to the adjacent basket by lacing wire in and out of the mesh openings. The maximum distance between each coil shall not exceed 4 inches.

4.7 MATERIAL SPECIFICATIONS

All perimeter edges of the mesh forming each unit shall be securely selvedged with wire of not less than 0.150-inch diameter so that the joints formed by tying the selvedges have at least the same strength as the body of the mesh.

Lacing wire shall be supplied in sufficient quantity for securing all edges of the gabion baskets and diaphragms and to provide for the necessary internal connection wires in each cell. The wire lacing shall meet or exceed the same specification as the wire used in the mesh.

The wire mesh shall be made of galvanized steel wire having a minimum size of U. S. Steel Wire Gauge No. 14. The tensile strength of the wire shall be in the range of 60,000 to 85,000 p.s.i. The minimum zinc coating of the wire shall be 0.80 ounces per square foot of uncoated wire surface as determined by test conducted in accordance with A.S.T.M. Designation A-90. The maximum

linear dimension of the mesh opening shall not exceed 3-1/2 inches and the area of the mesh opening shall not exceed 6 square inches.

Gabions shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into a rectangular basket of the specified sizes. Gabions shall be of single unit construction - the base, lid, and sides shall be woven into a single unit and the ends shall be connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

Where the length of the gabion exceeds five feet, the gabion shall be divided by diaphragms, of the same mesh and gauge as the body of the gabions, into cells of equal length and width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary.

4.8 PLANS, DESIGN DATA AND SPECIFICATIONS

In addition to the "Proposed Drainage Map", there shall also be submitted the following items concerning gabion sediment dams:

1. A "Structure Proportioning Computations Sheet" to be completed for each proposed gabion sediment dam.
2. Construction Plans showing:
   a. A topographic map on a 1" = 50' scale and 4-foot contour intervals showing the reservoir area and structure. Topographic map is to be made using transit-stadia survey method.
   b. Plan view of structure showing all pertinent dimensions.
   c. A cross-section view of gabion structure at the point where the maximum depth of water will be impounded against the structure showing all pertinent dimensions and elevations.
   d. A cross-section view taken along the centerline of the dam showing all pertinent dimensions and elevations.

e. A "Stage-Area-Storage Computations Sheet" and "Stage-Area-Storage Curves".

f. Construction Specifications.

4.9 CONSTRUCTION SPECIFICATIONS

4.9.1 SITE PREPARATION

Brush, trees and other undesirable material shall be cleared from the sediment pool and dam areas. Sod and topsoil shall be stripped from gabions foundation area.

4.9.2 PREPARATION OF FOUNDATION

Proper excavation shall be made along the foundation of and sides of the gabion structure as shown on the construction plans to assure that the gabion structure will be placed on the planned line and grade.

The key into the abutments shall be excavated as shown on the construction plans. The gabion structure must be keyed into the abutment a minimum of 3 feet at any point as measured in any direction.

The fill material beneath the gabion units along the sides of the structure shall be placed in 6-inch maximum lifts and mechanically tamped.

4.9.3 FILL AND BINDING

Backfilling of the key into the abutments and against the upstream face of the gabion shall progress simultaneously with the filling and binding of the baskets. The key into the embankment shall be backfilled with compactible material to the embankment's original contour. This material shall be placed in 6-inch maximum lifts and mechanically tamped.

Each gabion unit shall be bound together by a continuous piece of connecting wire stitched around the vertical edges with a coil about every four inches. Lacing wire shall be used to join the units together in the same manner. Empty gabion units shall be set to line and grade as shown on the plans.

A standard fence stretcher, chain fall, or steel rod may be used to stretch the wire baskets and hold alignment.

The gabions shall be filled with stone carefully placed by hand or machine to assure alignment and void bulges with a minimum of voids. After a gabion has been filled, the lid shall be bent over until it meets the sides and edges. The lid shall then be secured to the sides, ends and diaphragms with the lacing wire in the manner described above for assembling.

4.9.4 BACKFILLING UPSTREAM FACE

The upstream face of the cribbing may be backfilled with material from the pool area up to the sediment pool elevation behind the spillway and up to the top of dam elevation for the remainder on a slope of 3 horizontal to 1 vertical.

Very dry or wet material shall not be used. The fill material shall be free of all sod, roots, stones over 6 inches in diameter and other objectionable material. The moisture content of the material should be such that when kneaded in the hand, it will just form a ball that will not readily separate.

The embankment shall be brought up on uniform 6-8-inch layers of approximate uniform elevation over its entire area. Each layer shall be thoroughly compacted by making at least 4 complete passes with a tamping roller or by applying compactive effort with rubber-tired equipment.

4.9.5 SPILLWAY

The spillway shall conform to the alignment and dimensions shown on the plans.

4.9.6 DOWNSTREAM CHANNEL PROTECTION

4.9.6.1 GABION MATTRESS

The gabion mattress or apron shall conform to the alignment and grade shown on the plans. The mattress shall be bound in the same manner prescribed for the gabion baskets. Also, the edge of the mattress against the toe of the dam shall be bound to the dam in the same manner prescribed for the gabion baskets.

4.9.6.2 ROCK MATTRESS

The channel bottom and sides downstream of the structure shall be covered to a minimum depth of 3 feet with durable rock of which 50% is 3 feet or larger and the remainder sized to fill the voids with a minimum size of 6 inches. The rock shall not contain more than 10% earth, sand, or soft shale as determined by visual inspection. The rock shall extend out from the toe of the crib structure for a minimum distance of twice the height of the structure. The dumped rock shall form a trapezoidal channel with a bottom width equal or greater than the length of the spillway. The rock shall extend up the embankment sides to a minimum vertical depth of 4 feet.

4.9.7 VEGETATIVE PROTECTION AGAINST EROSION

All disturbed areas outside the pool area shall be mulched and vegetated in accordance with Reclamation rules and regulations for revegetation.

SECTION 5

CRIB SEDIMENT DAM

5.1 DEFINITION

A barrier or dam composed of rock-filled concrete cribbing constructed across a waterway to form a silt or sediment basin.

5.2 PURPOSE

To preserve the capacity of reservoirs, ditches, canals, diversions, waterways, and streams and to prevent undesirable deposition of bottom lands, in channels or waterways, and other areas by providing basins for the deposition and storage of silt, sand, gravel, stone and other detritus.

5.3 SCOPE

This standard establishes the minimum acceptable quality for the design and construction of crib sediment dams located in predominantly rural or agricultural areas in West Virginia when:

1. Failure of the structure would not result in loss of life; in damages to homes, commercial or industrial buildings; main highways, or railroads; in interruption of the use of service of public utilities; and
2. The contributing area does not exceed 500 acres; and
3. The vertical distance between the lowest point along the centerline of the dam and the crest of the spillway does not exceed 10 feet.

5.4 DRAINAGE AREA AND SITE EVALUATION AND LIMITATIONS

The contributing watershed above the site shall have an adequate plan for providing protection against erosion of disturbed areas. This plan shall provide for rapid revegetation of the disturbed areas in order to stabilize the area as quickly as possible after it has been disturbed. It is required to prevent excessive sedimentation from exceeding the design capacity of the sediment dam. All disturbed areas in the watershed shall be

revegetated according to West Virginia Division of Reclamation regulations.

Site condition shall be such that the following capacity requirements can be met.

5.4.1 SEDIMENT

The sediment pool shall have a minimum capacity (from the lowest elevation in the reservoir to the spillway elevation) to store 0.125 acre-feet per acre of disturbed area in the watershed. The disturbed area includes all land affected by previous operations that is not presently stabilized and all land that will be affected during the surface mining and reclamation work. The basin shall be cleaned out when the sediment accumulation approaches 60% of the design capacity. The design and construction drawings shall indicate the corresponding elevation.

5.4.2 STRUCTURES IN SERIES

When structures are built in series, the spillway size for the lower structure shall be based on the total drainage area above the lower structure. The required storage for sediment for any structure shall be based on the disturbed area in the uncontrolled drainage area above that structure.

When an existing upstream structure is not considered adequate or safe according to the specification herein, a lower structure in series must be designed considering failure of the upstream structure. This means that the sediment and spillway shall be based on the total drainage area above the lower structure.

Construction must be completed on all downstream structures prior to construction of an upper structure in a series.

5.5 EMERGENCY SPILLWAY

An emergency spillway will be required on all crib structures and will be designed to safely carry the expected peak discharge from a 25-year frequency storm. The crest of the spillway shall be located at the maximum elevation of the sediment pool.

All spillways shall have a rectangular cross-section as viewed along the centerline of the structure.

There shall be 1/2 foot of freeboard between the maximum design flow elevation in the spillway and the top of the dam. The peak discharge shall be obtained from Figure 3, Appendix I, Page I-5, Emergency Spillway Design Peak Discharge. The spillway shall be proportioned to carry the peak discharge by the formula, $Q = CLh3/2$, where Q is the peak discharge, L is the longitudinal length of the spillway, and h is height of the spillway opening minus 0.5 feet. C is a coefficient of discharge which may be found in Table 5, Appendix I, Page I-12.

In no case shall the total design head on the structure exceed 13.0 feet (the sum of the maximum distance from original ground to the spillway elevation plus h must be less than or equal to 13.0 feet).

5.6 CRIB DAM CROSS-SECTION

In order to establish a uniform yet stable cross-section (see Figure 5, Appendix I, Page I-7) for this type structure, all crib sediment dams shall:

1. Be a minimum of 6 feet in width; that is, the distance from inside to inside of headers must be 6 feet or more.
2. Be backfilled with material from the pool area on the upstream face. The slope of the backfill shall be a minimum of two horizontal to one vertical.
3. Have the channel bottom and sides downstream of the structure covered to a minimum depth of 3 feet with durable rock mattress of which 50% is 3 feet or larger and the remainder sized to fill the voids with a minimum size of 6 inches; or have the channel bottom and sides downstream of the structure covered with a 12-inch gabion mattress. The rock or gabion mattress shall extend out from the toe of the structure for a minimum distance of twice the height of the structure.

5.7 KEY-IN ABUTMENTS

The crib dam shall be keyed into the abutments with the channel or valley to a minimum depth of three feet at any point. The foundation of the crib dam shall be keyed into the channel bottom to a minimum depth of one foot. After the crib structure is in place, the key into the abutments shall be backfilled to the embankment's original contour with compactible material. The material shall be mechanically tamped in maximum lifts to 6 inches.

5.8 FILLING OF CRIB UNIT

Crib fill material shall consist of durable limestone, sandstone or river rock. The stone shall be hand or machine placed inside the cribbing in such a manner as to minimize the void space. If open-faced cribbing is used, the stone fill shall have a minimum size of one inch greater than that of the crib's vertical opening. If closed-faced cribbing is used, the stone fill shall be 3-7 inches in size.

5.9 MATERIAL SPECIFICATIONS

5.9.1 CRIB FABRICATION

Reinforced concrete cribbing shall be manufactured of dense, impermeable concrete, developing a compressive strength of not less than 4000 pounds per square inch in 28 days. Crib units shall be made in rigid steel forms and compacted by vibration. The surfaces of all members shall contain no recesses or depressions. Mesh or bar reinforcing shall be used, with the steel placed such as to act integrally with the concrete in resisting design stresses.

5.9.2 CRIB INTERLOCKING

Headers shall be made with reinforced projecting lugs to serve as the locking device. If other types of locking devices are employed, the manufacturer shall furnish proof of strength of such device based on test results from a qualified laboratory.

Concrete crib dams covered by these specifications shall be of the true crib type having stretchers running longitudinally with the wall at both the front and rear, and headers lying transversely to support the ends of the stretchers and tie the structure together.

5.9.3 GROSS VOLUME OF CRIB UNIT

The total volume of concrete contained in all crib units shall represent at least 16% of the gross volume of the crib wall with the filling in place.

5.10 PLANS, DESIGN DATA AND SPECIFICATIONS

In addition to the "Proposed Drainage Map", there shall also be submitted the following items concerning crib sediment dams.

1. A "Structure Proportioning Computations Sheet" to be completed for each proposed crib sediment dam.
2. Construction Plans showing:
   a. A topographic map on a 1" = 50' scale and 4-foot contour intervals showing the reservoir area and structure. Topographic map is to be made using transit-stadia survey method.
   b. Plan view of structure showing all pertinent dimensions.
   c. A cross-section view of crib structure at the point where the maximum depth of water will be impounded, against the structure showing all pertinent dimensions and elevations.
   d. A cross-section view taken along the centerline of the dam showing all pertinent dimensions and elevations.
   e. A "Stage-Area-Storage Computations Sheet" and "Stage-Area-Storage Curves".
   f. Construction Specifications.

5.11 CONSTRUCTION SPECIFICATIONS

5.11.1 SITE PREPARATION

Brush, trees and other undesirable material shall be cleared from the

sediment pool and dam areas. Sod and topsoil shall be stripped from cribs foundation area.

5.11.2 PREPARATION OF FOUNDATION

Proper excavation shall be made along the foundation and sides of the crib structure as shown on the construction plans to assure that the crib structure will be placed on the planned line and grade.

The key into the abutments shall be excavated as shown on the construction plans. The crib structure must be keyed into the abutments to a minimum of 3 feet at any point. The crib structure shall be keyed into the channel bottom to a minimum depth of 1 foot.

When the cribbing is on fill material, the fill material beneath the cribbing shall be placed in 6-inch maximum lifts and mechanically tamped.

5.11.3 PLACING CRIB MEMBERS

The prepared foundation bed for the cribbing shall be firm and normal to the face of the cribbing. The crib members shall be taken to insure the correct alignment.

The crib members shall be handled carefully and members that become cracked or otherwise damaged shall be removed and new members substituted.

5.11.4 FILLING CRIB

The filling of the interior, backfilling against the upstream face, backfilling key into embankment, and dumped rock against downstream face shall progress simultaneously with the erection of the cribbing. The interior of the cribbing shall be filled with durable limestone, sandstone, or river bedrock which shall be hand or machine placed inside the cribbing in such a manner as to minimize the void space. If open-faced cribbing is used, the stone fill shall have a minimum size of one inch greater than that of the crib's vertical opening. If closed face cribbing is used, the stone fill shall be 3-7 inches in size.

5.11.5 BACKFILLING UPSTREAM FACE

The upstream face of the cribbing shall be backfilled with material from the pool area up to the sediment pool elevation behind the spillway and up to the top of dam elevation for the remainder on a maximum slope of 3 horizontal to 1 vertical.

Very dry or wet material shall not be used. The fill material shall be free of all sod, roots, stones over 6 inches in diameter and other objectionable material. The moisture content of the material should be such that when kneaded in the hand, it will just form a ball that will not readily separate.

The embankment shall be brought up on uniform 6-8-inch layers of approximate uniform elevation over its entire area. Each layer shall be thoroughly compacted by making at least 4 complete passes with a tamping roller or by applying equal compactive effort with rubber-tired equipment.

5.11.6 BACKFILLING KEY INTO ABUTMENTS

The key into the abutments shall be backfilled to the embankment's original contour with compactible material. This material shall be placed in 6-inch maximum lifts and mechanically tamped.

5.11.7 DOWNSTREAM CHANNEL PROTECTION

5.11.7.1 ROCK MATTRESS

The channel bottom and sides downstream of the structure shall be covered to a minimum depth of 3 feet with durable rock of which 50% is 3 feet or larger and the remainder sized to fill the voids with a minimum size of 6 inches. The rock shall not contain more than 10% earth, sand, or soft shale as determined by visual inspection. The rock shall extend out from the toe of the crib structure. The dumped rock shall form a trapezoidal channel with a bottom width equal or greater than the length of the spillway. The rock shall extend up the embankment sides for a minimum vertical depth of 4 feet.

5.11.7.2 GABION MATTRESS

The channel bottom and sides downstream of the structure shall be covered with a 12-inch gabion mattress. The mattress shall form a trapezoidal channel with a bottom length equal to or greater than the length of the spillway. The mattress shall extend up the embankment to a minimum distance of twice the height of the structure.

Material specifications, binding and filling of gabion mattress baskets shall be as outlined under GABION SEDIMENT DAMS.

5.11.8 VEGETATIVE PROTECTION AGAINST EROSION

All disturbed areas outside the pool area shall be mulched and vegetated in accordance with Reclamation rules and regulations for revegetation.

SECTION 6

EXCAVATED SEDIMENT CHANNEL

6.1 DEFINITION

A channel excavated below the toe of the spoil to form a silt or sediment basin for control of sediment from the outslope.

6.2 PURPOSE

To preserve the capacity of reservoirs, ditches, canals, diversions, waterways and streams and to prevent undesirable deposition on bottom lands, in channels or waterways, and other areas by providing basins for the deposition and storage of silt, sand, gravel, stone and other detritus.

6.3 SCOPE

This standard establishes the minimum acceptable quality for the design and construction of an excavated sediment channel in predominantly rural or agricultural areas in West Virginia when:

1. Failure of the embankment for the channel would not result in loss of life; in damages to homes, commercial or industrial buildings; main highways, or railroads; in interruption of the use of service of public utilities.
2. The slope of the original ground on which the channel is constructed does not exceed 30%.
3. The maximum expected horizontal length of the spoil bank outslope does not exceed 100 feet.

6.4 SEDIMENT CAPACITY

The excavated sediment channel shall form a basin with a capacity to store 0.125 acre-feet per acre of disturbed area formed by the outslope of the spoil bank. The outslope area shall be based upon the maximum expected length of spoil slope. An outline of the predicted outslope area shall be shown on the proposed drainage plan.

The sediment in the channel shall be cleaned out when accumulation approaches 60% of the design capacity. The construction drawings shall indicate the corresponding elevation.

6.5 LIMITATIONS

The excavated sediment channel shall be built on a level grade around the hill or mountainside. Adequate space shall be provided between the toe of spoil bank and the channel to assure that sluffage from the spoil slope will not fill the channel.

Precaution shall be taken to assure that there is no overburden or spoil spillage over the outslope into the channel.

The excavated sediment channel shall have a V-notch cross-sectional appearance. The vertical depth of the inside cut or highwall shall not exceed 5 feet and the slope of the cut shall not exceed 1/2 horizontal to 1 vertical.

The bench formed by the channel shall be a minimum of 14 feet wide, and on a slope of 5 horizontal to 1 vertical towards the cut slope.

The channel fill slope shall be no greater than 1-1/2 horizontal to 1 vertical. Trees shall not be removed from beneath or through the fill slope.

An earthen barrier shall be installed across the channel at 200-foot intervals or less to assure that failure of the embankment or fill portion of the channel would result in release of water or sediment from only a 200-foot segment of the channel at any one time. The top or crest width of the barrier shall be 5 feet. Barrier height shall be 1 foot below the embankment or fill portion of the channel.

Drainage from an area other than the spoil outslope shall not be allowed to enter the channel at any time. The channel shall be terminated 10 feet each side of any drain (natural or constructed) from the bench area. In the event that a drain from the bench down the outslope is deemed necessary after completion of the channel and during the active mining operation at a location where allowance was not made for letting the drainage bypass the channel when

the channel was constructed, an earthen barrier shall be installed in the channel, 10 feet on each side of the drain. The embankment or fill shall be eliminated between these two barriers.

6.6 PLANS, DESIGN DATA AND SPECIFICATIONS

In addition to the "Proposed Drainage Map", there also will be submitted the following items:

1. A "Structure Proportioning Computations Sheet"
2. Construction Plans showing:
   a. Plan view drawn to scale of the channel
   b. Profile view drawn to scale of the channel
   c. Cross-section view drawn to scale through the channel showing the maximum existing ground slope on which the channel is to be constructed
   d. Cross-section of barrier as located in channel

   NOTE: The proximity of the toe and top of spoil slope to the excavated channel should be shown on all views.
3. Construction Specifications

6.7 CONSTRUCTION SPECIFICATIONS

6.7.1 STAKE- OUT

Prior to beginning the excavation of the channel, alignment and grade controls shall be established every 100 feet along the channel. Care shall be taken to establish a level, zero percent grade.

6.7.2 EXCAVATION

The channel shall be excavated as shown on the construction plans. A barrier with a 5-foot crest width shall be placed through the channel every 200 feet or less. The channel may be discontinued and restarted above or below the point where discontinued to avoid rock formations. In no case shall the channel be planned or built on a slope which exceeds 30%.

6.7.3 SURFACE RUNOFF

Surface runoff from an area other than the spoil outslope shall not be allowed to enter the channel at any time. The channel shall be terminated 10 feet each side of any drain (natural or constructed) from the bench area.

In the event that a drain from the bench down the outslope is deemed necessary after completion of the channel and during the active mining operation at a location where allowance was not made for letting the drainage bypass the channel when the channel was constructed, an earthen barrier shall be installed in the channel 10 feet each side of the drain. The embankment or fill portion of the channel shall be eliminated between these two barriers.

6.7.4 VEGETATIVE PROTECTION AGAINST EROSION

All disturbed areas created during the construction of the channel shall be seeded and mulched in accordance with Reclamation rules and regulations for revegetation.

SECTION 7

ACCEPTANCE OF EXISTING STRUCTURES FOR SEDIMENT CONTROL

Acceptance of existing structures for sediment control shall be based upon the ability of the structure to meet or exceed the recommended criteria outlined in this handbook. Plans should be submitted for the structure or structures as required in this handbook for that particular type structure.

Sediment control structures built under previous permits may be utilized for sediment control on new permits. A copy of the as-built plans and data as required for the structure shall be submitted with the drainage plan.

SECTION 8

MODIFICATION OF SEDIMENT CONTROL STRUCTURES

No modification of existing sediment control structures after their completion and approval by the Reclamation Division of the Department of Natural Resources shall be allowed without their approval. In no case will it be allowable to increase the capacity of an earthen, crib, or gabion dam by increasing the height of the embankment, cribbing or gabion above the structures designed height.

SECTION 9

ABANDONMENT PROCEDURES FOR SEDIMENT CONTROL STRUCTURES

9.1 SCOPE

This section shall cover the minimum requirements for abandoning sediment control structures prior to total release of bond for the particular permit. These abandonment procedures may be waived if the structure or structures are to be immediately utilized under another permit or the landowner signs a law-binding document stating that he will assume future responsibility for said structure or structures. A copy of this document shall be forwarded to the Department of Natural Resources for their records with the drainage plan.

All abandonment procedures shall be completed before the total bond is released.

9.2 ABANDONMENT PROCEDURES

9.2.1 EXCAVATED SEDIMENT PONDS

There is no required abandonment procedure for excavated sediment ponds unless they have an embankment. If they have an embankment, they shall follow the abandonment procedures for SEDIMENT DAMS - EMBANKMENT TYPE.

9.2.2 SEDIMENT DAMS - EMBANKMENT TYPE

Sediment dams and all accumulated sediment above the dam shall be removed from the natural drainway if they are built across it. Dams adjacent to natural drainways shall be abandoned by diverting the entrance channel to the natural drainways; thus preventing any future surface runoff from entering the impoundment.

When sediment dams are removed, the natural drainway shall be returned to its original profile and cross-section as near as practical. An original profile and cross-section view for the channel shall be submitted with the drainage plan. The channel sides and bottom shall be riprapped with 18 inches of durable stone, 25% of which is 18 inches or larger, and the remainder sized to fill the

voids. The riprap shall extend up to the top of the channel. The riprap requirement may be waived where the bottom and sides of the channel consist of bedrock.

9.2.3 CRIB OR GABION SEDIMENT CONTROL STRUCTURES

Crib or gabion sediment control structures and all accumulated sediment above the structure shall be removed from the natural drainway for abandonment. The natural drainway shall be returned to its original profile and cross-section. An original profile and cross-section view of the channel shall be submitted with the drainage plan. The channel shall be riprapped with 18 inches of durable stone, 25% of which is 18 inches or larger, and the remainder sized to fill the voids. The riprap requirement may be waived where the channel bottom and sides consist of bedrock.

9.2.4 EXCAVATED SEDIMENT CHANNEL

There is no required abandonment procedure for excavated sediment channels.

9.2.5 REVEGETATION OF DISTURBED AREAS

All areas disturbed during abandonment of a sediment control structure shall be mulched and vegetated in accordance with Reclamation rules and regulations for revegetation.

9.2.6 DISPOSAL OF WASTE MATERIAL

Waste material shall be spread continuously over an area designated on the drainage plan in accordance with these specifications.

Provisions shall be made for the diversion or safe passage of surface water concentrating on the land side of the spoil bank.

The spoil shall be placed so as not to endanger the stability of the stream bank and shall not exceed 3 feet in height above the natural ground surface, except by special design. Special designs shall be submitted with the drainage plan. The finished surface shall slope away from the edge of the stream or drainway insofar as feasible.

Surfaces of spoil shall not be steeper than 4 horizontal to 1 vertical on the land side, and 3 horizontal to 1 vertical on stream side.

If the spoil is spread to the edge of the stream bank, the stream side slope of the spoil shall be shaped to join the side slope of the stream bank so loose spoil will not slide or erode into the channel.

SECTION 10

VALLEY FILL

10.1 DEFINITION

A controlled earth and rock fill across or through the head of a valley or hollow to form a stable, permanent storage space for surface mine spoil material.

10.2 PURPOSE

The valley fill method was developed to improve aesthetics, reduce landslides, allow for full recovery of one or more coal seams, and produce rolling mountaintop land that is suitable for many uses other than forestry purposes.

The valley fill method provides storage space for spoil from mountaintop removal or as a waste area for overburden from contour benches.

Narrow V-shaped, steep-sided hollows near the ridge top, that are free of underground mine openings or wet weather springs, are selected for valley fills. The size of the selected hollow must be such that the overburden generated by the mining operation will completely fill the treated head of the hollow.

Instead of unstable outslope with its potential for slides and erosion, or islands of isolated land with no access, a large, stable, fairly level area can be constructed with this method.

10.3 DRAINAGE

Drainage for valley fills shall consist of a rock drain constructed through the fill from the original valley floor up to the finished ground line to provide a permanent means of conveying surface runoff past the fill area. The rock core shall be progressively brought up with the remainder of the fill.

During and after construction, the top of the fill shall be graded to drain back to the head of the fill. The maximum slope of the top of the fill shall be 3% in any direction.

A drainage pocket shall be maintained at the head of the fill during and after construction to intercept surface runoff and discharge the runoff through or over the rock core. In no case shall this pocket or sump have a potential for impounding more than 10,000 cubic feet of water.

The top of the rock drain shall form a trapezoidal channel for possible flows over the core instead of through it in the event the pores of the core become blocked by debris or sediment. The minimum base width of the channel shall be 8 feet and the minimum depth of the channel shall be 2 feet.

10.4 DESIGN DATA AND SPECIFICATIONS

In addition to the drainage map, the following items shall be submitted:

1. A three-dimensional sketch of the fill.
2. A profile view of the valley fill showing the original ground line as surveyed in 100-foot stations.
3. A cross-section through the valley fill at the midpoint of the 2:1 outer slope. The existing ground line should be shown as surveyed.
4. A cross-section through the valley fill at the midpoint of the bench. The existing ground line should be shown as surveyed.
5. Construction Specifications

10.5 CONSTRUCTION SPECIFICATIONS

1. All areas upon which valley fill is to be placed, shall first be cleared completely of all trees, brush, shrubs, and other organic material. This material shall be removed from the fill area and may be placed at the toe to catch siltation.
2. A rock core shall be progressively constructed (as the layers are brought up) through the valley fill. The rock core shall be a minimum of 16 feet in width and composed of rock with a minimum dimension of 12 inches. The rock core shall consist of no more than 10% fines as determined by visual inspection - fines being a material with a dimension of less than 12 inches.

3. Depositing and compacting valley fill in layers shall be begun at the toe of the fill. The layers shall be constructed approximately parallel with proposed finish grade. All material shall be deposited in uniform horizontal layers and compacted with haulage equipment.
4. The thickness of the layers shall not exceed the maximum size of the rock; the maximum dimension shall be 4 feet.
5. During and after construction, the top of the fill shall be graded to drain back to the head of the fill on a slope no greater than 3%. A drainage pocket shall be maintained at the head of the fill at all times to intercept surface runoff.
6. The outer slope shall be no steeper than 2 horizontal to 1 vertical. A 20-foot wide, bench shall be installed at a minimum of every 50 feet in vertical height of the fill with a 3% to 5% slope toward the fill area, normal to such, and a 1% slope toward the rock core.
7. When construction of the valley fill is finished, topsoil or other suitable material which will support vegetation shall be spread over the entire surface of the fill excluding the rock core. The top and outer slopes shall then be seeded according to revegetation plan.

SECTION 11

LOG AND POLE STRUCTURES

11.1 DEFINITION

A barrier composed of logs and poles constructed across a natural or constructed drainway.

11.2 PURPOSE

To retard stream flow and catch small sediment loads.

11.3 CONDITIONS WHERE PRACTICE APPLIES

Log and pole structures are to be used only to assist in sediment control and ARE NOT SUBSTITUTES for sediment dams or excavated sediment ponds. When used, log and pole structures will not reduce the required sediment capacity (0.125 acre-feet/acre of disturbed area) of sediment dams or excavated sediment ponds.

They may be used in locations such as:

1. In natural drainways close to the disturbed area to catch initial sediment loads.
2. In channels carrying water off the bench toward a natural drainway.
3. Other locations where small localized sedimentation problems exit.

11.4 DESIGN CRITERIA

A design is not needed for log and pole structures. Generally, they will follow the standard shown in Appendix I, Illustration No. 1, Page I-25. Log and pole structures will not be used on a drainway whose normal discharge is greater than 5 cubic feet per second.

SECTION 12

STONE CHECK DAMS

12.1 DEFINITION

A barrier composed of large stone constructed across a drainway.

12.2 PURPOSE

To retard stream flow and form a small sediment basin in order to assist in sediment control.

12.3 CONDITIONS WHERE PRACTICE APPLIES

Stone check dams may be used only to assist in sediment control. They ARE NOT SUBSTITUTES for sediment dams or excavated sediment ponds. If used above such structures, stone check dams will in no way reduce the required sediment capacity (0.125 acre-feet/acre of disturbed area) of sediment dams and excavated sediment ponds.

Stone check dams will not be used when the drainage area above them exceeds 50 acres. They may be used in locations such as:

1. In natural or constructed drainways close to the disturbed area in order to catch initial sediment loads.
2. In channels carrying water off the bench toward a natural drainway.
3. Other locations where small localized sedimentation problems exist.

12.4 DESIGN CRITERIA

A design is not required for stone check dams; however, the following standard criteria will be used as shown in Appendix I, Illustration No. 2, Page I-26.

1. Twenty-five percent of the rock will be 18 inches or larger. The remaining 75% shall be well graded material consisting of sufficient rock small enough to fill the voids between the larger rocks.
2. The dam will be keyed into the sides and bottom of the channel a minimum depth of 3 feet. Minimum width of the key will be 3 feet.

3. Upstream slope and downstream slope will be 3 horizontal to 1 vertical.
4. A weir the average width of the stream channel and a minimum of 1 foot deep will be positioned at the center of the dam.
5. Maximum height will be 4 feet (from lowest point along centerline of dam to crest of weir).
6. Minimum top width shall be 5 feet.

12.5 MAINTENANCE

Stone check dams shall be cleaned when sediment capacity is approached.

SECTION 13

TOE BERM

13.1 DEFINITION

A berm or "bench" of compacted and vegetated soil constructed at the toe of the outer slope.

13.2 PURPOSE

To control sheet erosion from the outer spoil slope by diminishing the velocity of the runoff and making it possible for sediment to deposit.

13.3 CONDITIONS WHERE PRACTICE APPLIES

The toe term is used at the toe of the outer spoil slope to control excessive erosion until the slope has been properly revegetated and stabilized. The toe berm should be constructed as soon as the toe of the outer spoil slope is established. This shall be done as mining progresses. The berm shall not be built where concentrated flows from the bench area occurs; it shall be built only where runoff is from spoil slope.

13.4 DESIGN CRITERIA

A design is not required for toe berms; however, the following standard criteria will be used:

1. Width of the toe berm will be 10 feet for every 100 feet of spoil slope length.
2. Toe berm will be sloped a minimum of 1% and a maximum of 3% away from the toe of spoil.
3. Outer slope of the toe berm will be 3 horizontal to 1 vertical or flatter.
4. Toe berm will be vegetated immediately after construction and shall cover the outer slope, berm, and shall extend a minimum of 10 feet up the spoil slope. The Ph and nutrient level of the soil shall be such that vigorous stand of vegetation can be established.

5. Toe berm will be compacted using suitable construction equipment. (Refer to Figure 6, Appendix I, Page I-8, for different types of toe berm construction).

SECTION 14

LEVEL SPREADER

14.1 DEFINITION

An outlet constructed at zero percent grade across the slope where concentrated runoff may be spread at non-erosive velocities over undisturbed areas stabilized by existing vegetation.

14.2 PURPOSE

The purpose of the level spreader is to convert a concentrated flow of storm runoff into sheet flow and to outlet it onto areas stabilized by existing vegetation without causing erosion.

14.3 CONDITIONS WHERE PRACTICE APPLIES

Level spreaders may be used where storm runoff is concentrated and diverted from surface mined areas onto undisturbed areas (i.e., at diversion outlets, etc.). This practice applies only in those situations where the spreader can be constructed on undisturbed soil and where the area directly below the level lip is stabilized by existing vegetation.

14.4 DESIGN CRITERIA

A specific design for level spreaders will not be required. However, spreader length will be determined by estimating Q_1 flow from Figure 1, Appendix I, Page I-3, and selecting the appropriate length from Table 7, Level Spreader, Appendix I, Page I-14.

14.5 OUTLETS

Final discharge will be over the level lip onto an area already stabilized by existing vegetation.

SECTION 15

DIVERSION OR CONSTRUCTED DRAINWAY

15.1 DEFINITION

A graded channel constructed across the slope with or without a supporting ridge on the lower side.

15.2 PURPOSE

To divert water away from surface mined areas and thereby reduce acid water and sediment problems.

15.3 CONDITIONS WHERE PRACTICE APPLIES

Diversions may be used above the highwall to keep water out of the pit, below the spoil slopes to direct runoff to sediment ponds, and in other locations as needed.

15.4 DESIGN CRITERIA

15.4.1 CAPACITY

Diversions shall have the capacity to carry at least the peak discharge from the contributing watershed for a one-year frequency storm. This discharge shall be obtained from Figure I, Diversion Design Peak Discharge, Appendix I, Page I-3, Table 8; Appendix I, Page I-15; and Chart 2, Appendix I, Page I-2, will be used to proportion trapezoidal- and triangular-shaped diversion ditches. Table 9, Appendix I, Pages I-16 through I-22, will be used to proportion parabolic-shaped diversions. Trapezoidal- or triangular-shaped ditches are easier than parabolic to construct on slopes exceeding 20 percent. All diversions constructed in earth will be vegetated immediately upon completion according to Reclamation rules and regulations for revegetation.

15.4.2 VELOCITY

Maximum permissible velocities of flow shall be as follows:

MAXIMUM PERMISSIBLE VELOCITIES

Feet per Second

Soil Texture	Vegetated Channel	Rock Riprap
Sand, silt, sandy loam and silty loam	2.5	12
Silty clay loam and sandy clay loam	3.5	12
Clay	4.5	12

Rock riprap, when required, will be placed in a 1.5-foot thick blanket on the bottom and sides of the channel. Twenty-five percent of the rock will be 18 inches or slightly larger. The remaining 75% shall be well-graded material consisting of sufficient rock small enough to fill the voids between the larger rocks.

15.4.3 CROSS-SECTION

The channel shall be approximately parabolic, triangular, or trapezoidal, with side slopes no steeper that 1.5:1. When a ridge is used, it shall have a minimum width of four (4) feet at the design water elevation, and must provide a minimum 0.5 feet for freeboard and settlement above this elevation. Typical cross-sections are shown in Appendix I, Illustration No. 3, Page I-27.

15.4.4 GRADE

Channel grades may be uniform or variable. The allowable velocity for the particular soil type and vegetal cover will determine the maximum grade.

15.4.5 LOCATION

Diversion location shall be determined by outlet conditions, topography, soil type, and length of slope.

15.4.6 PROTECTION AGAINST SEDIMENTATION

When movement of sediment into the channel is a significant problem, a vegetated filter strip shall be used above the diversion.

15.4.7 OUTLETS

Each diversion must have an adequate outlet. The outlet may be a natural drainway, vegetated area, or other stable watercourse. In all cases, the outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed before diversion construction, if needed, to insure establishment of vegetation cover in the outlet channels.

15.4.8 MAINTENANCE

All diversions shall be kept free of sediment and other debris so that the flow of water will remain uninterrupted.

15.5 PLANS, DESIGN DATA AND SPECIFICATIONS

In addition to the "Proposed Drainage Map", there shall also be submitted the following items concerning diversions:

1. A "Diversion Design Computations" to be completed for each proposed diversion. (See Page I-23, Appendix I).
2. Construction Plans showing:
   a. A surveyed profile along the centerline of the diversion showing original ground line and proposed diversion bottom.
   b. Channel cross-sections showing the bottom width, side slopes, and depth of flow.
   d. Type of soil in which diversion will be excavated. The soil shall be SAMPLED and CLASSIFIED at intervals not exceeding 500 feet.
3. Construction and vegetation specifications.

15.6 CONSTRUCTION SPECIFICATIONS

15.6.1 SITE PREPARATION

Obstructions will be removed, as necessary for construction of the diversion.

15.6.2 EXCAVATION AND SHAPING

The completed diversion shall conform to the line, grade, and cross-section

as shown on the plans. The top of the constructed ridge or low bank shall not be lower at any point than the designed elevation, including freeboard and the settlement factor. The constructed channel shall be generally free draining and low spots shall not exceed 0.2 feet in depth. All portions of the diversion shall be finished and smoothed as needed for the establishment of vegetative cover.

15.6.3 PROTECTION AGAINST EROSION

The completed diversion shall be mulched and vegetated in accordance with Reclamation rules and regulations for revegetation.

SECTION 16

ROCK RIPRAP FLUME

16.1 DEFINITION

A temporary rock riprap-lined channel to conduct surface runoff from the top of a slope to the bottom of the slope.

16.2 PURPOSE

To convey storm runoff safely down steep slopes without scouring or erosion damage.

16.3 CONDITIONS WHERE PRACTICE APPLIES

Rock riprap flumes shall be used to convey surface water from the bench to a natural drainway and also in other locations where concentrated flows will produce erosion problems.

16.4 DESIGN CRITERIA

16.4.1 CAPACITY

The flume shall be designed to carry the expected peak flow from a one-year frequency storm. This peak flow shall be obtained from Figure 1, Diversion Design Peak Discharge, Appendix I, Page I-3. See Table 2, Appendix I, Page I-10 for the required dimensions.

16.4.2 SLOPE

The maximum allowable slope shall be 50 percent.

16.4.3 ROCK RIPRAP

A 1.5-foot thick blanket of durable rock riprap will be required. Twenty-five percent of the rock will be 18 inches or larger and the remaining 75% shall be well graded material consisting of sufficient rock small enough to fill the voids between the larger rocks. Shale shall not be used for riprap.

See Figure 7, Rock Riprap Flume, Appendix I, Page I-9, for typical cross-section views of rock riprap flume.

SECTION 17

PIPE FLOW

17.1 DEFINITION

An enclosed watertight conduit.

17.2 PURPOSE

To convey storm runoff down steep slopes without scouring or erosion damage.

17.3 CONDITIONS WHERE PRACTICE APPLIES

Pipe may be used to convey surface water from the bench to a natural drainway, and in other locations where concentrated flows will produce erosion damage. In all cases, pipe shall be used to carry water beneath haulage roads.

17.4 DESIGN CRITERIA

17.4.1 CAPACITY

The size of pipe used shall be adequate to carry the expected peak flow from a one-year frequency storm. This peak flow shall be obtained from Figure 1, Diversion Design Peak Discharge, Appendix I, Page I-3. See Table 3, Appendix I, Page I-10, for required dimensions.

17.4.2 BEDDING

All pipe shall be placed in a trench excavated in solid undisturbed ground or formed in compacted earth. The pipe shall be imbedded in a formed cradle to a depth no less than 1/10 times the outside diameter of the pipe. Backfill material shall be placed around and over the pipe in 4-inch layers and thoroughly compacted.

SECTION 18

HAULAGEWAYS

A surveyed profile must be submitted accompanied by typical cross-sections of haul road and ditches showing pipes, entrance, exit channels, and sediment control structures to be used on haulageway.

18.1 GRADING

The grading of a haulageway shall be such that:

1. No sustained grade shall exceed 10%;
2. The maximum pitch grade shall not exceed 15% for 300 feet;
3. There shall not be more than 300 feet of maximum pitch grade for each 1,000 feet of road constructed;
4. The surface shall be insloped toward the ditch line at the minimum rate of 1/2 inch per foot of surface width or crowned at the minimum rate of 1/2 inch per foot of surface width as measured from the centerline of the haulageway.

18.2 CUT SLOPES

Cut slopes should not be more than 1:1 in soils or 1/4:1 in rock.

18.3 DITCHES

A ditch shall be provided on both sides of a through-cut and on the inside shoulder of a cut-fill section, with ditch relief cross-drains being spaced according to grade. Water shall be intercepted before reaching a switchback or large fill and led off. Water on a fill or switchback shall be released below the fill, not over it.

18.4 CULVERTS

Ditch relief culverts shall be installed according to the following provisions:

1.

Road Grade in Percent	Spacing of Culverts in Feet
2 - 5	300 - 800
6 - 10	200 - 300
11 - 15	100 - 200

2. The culvert shall cross the haulageway at a 30-degree angle downgrade;
3. The inlet end shall be protected by a headwall of suitable material and the outlet end shall be placed below the toe of the fill with an apron of rock riprap or other approved material.
4. The culvert shall be covered by compacted fill to a depth of one foot or half the culvert diameter, whichever is greater.

18.5 CULVERT OPENINGS

1. Culvert openings installed on haulageways should not be less than one hundred (100) square inches in area, but in any event, all culvert openings shall be adequate to carry storm runoff and shall receive necessary maintenance to function property at all times.
2. If sediment is to be controlled on haul road, then culverts must have a perforated vertical riser on the upstream end and discharge must be controlled to prevent erosion of slopes.

18.6 NATURAL DRAINWAY

Minor alterations and relocations of natural drainways as shown on the reclamation plan will be permitted if the natural drainway will not be blocked and if no damage is ensued to the natural drainway or to adjoining landowners.

18.7 STREAM CROSSINGS

Drainage structures shall be required in order to cross a stream channel. They shall be such so as not to affect the flow of the stream. Consideration will be given to the time of year the stream is crossed and the length of time the channel is used, but in no event, and under no condition will the flow of the stream be affected or the sediment load of the stream increased during construction and/or use.

18.8 WATER BARS

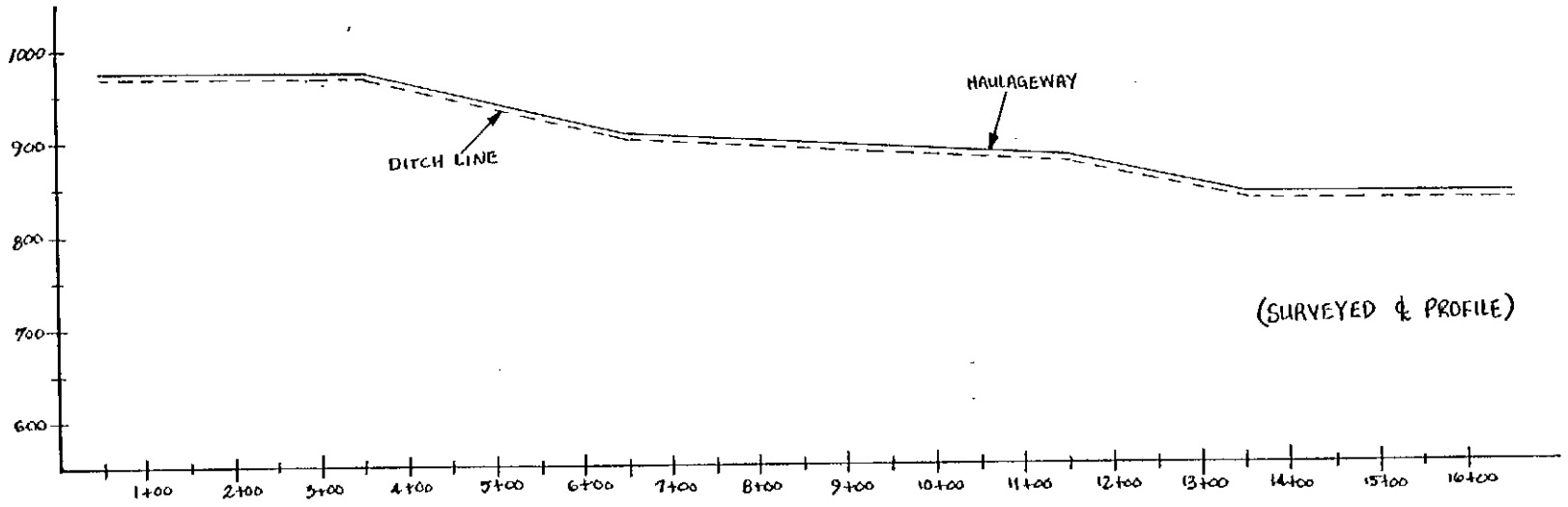
Water barriers shall be installed according to the following table of spacings in terms of percent of haulageway grade prior to the abandonment of a haulageway:

PERCENT OF HAULAGEWAY	SPACING OF WATER BARRIERS IN FEET
2	250
5	135
10	80
15	60
20	45
Above 20	25

Sediment control must be provided for the haulageway by one or more of the methods described in this handbook.

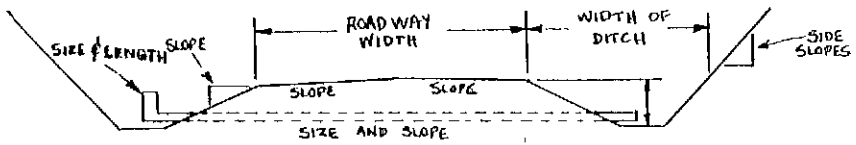
18.9

CENTER LINE PROFILE AND CROSS-SECTION OF HAUL ROAD



CENTER LINE PROFICE OF HAUL ROAD AND DITCH LINE

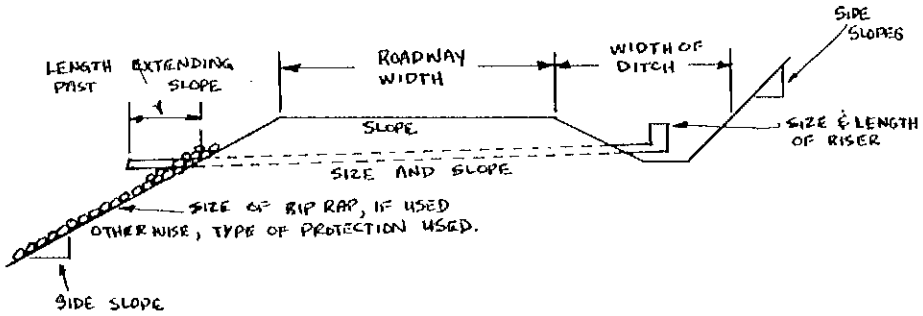
SCALE _____



THROUGH - CUT

CROSS SECTIONAL VIEW OF HAULAGEWAY

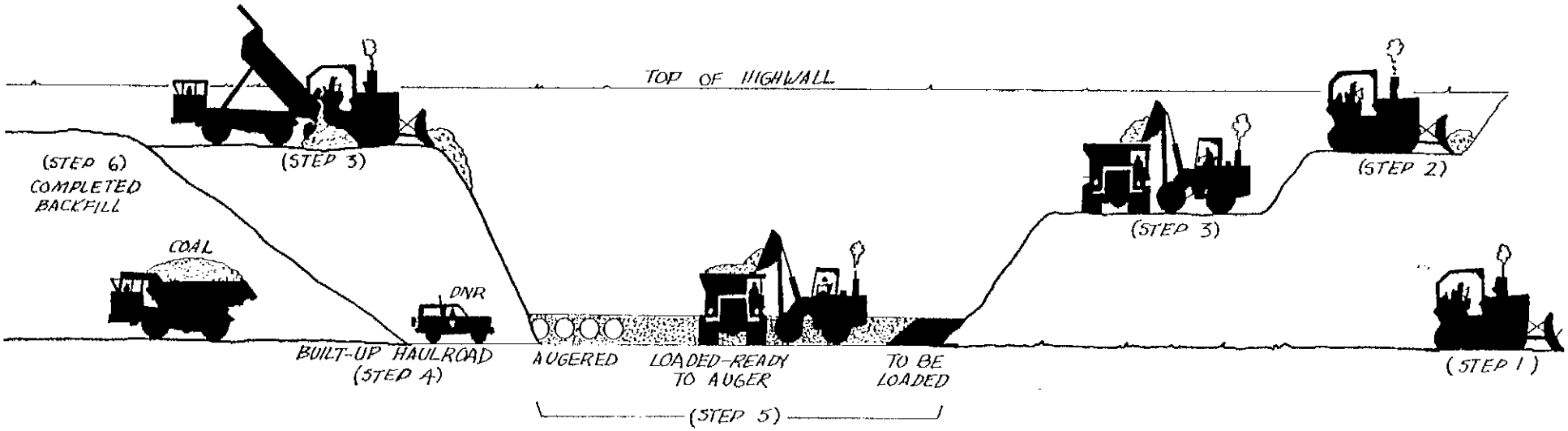
SCALE _____



CUT - FILL

CROSS SECTIONAL VIEW OF HAULAGEWAY

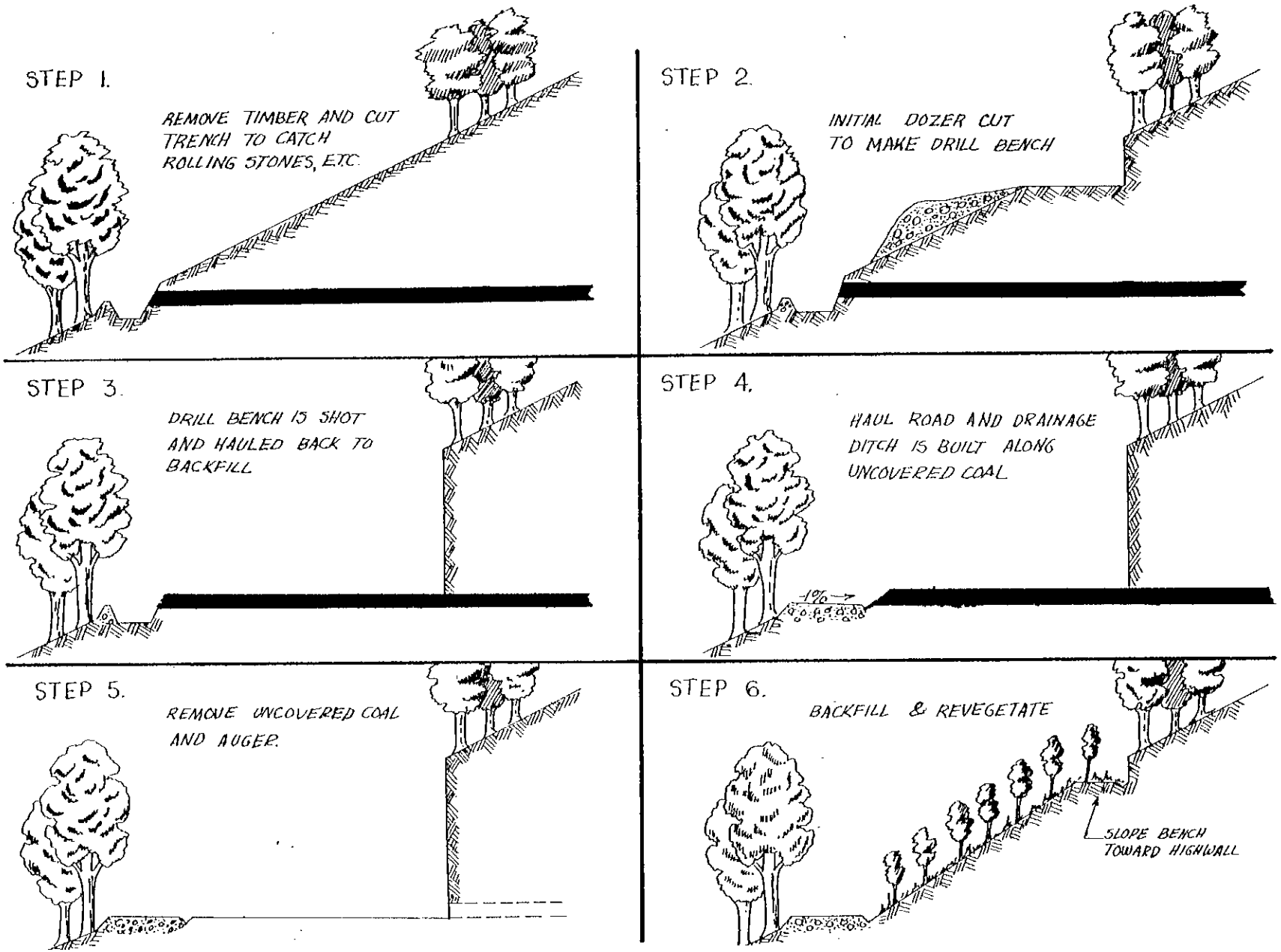
SCALE _____



SURFACE MINING

WEST VIRGINIA

CONTROLLED PLACEMENT OF SPOIL

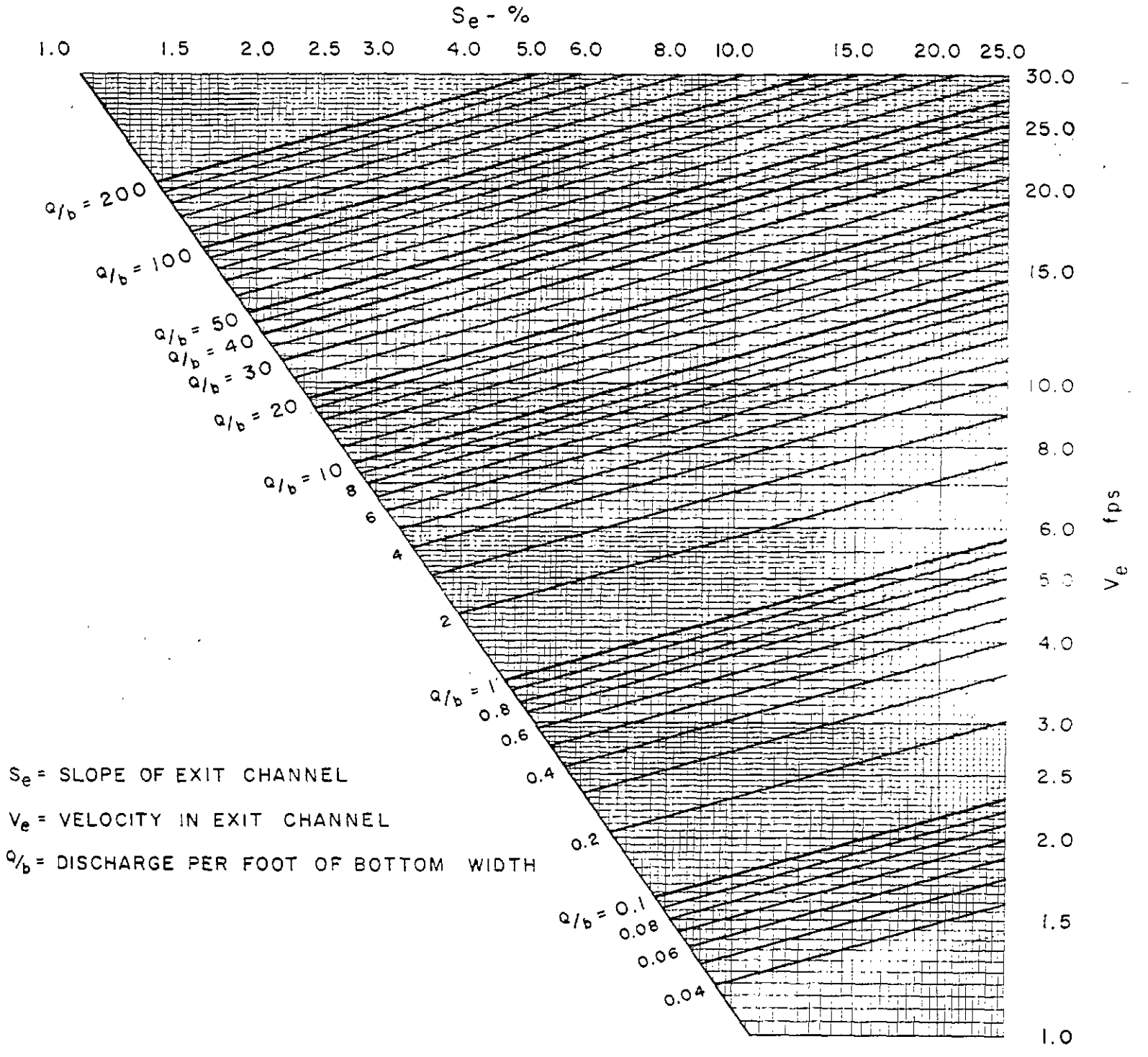

STEP 1.
REMOVE TIMBER AND CUT TRENCH TO CATCH ROLLING STONES, ETC.
STEP 2.
INITIAL DOZER CUT TO MAKE DRILL BENCH
STEP 3.
DRILL BENCH IS SHOT AND HAULED BACK TO BACKFILL
STEP 4.
HAUL ROAD AND DRAINAGE DITCH IS BUILT ALONG UNCOVERED COAL
1%
STEP 5.
REMOVE UNCOVERED COAL AND AUGER.
STEP 6.
BACKFILL & REVEGETATE
SLOPE BENCH TOWARD HIGHWALL

APPENDIX I

CHARTS, FIGURES, TABLES, SHEETS AND ILLUSTRATIONS

CHART NO. 1

EMERGENCY SPILLWAY VELOCITY CHART



S_e = SLOPE OF EXIT CHANNEL

V_e = VELOCITY IN EXIT CHANNEL

Q/b = DISCHARGE PER FOOT OF BOTTOM WIDTH

DIVERSION DESIGN CHART

CHART NO. 2

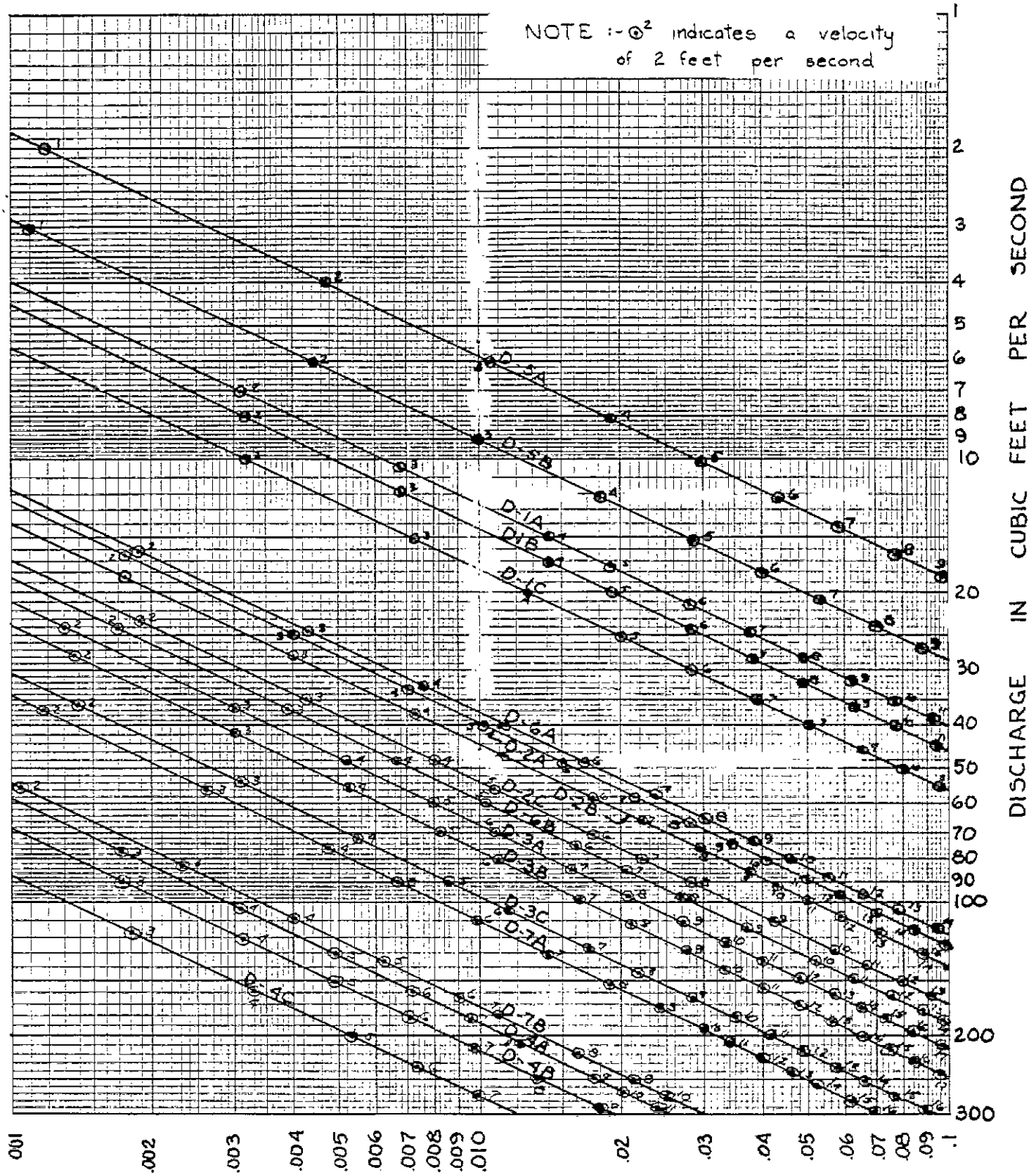


FIGURE 1

DIVERSION DESIGN PEAK DISCHARGE

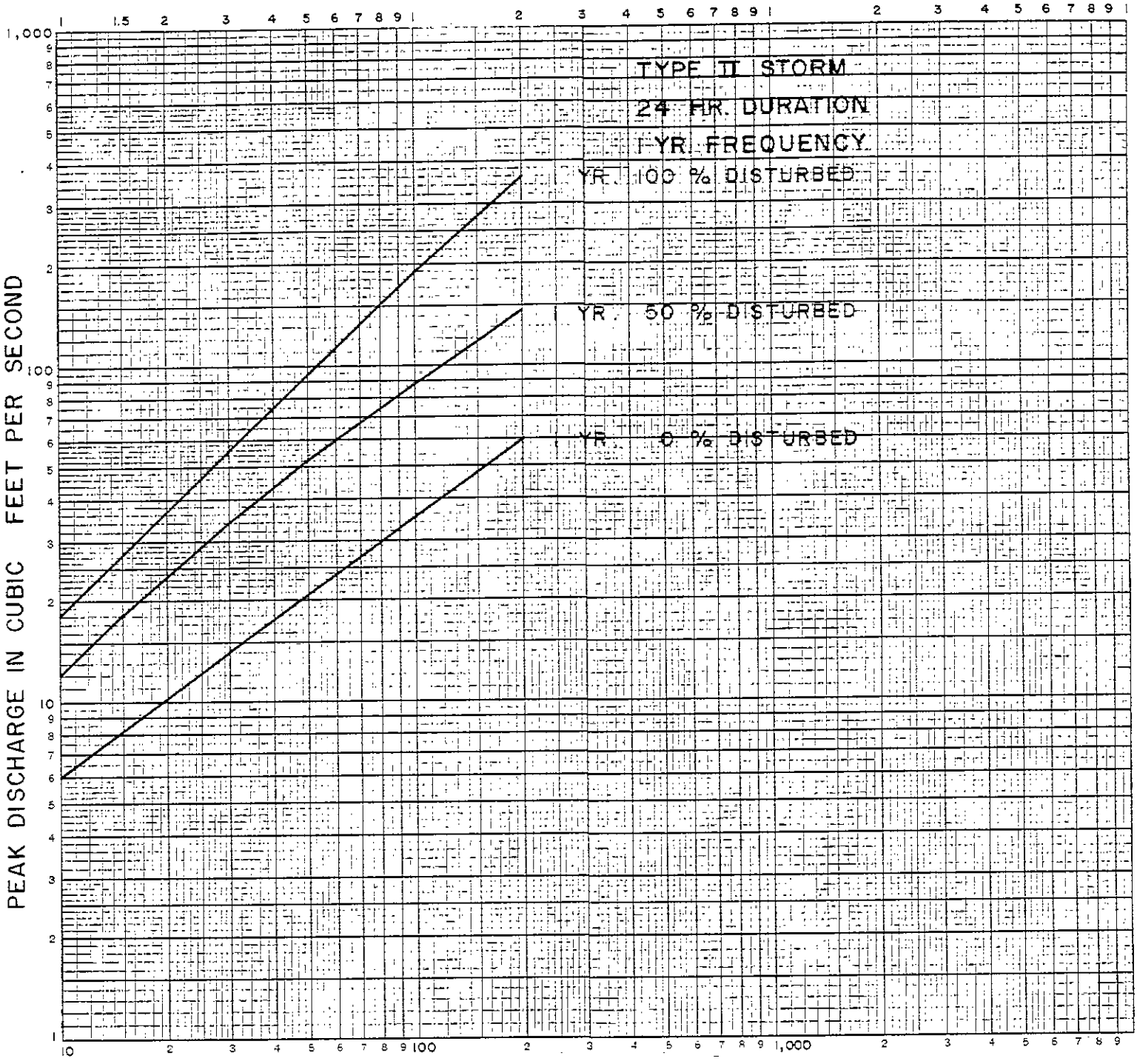


FIGURE 2

EMERGENCY SPILLWAY DESIGN PEAK

DISCHARGE

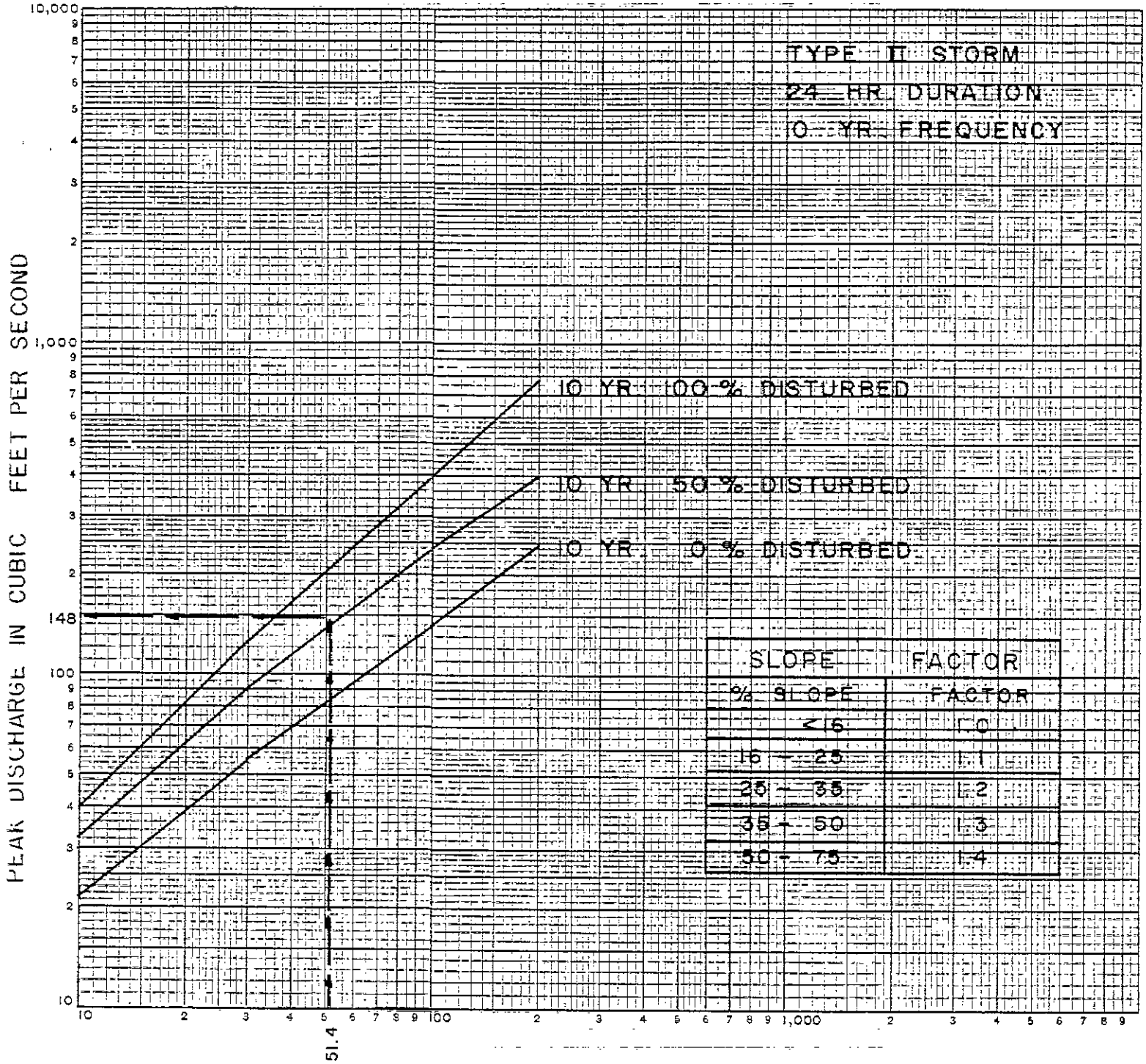
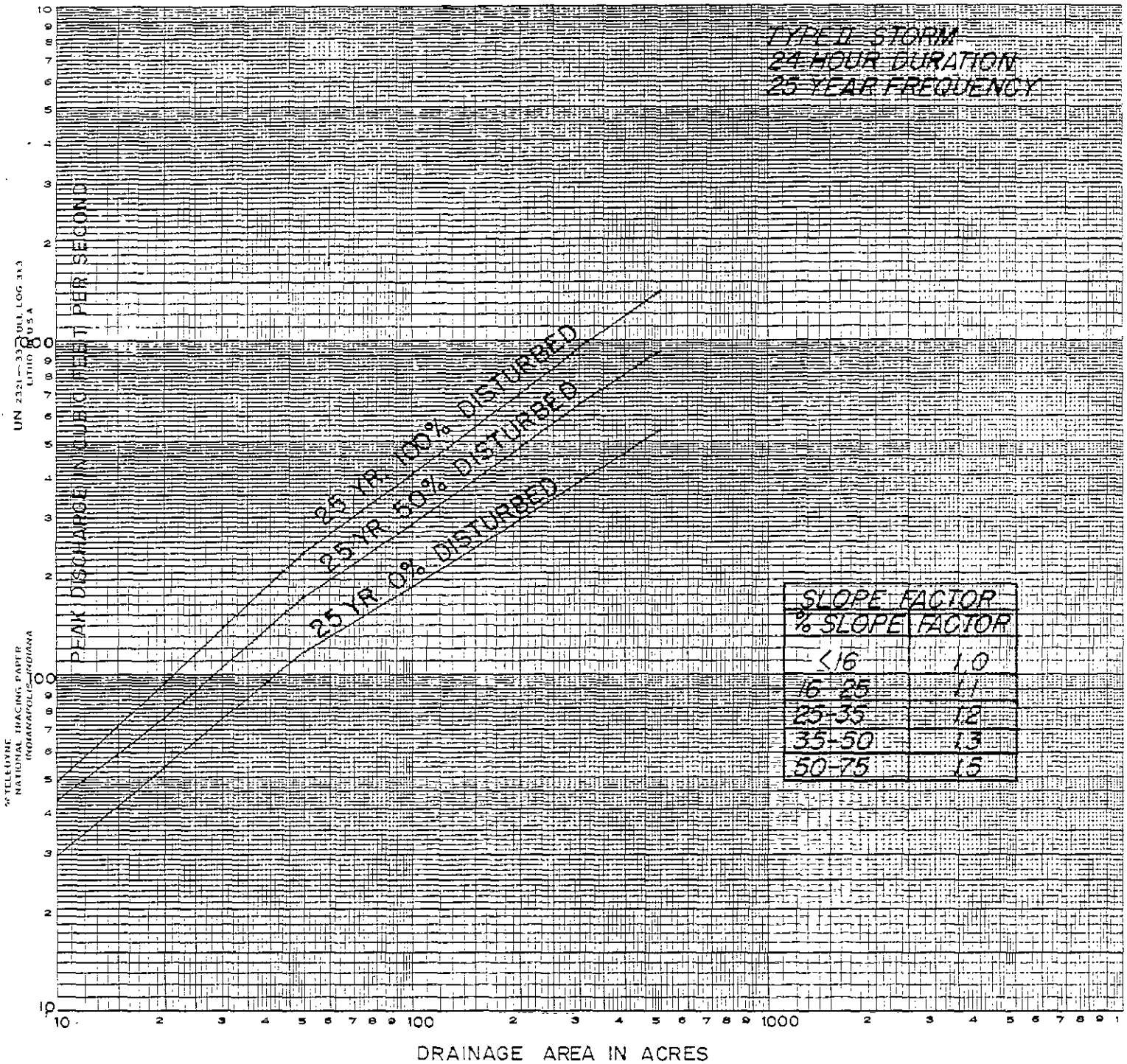


FIGURE 3

EMERGENCY SPILLWAY DESIGN PEAK DISCHARGE



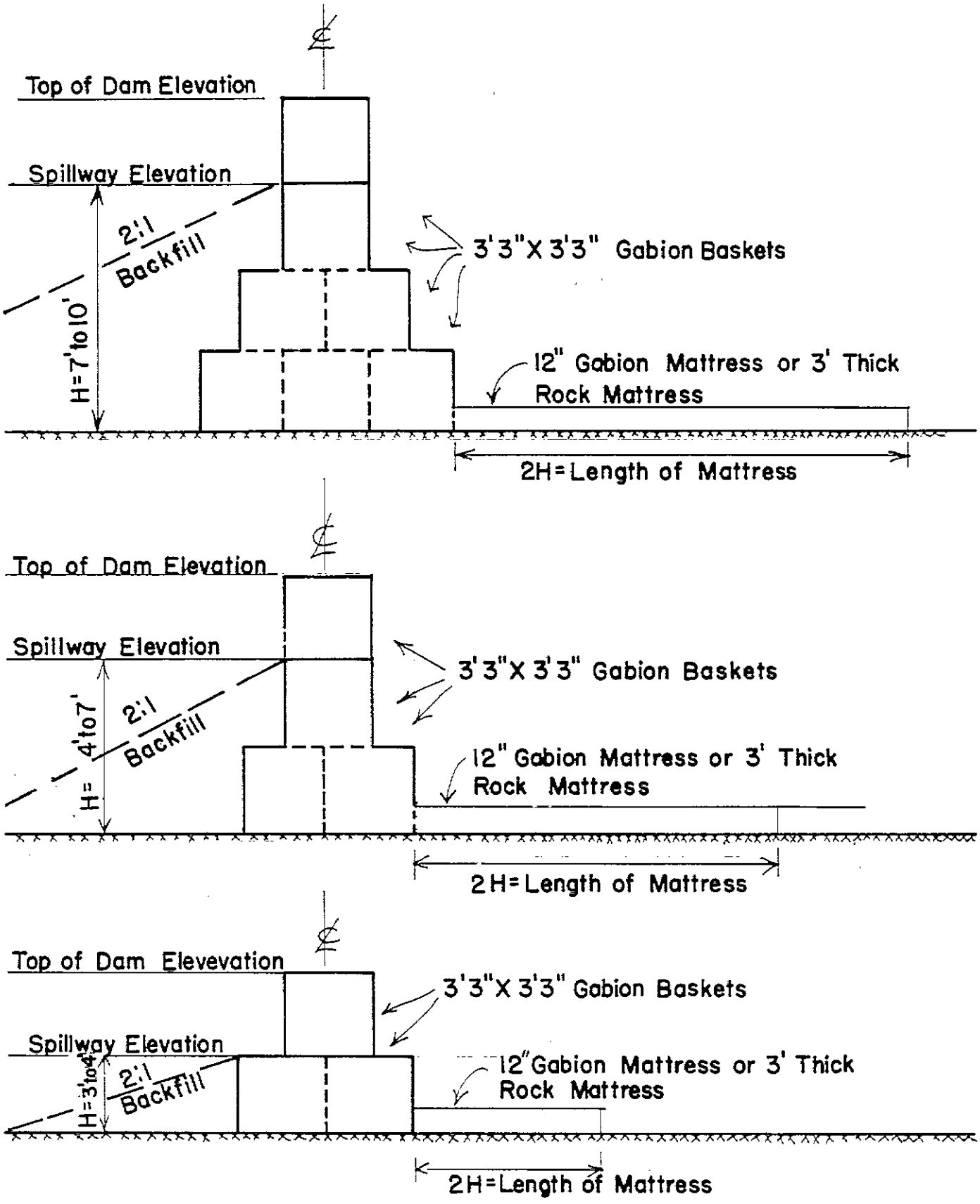


FIGURE 4 ACCEPTABLE CROSS SECTIONS FOR GABION SEDIMENT DAMS

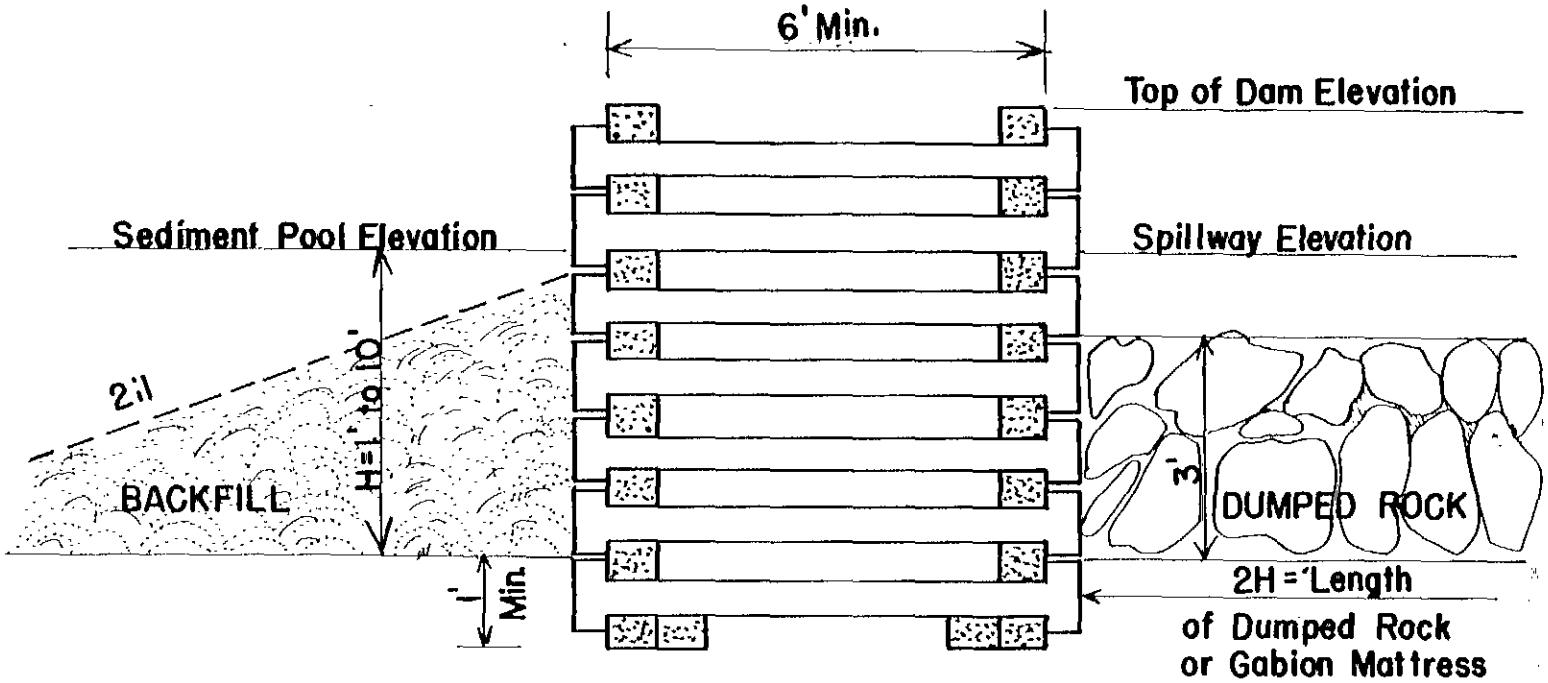
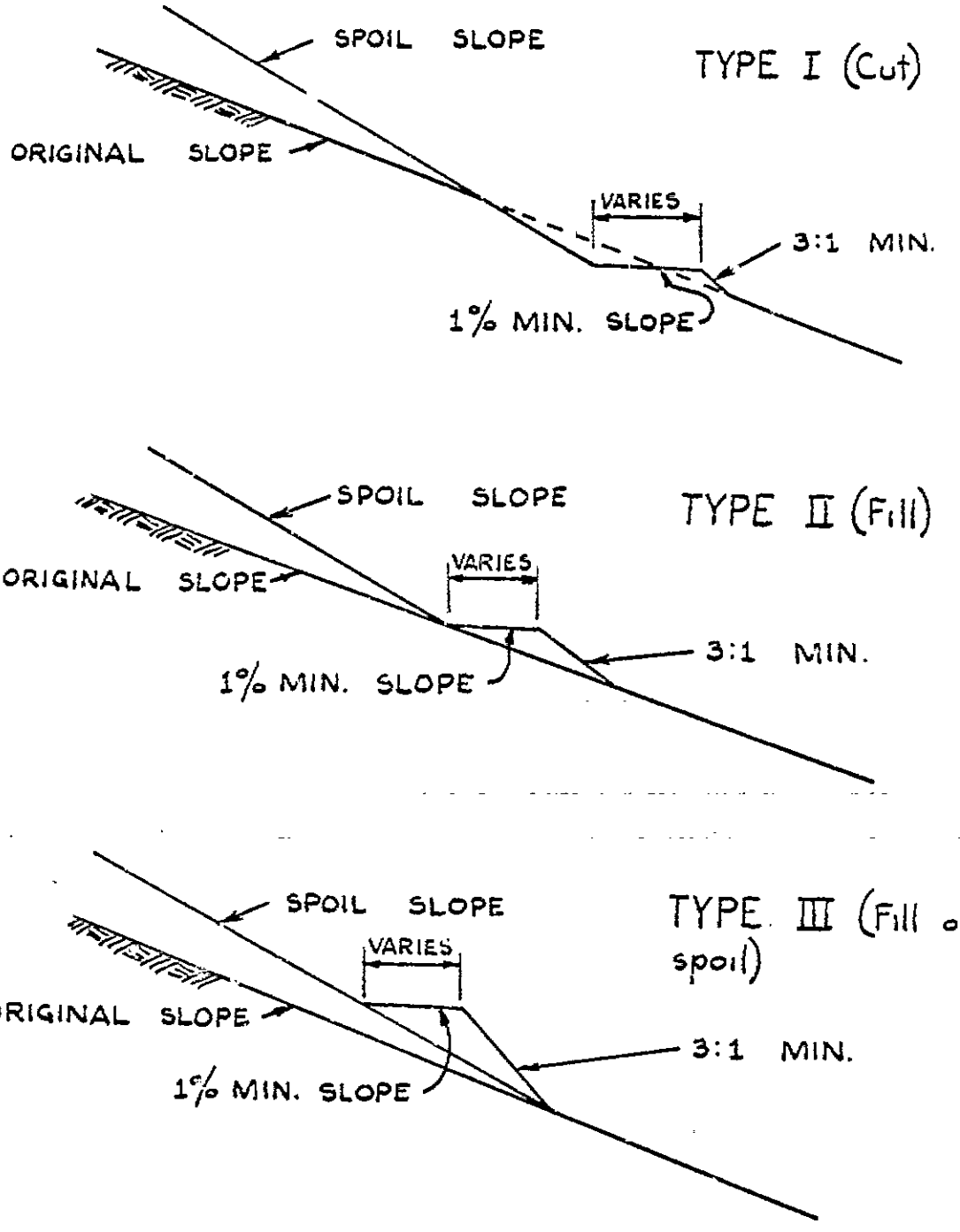


FIGURE 5 ACCEPTABLE CROSS SECTION FOR CRIB SEDIMENT DAMS

TOE BERM

FIGURE 6



NOTE : NO SCALE

Figure 7
ROCK RIP RAP FLUME

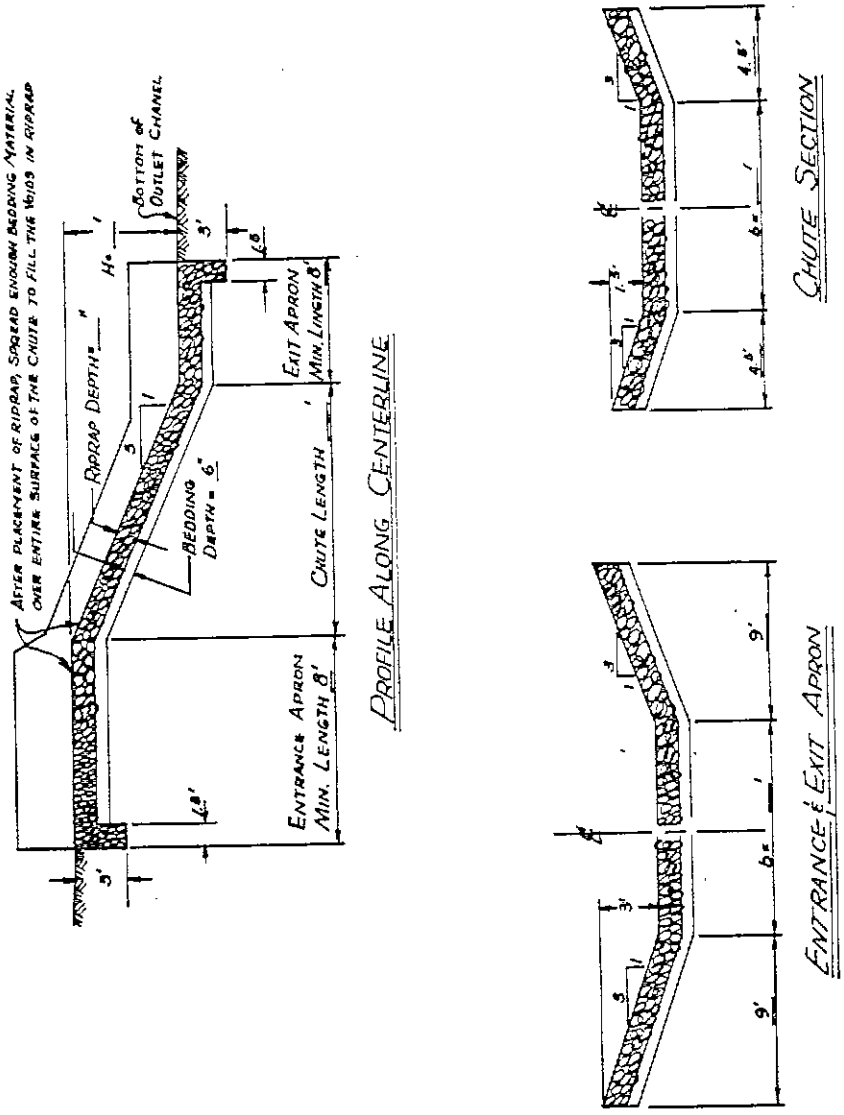


TABLE 1

MINIMUM REQUIRED PRINCIPAL SPILLWAY SIZE

Drainage Area (Ac)	Pipe Conduit Diameter (In)	Drop Inlet Diameter (In)	Square Drop Inlet Dimensions (Ft)	Minimum Drop Inlet Height (Ft)
0- 99	18	30	2 x 2	3.0
100-149	24	36	2.5 x 2.5	4.0
150-200	30	42	3 x 3	5.0

TABLE 2

ROCK RIPRAP FLUME REQUIRED DIMENSIONS

DISCHARGE (cfs)	BOTTOM (ft.)	SIDE SLOPE	CHUTE DEPTH (ft.)	INLET & EXIT DEPTH (ft.)
0 - 30	4	3:1	1.5	3.0
30 - 50	6	3:1	1.5	3.0
50 - 65	8	3:1	1.5	3.0
65 - 80	10	3:1	1.5	3.0
80 - 100	12	3:1	1.5	3.0

TABLE 3

PIPE FLOW REQUIRED DIMENSIONS

DISCHARGE (cfs)	PIPE DIAMETER (Inches)
0 - 10	21"
10 - 20	24"
20 - 40	30"
40 - 60	36"
60 - 100	42"

TABLE 4

ENERGY SPILLWAY HYDRAULICS

b-Ft / Hp-Ft	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	DISCHARGE CFS													
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.5	6	9	12	15	18	21	24	27	30	33	36	39	42	45
1.0	20	30	40	50	60	70	80	90	100	110	120	130	140	150
1.5	39	59	78	98	118	137	157	176	196	216	235	255	274	294
2.0	64	96	128	160	192	224	256	288	320	352	384	416	448	480
2.5	94	141	188	235	282	329	376	423	470	517	564	611	658	705
3.0	129	194	258	323	387	452	516	581	645	710	774	839	903	968
3.5	169	254	338	423	507	592	676	761	845	930	1014	1099	1183	1268
4.0	212	318	424	530	636	742	848	954	1060	1166	1272	1378	1484	1590
4.5	258	387	516	645	774	903	1032	1161	1290	1419	1548	1677	1806	1935
5.0	305	458	610	763	915	1068	1220	1373	1525	1678	1830			
5.5	364	546	728	910	1092	1274	1456	1638	1820					
6.0	422	633	844	1055	1266	1477	1688	1899						
6.5	482	723	964	1205	1446	1687	1928							
7.0	550	825	1100	1375	1650	1925								
7.5	618	927	1236	1545	1854									
8.0	690	1035	1380	1725										
8.5	764	1146	1528	1910										
9.0	845	1268	1690											
9.5	924	1386	1848											
10.0	1010	1515												

Reference - SCS Technical Release No. 35 (Z=?, n=0.040, L=100 Ft.)

TABLE 5 VALUES OF C IN THE FORMULA $Q = CLh^{3/2}$

*Height of Weir h	Breadth of weir in feet					
	3.25	4.00	5.00	6.00	10.00	15.00
1.0	2.65	2.67	2.68	2.68	2.68	2.63
1.2	2.65	2.67	2.66	2.67	2.69	2.64
1.4	2.64	2.65	2.65	2.65	2.67	2.64
1.6	2.66	2.66	2.65	2.65	2.64	2.63
1.8	2.66	2.66	2.65	2.65	2.64	2.63
2.0	2.71	2.68	2.65	2.65	2.64	2.63
2.5	2.79	2.72	2.67	2.66	2.64	2.63
3.0	2.77	2.73	2.66	2.66	2.64	2.63
3.5	2.92	2.76	2.68	2.67	2.64	2.63
4.0	3.00	2.79	2.70	2.69	2.64	2.63
4.5	3.21	2.88	2.74	2.72	2.64	2.63
5.0	3.26	3.07	2.79	2.76	2.64	2.63
5.5	3.32	3.32	2.88	2.85	2.64	2.63

*h = Planned height of spillway minus 0.5 feet.

TABLE 6

THREE-HALVES POWERS OF NUMBERS

No.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
1.5	1.837	1.856	1.874	1.892	1.911	1.930	1.948	1.967	1.986	2.005
1.6	2.024	2.043	2.062	2.081	2.100	2.120	2.139	2.158	2.178	2.197
1.7	2.216	2.236	2.256	2.276	2.295	2.315	2.335	2.355	2.375	2.395
1.8	2.415	2.435	2.455	2.476	2.496	2.516	2.537	2.557	2.578	2.598
1.9	2.619	2.640	2.660	2.681	2.702	2.723	2.744	2.765	2.786	2.807
2.0	2.828	2.850	2.871	2.892	2.914	2.935	2.957	2.978	3.000	3.022
2.1	3.043	3.065	3.087	3.109	3.131	3.153	3.174	3.197	3.219	3.241
2.2	3.263	3.285	3.308	3.330	3.352	3.375	3.398	3.420	3.443	3.465
2.3	3.488	3.511	3.534	3.557	3.580	3.602	3.626	3.649	3.672	3.695
2.4	3.718	3.741	3.765	3.788	3.811	3.835	3.858	3.882	3.906	3.929
2.5	3.953	3.977	4.000	4.024	4.048	4.072	4.096	4.120	4.144	4.168
2.6	4.192	4.217	4.241	4.265	4.290	4.314	4.338	4.363	4.387	4.412
2.7	4.437	4.461	4.486	4.511	4.536	4.560	4.585	4.610	4.635	4.660
2.8	4.685	4.710	4.736	4.761	4.786	4.811	4.837	4.862	4.888	4.913
2.9	4.938	4.964	4.990	5.015	5.041	4.067	4.093	5.118	5.144	5.170
3.0	5.196	5.222	5.248	5.274	5.300	5.327	5.353	5.379	5.404	5.432
3.1	5.458	5.481	5.511	5.538	5.564	5.591	5.617	5.644	5.671	5.698
3.2	5.724	5.751	5.778	5.805	5.832	5.859	5.886	5.913	5.940	5.968
3.3	5.995	6.022	6.049	6.077	6.104	6.132	6.159	6.186	6.214	6.242
3.4	6.269	6.297	6.325	6.352	6.380	6.408	6.436	6.464	6.492	6.520
3.5	6.548	6.576	6.604	6.632	6.660	6.689	6.717	6.745	6.774	6.802
3.6	6.830	6.859	6.888	6.916	6.945	6.973	7.002	7.031	7.060	7.088
3.7	7.117	7.146	7.175	7.204	7.233	7.262	7.291	7.320	7.349	6.378
3.8	7.408	7.437	7.466	7.496	7.525	7.554	7.584	7.613	7.643	7.672
3.9	7.702	7.732	7.761	7.791	7.821	7.850	7.880	7.910	7.940	7.970

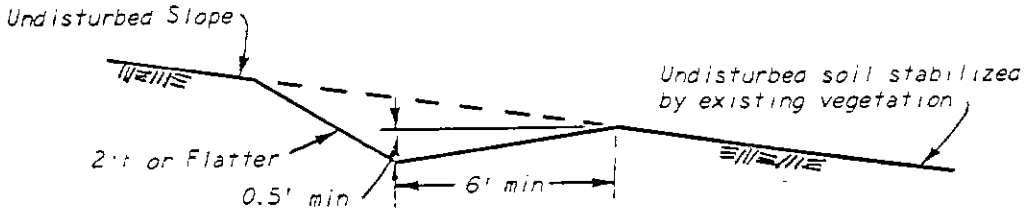
TABLE 6

THREE-HALVES POWERS OF NUMBERS

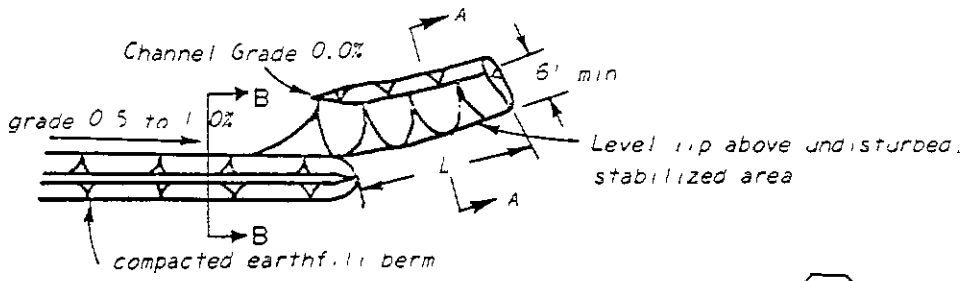
No.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4.0	8.000	8.030	8.060	8.090	8.120	8.150	8.181	8.211	8.241	8.272
4.1	8.302	8.332	8.363	8.393	8.424	8.454	8.485	8.515	8.546	8.577
4.2	8.607	8.638	8.669	8.700	8.731	8.762	8.793	8.824	8.855	8.886
4.3	8.917	8.948	8.979	9.010	9.041	9.073	9.104	9.135	9.167	9.198
4.4	9.230	9.261	9.292	9.324	9.356	9.387	9.419	9.451	9.482	9.514
4.5	9.546	9.578	9.610	9.642	9.674	9.706	9.738	9.770	9.802	9.834
4.6	9.866	9.898	9.930	9.963	9.995	10.03	10.06	10.09	10.12	10.16
4.7	10.19	10.22	10.25	10.29	10.32	10.35	10.39	10.42	10.45	10.48
4.8	10.52	10.55	10.58	10.62	10.65	10.68	10.71	10.75	10.78	10.81
4.9	10.85	10.88	10.91	10.95	10.98	11.01	11.05	11.08	11.11	11.15
5.0	11.18	11.21	11.25	11.28	11.31	11.35	11.38	11.42	11.45	11.48
5.1	11.52	11.55	11.59	11.62	11.65	11.69	11.72	11.76	11.79	11.82
5.2	11.86	11.89	11.93	11.96	11.99	12.03	12.06	12.10	12.13	12.17
5.3	12.20	12.24	12.27	12.31	12.34	12.37	12.41	12.44	12.48	12.51
5.4	12.55	12.58	12.62	12.65	12.69	12.72	12.76	12.79	12.83	12.86
5.5	12.90	12.93	12.97	13.00	13.04	13.07	13.11	13.15	13.18	13.22
5.6	13.25	13.29	13.32	13.36	13.39	13.43	13.47	13.50	13.54	13.57
5.7	13.61	13.64	13.68	13.72	13.75	13.79	13.82	13.86	13.90	13.93
5.8	13.97	14.00	14.01	14.08	14.11	14.15	14.19	14.22	14.26	14.29
5.9	14.33	14.37	14.40	14.44	14.48	14.51	14.55	14.59	14.62	14.66
6.0	14.70	14.73	14.77	14.81	14.84	14.88	14.92	14.95	14.99	15.03
6.1	15.07	15.10	15.14	15.18	15.21	14.25	15.29	15.33	15.36	15.40
6.2	15.44	15.48	15.51	15.55	15.59	15.62	15.66	15.70	15.74	15.78
6.3	15.81	15.85	15.89	15.93	15.96	16.00	16.04	16.08	16.12	16.15
6.4	16.19	16.23	16.27	16.30	16.34	16.38	16.42	16.46	16.50	16.53

TABLE 7

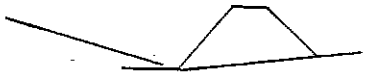
LEVEL SPREADER



SECTION A-A



PLAN VIEW



SECTION B-B

Table

Designed Q (cfs)	Minimum Length ("L" in Feet)
up to 10	15
11 to 20	20
21 to 30	28
31 to 40	36
41 to 50	44

General Notes:

1. All drawings Not to Scale.
   Construct level lip on zero percent grade to insure uniform spreading of storm runoff (converting channel flow to sheet flow).
2. Level spreaders must be constructed on undisturbed soil (not on fill).
3. Entrance to spreader must be graded in a manner to insure that runoff enters directly onto the zero percent graded channel.
4. Storm runoff converted to sheet flow must outlet onto areas already stabilized by existing vegetation.
5. Periodic inspection and maintenance must be provided to insure intended purpose is accomplished.

TRAPEZOID AND TRIANGULAR SHAPED DIVERSION DITCH PROPORTIONING

TABLE 8

NO.	SIDE SLOPES	BOT. WIDTH B	DEPTH H	TOP WIDTH W	AREA A (ft^2)
D-1A	1½ : 1	2'-0"	1'-0"	5'-0"	3.50
D-1B	2 : 1	2'-0"	1'-0"	6'-0"	4.00
D-1C	3 : 1	2'-0"	1'-0"	8'-0"	5.00
D-2A	1½ : 1	3'-0"	1'-6"	7'-6"	7.88
D-2B	2 : 1	3'-0"	1'-6"	9'-0"	9.00
D-2C	3 : 1	3'-0"	1'-6"	12'-0"	11.25
D-3A	1½ : 1	3'-0"	2'-0"	9'-0"	12.00
D-3B	2 : 1	3'-0"	2'-0"	11'-0"	14.00
D-3C	3 : 1	3'-0"	2'-0"	15'-0"	18.00
D-4A	1½ : 1	4'-0"	3'-0"	13'-0"	25.50
D-4B	2 : 1	4'-0"	3'-0"	16'-0"	30.00
D-4C	3 : 1	4'-0"	3'-0"	22'-0"	39.00
D-5A	2 : 1	—	1'-0"	4'-0"	2.00
D-5B	3 : 1	—	1'-0"	6'-0"	3.00
D-6A	2 : 1	—	2'-0"	8'-0"	8.00
D-6B	3 : 1	—	2'-0"	12'-0"	12.00
D-7A	2 : 1	—	3'-0"	12'-0"	18.00
D-7B	3 : 1	—	3'-0"	18'-0"	27.00

TABLE 9

PARABOLIC WATERWAY DESIGN

GRADE %	Q cfs	V = 2.0		V = 2.5		V = 3.0		V = 3.5		V = 4.0		V = 4.5		V = 5.0		V = 5.5		V = 6.0	
		T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D
.25	15																		
	20																		
	25	10	2.4																
	30	11	2.3																
	35	13	2.3																
	40	15	2.3	10	2.7														
	45	17	2.2	12	2.6														
	50	19	2.2	13	2.6														
	55	20	2.2	14	2.6														
	60	22	2.2	15	2.5														
	65	24	2.2	17	2.5														
	70	26	2.2	18	2.5	13	3.1												
	75	28	2.2	19	2.5	13	3.0												
	80	29	2.2	20	2.5	14	3.0												
	90	33	2.2	23	2.5	16	3.0												
	100	38	2.2	25	2.5	18	3.0												
.50	15	9	1.6																
	20	11	1.6																
	25	14	1.6	9	1.9														
	30	17	1.6	11	1.9	8	2.2												
	35	20	1.6	12	1.9	9	2.1												
	40	22	1.6	14	1.8	11	2.1												
	45	25	1.5	16	1.8	12	2.0												
	50	28	1.5	18	1.8	13	2.0	10	2.4										
	55	31	1.5	19	1.8	15	2.0	11	2.4										
	60	33	1.5	21	1.8	16	2.0	11	2.4										
	65	36	1.5	23	1.8	17	2.0	12	2.4										
	70	39	1.5	24	1.8	18	2.0	13	2.3										
	75	42	1.5	26	1.8	20	2.0	14	2.3	11	2.7								
	80	44	1.5	28	1.8	21	2.0	15	2.3	12	2.7								
	90	50	1.5	31	1.8	24	2.0	17	2.3	13	2.7								
	100	55	1.5	35	1.8	26	2.0	19	2.3	15	2.6	12	3.0						

Q = Flow in Cubic Feet per second V = Velocity in Feet per Second T = Top Width in Feet
D = Depth in Feet

TABLE 9

PARABOLIC WATERWAY DESIGN

GRADE %	Q cfs	V = 2.0 T	V = 2.0 D	V = 2.5 T	V = 2.5 D	V = 3.0 T	V = 3.0 D	V = 3.5 T	V = 3.5 D	V = 4.0 T	V = 4.0 D	V = 4.5 T	V = 4.5 D	V = 5.0 T	V = 5.0 D	V = 5.5 T	V = 5.5 D	V = 6.0 T	V = 6.0 D
.75	15	12	1.3	7	1.6														
	20	16	1.3	9	1.5														
	25	19	1.3	11	1.5	8	1.7												
	30	23	1.3	13	1.5	10	1.7	8	1.9										
	35	27	1.3	15	1.5	11	1.7	9	1.9										
	40	31	1.3	18	1.5	13	1.7	10	1.9										
	45	35	1.3	20	1.5	14	1.7	11	1.8										
	50	38	1.3	22	1.5	16	1.6	13	1.8	9	2.2								
	55	42	1.3	24	1.5	18	1.6	14	1.8	10	2.1								
	60	46	1.3	26	1.5	19	1.6	15	1.8	11	2.1								
	65	50	1.3	28	1.5	21	1.6	16	1.8	12	2.1	10	2.1						
	70	53	1.3	30	1.5	22	1.6	17	1.8	13	2.1	11	2.4						
	75	57	1.3	33	1.5	24	1.6	19	1.8	14	2.1	11	2.3						
	80	61	1.3	35	1.5	25	1.6	20	1.8	15	2.1	12	2.3						
	90	68	1.3	39	1.5	28	1.6	22	1.8	16	2.1	13	2.3	11	2.6				
	100	76	1.3	43	1.5	32	1.6	25	1.8	18	2.1	15	2.3	12	2.6				
1.00	15	13	1.1	8	1.3														
	20	18	1.1	11	1.3	8	1.5												
	25	22	1.1	14	1.3	9	1.5	8	1.6										
	30	27	1.1	17	1.3	11	1.5	9	1.6										
	35	31	1.1	19	1.3	13	1.5	11	1.6	8	1.8								
	40	35	1.1	22	1.3	15	1.4	12	1.6	9	1.8								
	45	40	1.1	25	1.3	17	1.5	13	1.6	10	1.8								
	50	44	1.1	28	1.3	19	1.4	15	1.6	11	1.8	9	2.0						
	55	48	1.1	30	1.3	20	1.4	16	1.5	12	1.8	10	2.0						
	60	53	1.1	33	1.3	22	1.4	18	1.5	14	1.7	10	2.0						
	65	57	1.1	36	1.3	24	1.4	19	1.5	15	1.7	11	2.0	9	2.2				
	70	61	1.1	38	1.3	26	1.4	21	1.5	16	1.7	12	2.0	10	2.2				
	75	66	1.1	41	1.3	28	1.4	22	1.5	17	1.7	13	2.0	11	2.2				
	80	70	1.1	44	1.3	29	1.4	24	1.5	18	1.7	14	2.0	11	2.2				
	90	79	1.1	49	1.3	33	1.4	27	1.5	20	1.7	15	1.9	13	2.2	11	2.4		
	100	87	1.1	55	1.3	37	1.4	29	1.5	22	1.7	17	1.9	14	2.2	12	2.4		

Q = Flow in Cubic Feet per second V = Velocity in Feet per Second T = Top Width in Feet
D = Depth in Feet

TABLE 9

PARABOLIC WATERWAY DESIGN

GRADE %	Q cfs	V = 2.0		V = 2.5		V = 3.0		V = 3.5		V = 4.0		V = 4.5		V = 5.0		V = 5.5		V = 6.0	
		T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D
1.25	15	15	1.0	10	1.2	7	1.4												
	20	20	1.0	13	1.1	9	1.3	7	1.5										
	25	25	1.0	16	1.1	11	1.3	8	1.5	7	1.6								
	30	31	1.0	19	1.1	13	1.3	10	1.4	8	1.6								
	35	36	1.0	23	1.1	15	1.3	11	1.4	9	1.6	7	1.8						
	40	41	1.0	26	1.1	17	1.3	13	1.4	11	1.6	8	1.8						
	45	46	1.0	29	1.1	19	1.3	14	1.4	12	1.5	9	1.7						
	50	50	1.0	32	1.1	21	1.3	16	1.4	13	1.5	10	1.7	8	2.0				
	55	55	1.0	35	1.1	23	1.3	18	1.4	14	1.5	11	1.7	9	1.9				
	60	60	1.0	38	1.1	26	1.3	19	1.4	16	1.5	12	1.7	10	1.9				
	65	65	1.0	41	1.1	28	1.3	21	1.4	17	1.5	13	1.7	11	1.9	9	2.2		
	70	70	1.0	45	1.1	30	1.3	22	1.4	18	1.5	14	1.7	11	1.9	9	2.2		
	75	75	1.0	48	1.1	32	1.3	24	1.4	19	1.5	15	1.7	12	1.9	10	2.1		
	80	80	1.0	51	1.1	34	1.3	25	1.4	21	1.5	16	1.7	13	1.9	11	2.1	9	2.3
	90	90	1.0	57	1.1	38	1.3	29	1.4	23	1.5	18	1.7	15	1.9	12	2.1	10	2.3
	100	100	1.0	63	1.1	42	1.3	32	1.4	26	1.5	20	1.7	16	1.9	13	2.1	11	2.3
1.50	15	17	0.9	11	1.1	8	1.2												
	20	23	0.9	15	1.0	10	1.2	7	1.4	6	1.5								
	25	28	0.9	19	1.0	12	1.2	9	1.4	7	1.5								
	30	34	0.9	22	1.0	15	1.2	10	1.3	8	1.5	7	1.6						
	35	40	0.9	26	1.0	17	1.1	12	1.3	10	1.4	8	1.6						
	40	45	0.9	30	1.0	20	1.2	14	1.3	11	1.4	9	1.6	7	1.8				
	45	51	0.9	33	1.0	22	1.1	15	1.3	12	1.4	10	1.5	8	1.8				
	50	56	0.9	37	1.0	25	1.1	17	1.3	14	1.4	11	1.5	9	1.8				
	55	62	0.9	41	1.0	27	1.1	19	1.3	15	1.4	12	1.5	10	1.7	8	1.9		
	60	67	0.9	44	1.0	30	1.1	20	1.3	16	1.4	14	1.5	11	1.7	9	1.9		
	65	73	0.9	48	1.0	32	1.1	22	1.3	18	1.4	15	1.5	11	1.7	10	1.9		
	70	78	0.9	51	1.0	34	1.1	24	1.3	19	1.4	16	1.5	12	1.7	10	1.9	9	2.1
	75	83	0.9	55	1.0	37	1.1	25	1.3	21	1.4	17	1.5	13	1.7	11	1.9	9	2.1
	80	89	0.9	59	1.0	39	1.1	27	1.3	22	1.4	18	1.5	14	1.7	12	1.9	10	2.1
	90	100	0.9	66	1.0	44	1.1	30	1.3	25	1.4	20	1.5	16	1.7	13	1.9	11	2.0
	100	111	0.9	73	1.0	49	1.1	33	1.3	27	1.4	22	1.5	17	1.7	15	1.9	12	2.0

Q = Flow in Cubic Feet per second V = Velocity in Feet per Second T = Top Width in Feet
D = Depth in Feet

TABLE 9

PARABOLIC WATERWAY DESIGN

GRADE	Q	V = 2.0		V = 2.5		V = 3.0		V = 3.5		V = 4.0		V = 4.5		V = 5.0		V = 5.5		V = 6.0	
%	cfs	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D
1.75	15	19	0.9	12	1.0	9	1.1	6	1.3										
	20	25	0.9	16	1.0	11	1.1	8	1.3	7	1.3								
	25	31	0.9	20	1.0	14	1.1	10	1.2	8	1.3	7	1.5						
	30	37	0.9	24	1.0	17	1.1	12	1.2	10	1.3	8	1.4						
	35	43	0.9	28	1.0	20	1.1	13	1.2	11	1.3	9	1.4	7	1.6				
	40	49	0.9	32	1.0	22	1.1	15	1.2	13	1.3	10	1.4	8	1.6				
	45	55	0.9	36	1.0	25	1.1	17	1.2	14	1.3	12	1.4	9	1.6	8	1.7		
	50	61	0.9	40	1.0	28	1.1	19	1.2	16	1.3	13	1.4	10	1.4	8	1.7		
	55	67	0.9	44	1.0	31	1.1	21	1.2	17	1.3	14	1.4	11	1.5	9	1.7	8	1.9
	60	73	0.9	48	1.0	33	1.1	23	1.2	19	1.3	15	1.4	12	1.5	10	1.7	8	1.9
	65	78	0.9	52	1.0	36	1.1	25	1.2	21	1.3	17	1.4	13	1.5	11	1.7	9	1.9
	70	84	0.9	56	1.0	39	1.1	27	1.2	22	1.3	18	1.4	14	1.5	12	1.7	10	1.9
	75	90	0.9	59	1.0	42	1.1	29	1.2	24	1.3	19	1.4	15	1.5	12	1.7	10	1.9
	80	96	0.9	63	1.0	44	1.1	30	1.2	25	1.3	20	1.4	16	1.5	13	1.7	11	1.9
	90	108	0.9	71	1.0	50	1.1	34	1.2	28	1.3	23	1.4	18	1.5	15	1.7	12	1.9
	100	120	0.9	79	1.0	55	1.1	38	1.2	31	1.3	25	1.4	20	1.5	16	1.7	13	1.9
2.00	15	21	0.8	13	0.9	9	1.0	7	1.2										
	20	28	0.8	17	0.9	12	1.0	9	1.1	7	1.3	5	1.4						
	25	35	0.8	21	0.9	15	1.0	11	1.1	8	1.3	7	1.4						
	30	41	0.8	26	0.9	18	1.0	13	1.1	10	1.2	8	1.3	7	1.5				
	35	48	0.8	30	0.9	22	1.0	15	1.1	11	1.2	9	1.3	8	1.5				
	40	55	0.8	34	0.9	25	1.0	18	1.1	13	1.2	11	1.3	9	1.5	7	1.7		
	45	62	0.8	38	0.9	28	1.0	20	1.1	14	1.2	12	1.3	10	1.4	8	1.6		
	50	68	0.8	42	0.9	31	1.0	22	1.1	16	1.2	13	1.3	11	1.4	9	1.6	8	1.7
	55	75	0.8	46	0.9	34	1.0	24	1.1	17	1.2	14	1.3	12	1.4	10	1.6	8	1.7
	60	82	0.8	51	0.9	37	1.0	26	1.1	19	1.2	16	1.3	13	1.4	11	1.6	9	1.7
	65	88	0.8	55	0.9	40	1.0	28	1.1	21	1.2	17	1.3	14	1.4	11	1.6	10	1.7
	70	95	0.8	59	0.9	43	1.0	30	1.1	22	1.2	18	1.3	15	1.4	12	1.6	10	1.7
	75	101	0.8	63	0.9	46	1.0	32	1.1	24	1.2	20	1.3	16	1.4	13	1.6	11	1.7
	80	108	0.8	67	0.9	48	1.0	35	1.1	25	1.2	21	1.3	17	1.4	14	1.6	12	1.7
	90	121	0.8	75	0.9	54	1.0	39	1.1	28	1.2	23	1.3	19	1.4	16	1.6	13	1.7
	100	134	0.8	83	0.9	60	1.0	43	1.1	31	1.2	26	1.3	21	1.4	17	1.6	15	1.7

Q = Flow in Cubic Feet per second V = Velocity in Feet per Second T = Top Width in Feet
D = Depth in Feet

TABLE 9

PARABOLIC WATERWAY DESIGN

GRADE %	Q cfs	V = 2.0		V = 2.5		V = 3.0		V = 3.5		V = 4.0		V = 4.5		V = 5.0		V = 5.5		V = 6.0	
		T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D
3.0	15	24	0.7	16	0.8	11	0.8	9	0.9	7	1.0	5	1.2						
	20	31	0.7	22	0.8	15	0.8	12	0.9	9	1.0	7	1.1	6	1.2				
	25	39	0.7	27	0.8	19	0.8	15	0.9	11	1.0	8	1.0	7	1.2	6	1.3		
	30	47	0.7	32	0.8	23	0.8	17	0.9	13	1.0	10	1.1	9	1.2	7	1.2	6	1.4
	35	55	0.7	38	0.8	26	0.8	20	0.9	15	1.0	11	1.1	10	1.1	8	1.2	7	1.4
	40	62	0.7	43	0.8	30	0.8	23	0.9	17	1.0	13	1.1	12	1.1	9	1.2	8	1.4
	45	70	0.7	48	0.8	34	0.8	26	0.9	19	1.0	15	1.1	13	1.1	11	1.2	9	1.3
	50	77	0.7	54	0.8	38	0.8	29	0.9	21	1.0	16	1.1	14	1.1	12	1.2	9	1.3
	55	85	0.7	59	0.8	41	0.8	32	0.9	23	1.0	18	1.1	16	1.1	13	1.2	10	1.4
	60	93	0.7	64	0.8	45	0.8	35	0.9	26	1.0	19	1.1	17	1.1	14	1.2	11	1.3
	65	100	0.7	70	0.8	49	0.8	37	0.9	28	1.0	21	1.1	19	1.1	15	1.2	12	1.3
	70	107	0.7	74	0.8	52	0.8	40	0.9	30	1.0	22	1.1	20	1.1	16	1.2	13	1.3
	75	115	0.7	79	0.8	56	0.8	43	0.9	32	1.0	24	1.1	21	1.1	18	1.2	14	1.3
	80	122	0.7	85	0.8	59	0.8	46	0.9	34	1.0	26	1.1	23	1.1	19	1.2	15	1.3
	90	137	0.7	95	0.8	67	0.8	51	0.9	38	1.0	29	1.1	26	1.1	21	1.2	17	1.3
	100	152	0.7	105	0.8	74	0.8	57	0.9	42	1.0	32	1.1	28	1.1	23	1.2	19	1.3
4.0	15	28	0.6	20	0.7	14	0.7	10	0.8	8	0.9	6	0.9	5	1.1				
	20	37	0.6	27	0.7	19	0.7	14	0.8	11	0.8	8	0.9	6	1.0	6	1.1		
	25	46	0.6	33	0.7	23	0.7	17	0.8	13	0.8	11	0.9	8	1.0	7	1.1	6	1.2
	30	55	0.6	40	0.7	28	0.7	20	0.8	16	0.8	13	0.9	10	1.0	8	1.1	7	1.2
	35	64	0.6	46	0.7	32	0.7	24	0.8	18	0.8	15	0.9	11	1.0	10	1.1	8	1.2
	40	73	0.6	52	0.7	37	0.7	27	0.8	21	0.8	17	0.9	13	1.0	11	1.0	9	1.1
	45	82	0.6	59	0.7	41	0.7	30	0.8	23	0.8	19	0.9	14	1.0	12	1.1	10	1.1
	50	91	0.6	65	0.7	46	0.7	34	0.8	26	0.8	21	0.9	16	1.0	14	1.1	11	1.1
	55	100	0.6	72	0.7	50	0.7	37	0.8	29	0.8	23	0.9	17	1.0	15	1.0	12	1.1
	60	109	0.6	78	0.7	55	0.7	40	0.8	31	0.8	25	0.9	19	1.0	16	1.0	13	1.1
	65	117	0.6	84	0.7	59	0.7	44	0.8	34	0.8	27	0.9	20	1.0	18	1.0	14	1.1
	70	126	0.6	90	0.7	63	0.7	47	0.8	36	0.8	29	0.9	22	1.0	19	1.0	15	1.1
	75	135	0.6	97	0.7	68	0.7	50	0.8	39	0.8	31	0.9	24	1.0	20	1.0	17	1.1
	80	143	0.6	103	0.7	72	0.7	53	0.8	41	0.8	33	0.9	25	1.0	21	1.0	18	1.1
	90	161	0.6	115	0.7	81	0.7	60	0.8	46	0.8	37	0.9	28	1.0	24	1.0	20	1.1
	100	178	0.6	128	0.7	90	0.7	66	0.8	51	0.8	41	0.9	31	1.0	27	1.0	22	1.1

Q = Flow in Cubic Feet per second V = Velocity in Feet per Second T = Top Width in Feet
D = Depth in Feet

TABLE 9

PARABOLIC WATERWAY DESIGN

GRADE %	Q cfs	V = 2.0		V = 2.5		V = 3.0		V = 3.5		V = 4.0		V = 4.5		V = 5.0		V = 5.5		V = 6.0	
		T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D
5.0	15	29	0.6	21	0.6	15	0.7	12	0.7	9	0.8	7	0.8	6	0.9	5	1.0		
	20	39	0.6	28	0.6	20	0.7	16	0.7	12	0.8	10	0.8	8	0.9	6	1.0	5	1.1
	25	49	0.6	35	0.6	25	0.7	20	0.7	15	0.8	12	0.8	10	0.9	8	1.0	7	1.0
	30	58	0.6	42	0.6	30	0.7	24	0.7	18	0.8	14	0.8	11	0.9	9	1.0	8	1.0
	35	68	0.6	49	0.6	35	0.7	28	0.7	21	0.8	17	0.8	13	0.9	11	0.9	9	1.0
	40	77	0.6	56	0.6	40	0.7	32	0.7	24	0.8	19	0.8	15	0.9	12	0.9	10	1.0
	45	86	0.6	63	0.6	44	0.7	36	0.7	27	0.8	21	0.8	17	0.9	14	0.9	12	1.0
	50	96	0.6	69	0.6	49	0.7	49	0.7	39	0.8	24	0.8	19	0.9	15	0.9	13	1.0
	55	105	0.6	76	0.6	54	0.7	44	0.7	33	0.8	26	0.8	21	0.9	17	0.9	14	1.0
	60	114	0.6	83	0.6	59	0.7	48	0.7	36	0.8	28	0.8	22	0.9	18	0.9	15	1.0
	65	123	0.6	89	0.6	63	0.7	52	0.7	38	0.8	31	0.8	24	0.9	19	0.9	17	1.0
	70	132	0.6	96	0.6	68	0.7	56	0.7	41	0.8	33	0.8	26	0.9	21	0.9	18	1.0
	75	142	0.6	102	0.6	73	0.7	59	0.7	44	0.8	35	0.8	28	0.9	22	0.9	19	1.0
	80	151	0.6	109	0.6	78	0.7	63	0.7	47	0.8	37	0.8	30	0.9	24	0.9	20	1.0
	90	169	0.6	122	0.6	87	0.7	71	0.7	53	0.8	42	0.8	33	0.9	27	0.9	23	1.0
	100	187	0.6	136	0.6	97	0.7	79	0.7	59	0.8	47	0.8	37	0.9	30	0.9	26	1.0
6.0	15	35	0.5	23	0.6	17	0.6	13	0.7	10	0.7	8	0.8	7	0.8	5	0.9	4	1.0
	20	46	0.5	30	0.6	22	0.6	17	0.7	13	0.7	11	0.7	9	0.8	7	0.9	6	1.0
	25	57	0.5	37	0.6	28	0.6	21	0.7	17	0.7	13	0.7	11	0.8	9	0.9	7	0.9
	30	69	0.5	45	0.6	33	0.6	25	0.7	20	0.7	16	0.7	13	0.8	10	0.9	8	0.9
	35	80	0.5	52	0.6	38	0.6	29	0.7	23	0.7	19	0.7	15	0.8	12	0.9	10	0.9
	40	91	0.5	59	0.6	44	0.6	33	0.7	26	0.7	21	0.7	17	0.8	14	0.9	11	0.9
	45	102	0.5	67	0.6	49	0.6	37	0.7	30	0.7	24	0.7	19	0.8	16	0.9	13	0.9
	50	113	0.5	74	0.6	54	0.6	42	0.7	33	0.7	26	0.7	22	0.8	17	0.9	14	0.9
	55	123	0.5	81	0.6	60	0.6	46	0.7	36	0.7	29	0.7	24	0.8	19	0.8	15	0.9
	60	134	0.5	88	0.6	65	0.6	50	0.7	39	0.7	32	0.7	26	0.8	21	0.8	17	0.9
	65	145	0.5	95	0.6	70	0.6	54	0.7	42	0.7	34	0.7	28	0.8	22	0.9	18	0.9
	70	155	0.5	102	0.6	75	0.6	58	0.7	45	0.7	37	0.7	30	0.8	24	0.9	19	0.9
	75	166	0.5	109	0.6	81	0.6	62	0.7	49	0.7	39	0.7	32	0.8	26	0.8	21	0.9
	80	176	0.5	116	0.6	86	0.6	65	0.7	52	0.7	42	0.7	34	0.8	27	0.9	22	0.9
	90	198	0.5	130	0.6	96	0.6	73	0.7	58	0.7	47	0.7	38	0.8	31	0.8	25	0.9
	100	219	0.5	144	0.6	107	0.6	81	0.7	64	0.7	52	0.7	42	0.8	34	0.9	28	0.9

Q = Flow in Cubic Feet per second V = Velocity in Feet per Second T = Top Width in Feet
D = Depth in Feet

TABLE 9

PARABOLIC WATERWAY DESIGN

GRADE %	Q cfs	V = 2.0 T	V = 2.0 D	V = 2.5 T	V = 2.5 D	V = 3.0 T	V = 3.0 D	V = 3.5 T	V = 3.5 D	V = 4.0 T	V = 4.0 D	V = 4.5 T	V = 4.5 D	V = 5.0 T	V = 5.0 D	V = 5.5 T	V = 5.5 D	V = 6.0 T	V = 6.0 D
8.0	15	37	0.5	27	0.5	19	0.5	15	0.6	12	0.6	9	0.7	8	0.8	6	0.7	5	0.8
	20	49	0.5	35	0.5	25	0.5	20	0.6	16	0.6	13	0.7	10	0.7	9	0.7	7	0.8
	25	61	0.5	44	0.5	31	0.5	25	0.6	19	0.6	16	0.7	13	0.7	11	0.7	9	0.8
	30	73	0.5	53	0.5	37	0.5	30	0.6	23	0.6	19	0.7	16	0.7	13	0.7	11	0.8
	35	85	0.5	61	0.5	43	0.5	35	0.6	27	0.6	22	0.6	18	0.7	15	0.7	12	0.8
	40	97	0.5	70	0.5	49	0.5	40	0.6	31	0.6	25	0.6	21	0.7	17	0.7	14	0.8
	45	109	0.5	78	0.5	55	0.5	45	0.6	35	0.6	28	0.6	23	0.7	19	0.7	16	0.8
	50	120	0.5	87	0.5	61	0.5	50	0.6	38	0.6	31	0.7	26	0.7	21	0.7	17	0.8
	55	132	0.5	95	0.5	67	0.5	55	0.6	42	0.6	34	0.7	28	0.7	23	0.7	19	0.8
	60	143	0.5	103	0.5	73	0.5	60	0.6	46	0.6	37	0.7	31	0.7	25	0.7	21	0.8
	65	155	0.5	111	0.5	79	0.5	65	0.6	50	0.6	40	0.7	33	0.7	27	0.7	23	0.8
	70	166	0.5	120	0.5	85	0.5	69	0.6	53	0.6	43	0.6	36	0.7	29	0.7	24	0.8
	75	177	0.5	128	0.5	91	0.5	74	0.6	57	0.6	46	0.7	38	0.7	31	0.7	26	0.8
	80	188	0.5	136	0.5	96	0.5	79	0.6	61	0.6	49	0.6	41	0.7	33	0.7	28	0.8
	90	211	0.5	152	0.5	108	0.6	88	0.6	68	0.6	55	0.7	46	0.7	37	0.7	31	0.8
	100	234	0.5	168	0.5	120	0.6	98	0.6	75	0.6	61	0.7	51	0.7	41	0.7	34	0.8
10.0	15	45	0.4	33	0.5	23	0.5	17	0.5	13	0.6	11	0.6	9	0.6	7	0.7	.6	0.7
	20	60	0.4	43	0.5	30	0.5	22	0.5	18	0.6	14	0.6	12	0.6	10	0.7	8	0.7
	25	75	0.4	54	0.5	38	0.5	28	0.5	22	0.6	18	0.6	15	0.6	12	0.7	10	0.7
	30	89	0.4	64	0.5	45	0.5	33	0.5	27	0.6	21	0.6	18	0.6	15	0.6	12	0.7
	35	104	0.4	75	0.5	53	0.5	38	0.5	31	0.6	25	0.6	21	0.6	17	0.7	14	0.7
	40	118	0.4	85	0.5	60	0.5	44	0.5	35	0.6	28	0.6	24	0.6	20	0.7	16	0.7
	45	132	0.4	95	0.5	67	0.5	49	0.5	40	0.6	32	0.6	27	0.6	22	0.7	18	0.7
	50	146	0.4	105	0.5	74	0.5	54	0.5	44	0.6	35	0.6	30	0.6	24	0.7	20	0.7
	55	160	0.4	115	0.5	82	0.5	60	0.5	48	0.6	39	0.6	32	0.6	27	0.6	22	0.7
	60	174	0.4	124	0.5	87	0.5	65	0.5	52	0.6	42	0.6	35	0.6	29	0.7	24	0.7
	65	188	0.4	135	0.5	96	0.5	70	0.5	57	0.6	45	0.6	38	0.6	32	0.7	26	0.7
	70	201	0.4	145	0.5	103	0.5	75	0.5	61	0.6	49	0.6	41	0.6	34	0.7	28	0.7
	75	215	0.4	155	0.5	110	0.5	80	0.5	65	0.6	52	0.6	44	0.6	36	0.7	30	0.7
	80	228	0.4	164	0.5	116	0.5	85	0.5	69	0.6	55	0.6	47	0.6	39	0.7	32	0.7
	90	255	0.4	184	0.5	131	0.5	96	0.5	76	0.6	62	0.6	52	0.6	43	0.7	36	0.7
	100	282	0.4	204	0.5	145	0.5	106	0.5	86	0.6	69	0.6	58	0.6	48	0.7	40	0.7

Q = Flow in Cubic Feet per second V = Velocity in Feet per Second T = Top Width in Feet

D = Depth in Feet

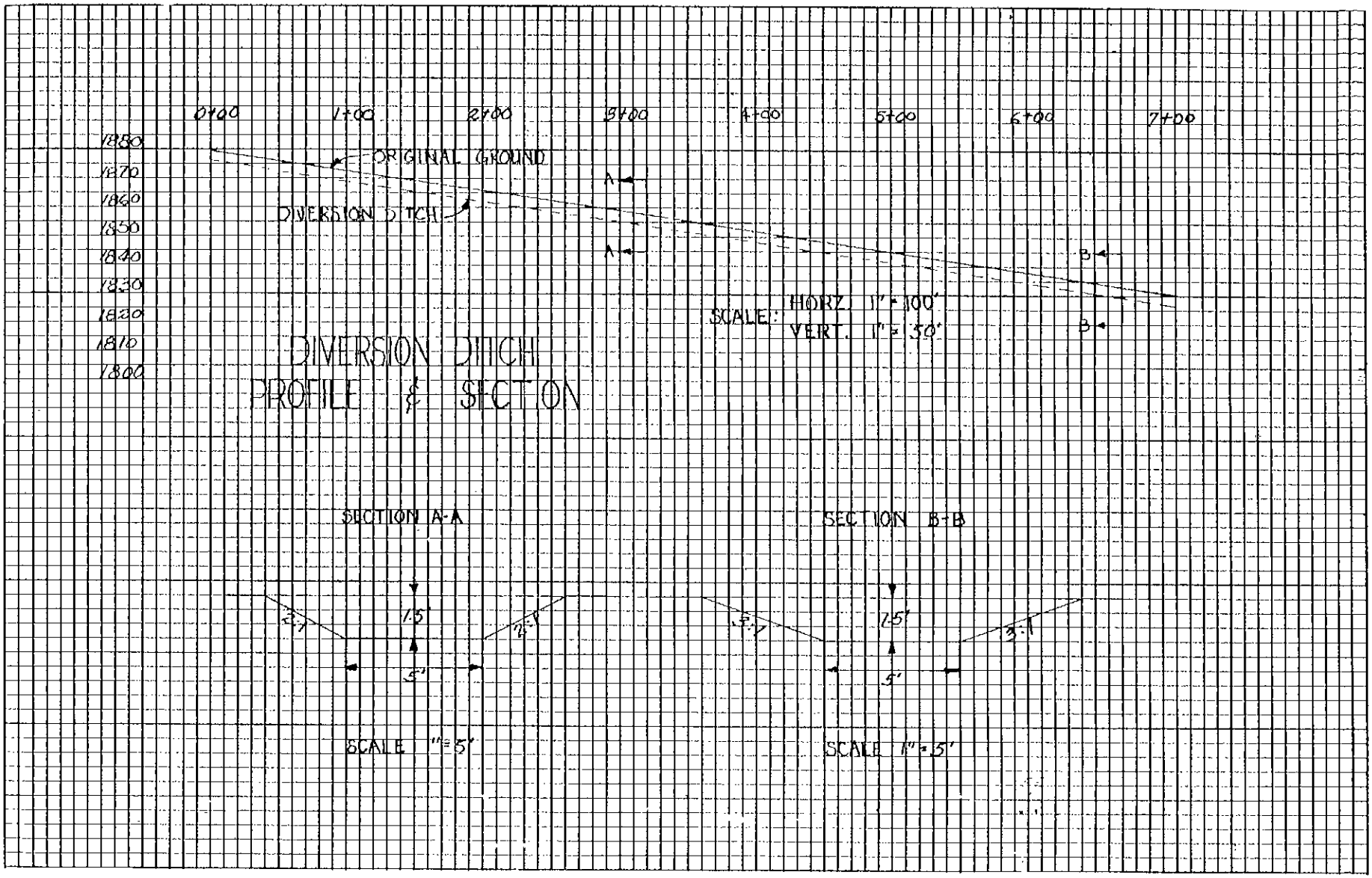
DIVERSION DESIGN COMPUTATION SHEET

LINE	STATIONS	SOIL TYPE	DRAIN AREA (AC)	REQ'D CAP. (cfs)	GRADE (%)	DIMENSIONS DEPTH (FT.)	DIMENSIONS BOTTOM (FT.)	SIDE SLOPES	AVAIL. CAP. (cfs)	VELOCITY DESIGN (ft./sec.)	VELOCITY ALLOW. (ft./sec.)

SEEDING

MATERIALS	KIND	RATE	TOTAL (lbs.)
Seed			
Fertilizer			
Lime			
Mulch			

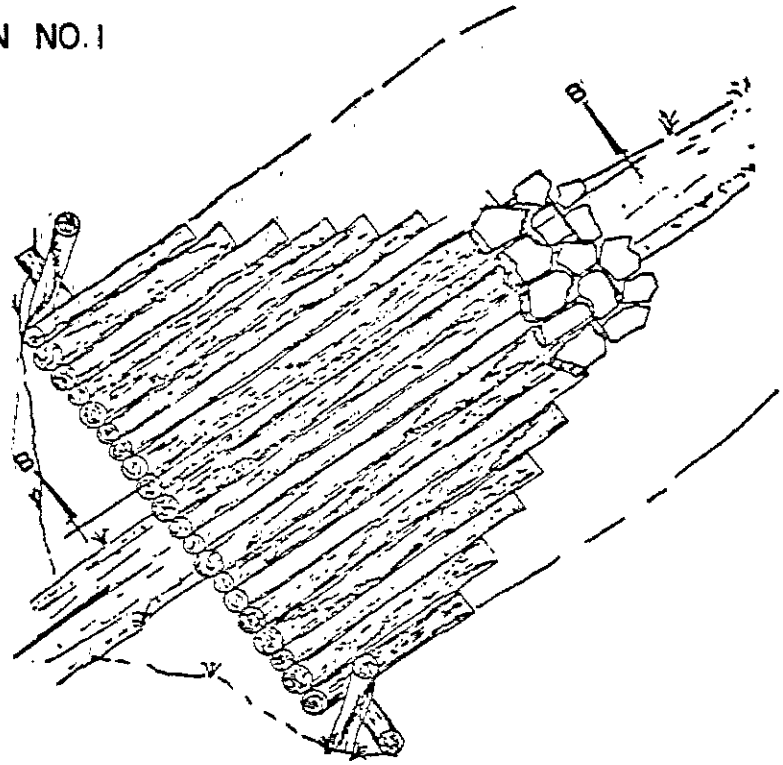
SHEET NO. 1



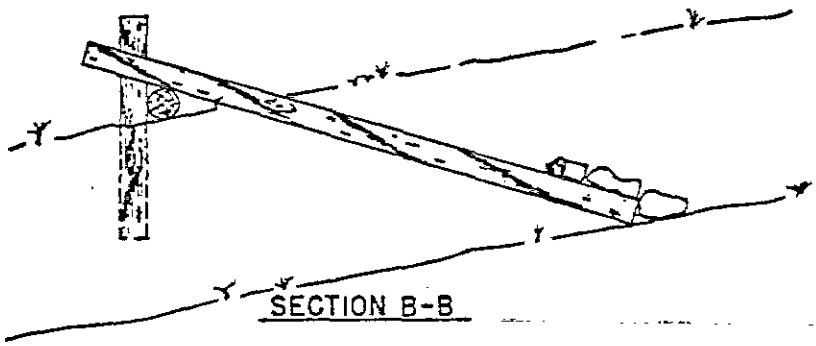
PROFILE ALONG CENTERLINE OF DIVERSION SHOWING CROSS SECTIONS

SHEET NO. 2

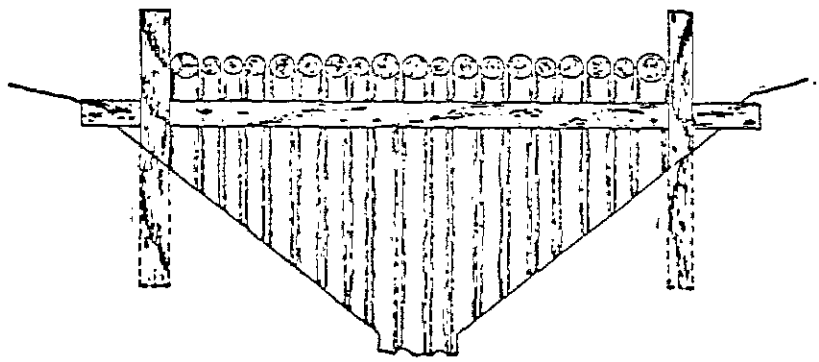
ILLUSTRATION NO. I



LOG & POLE SILT STRUCTURE

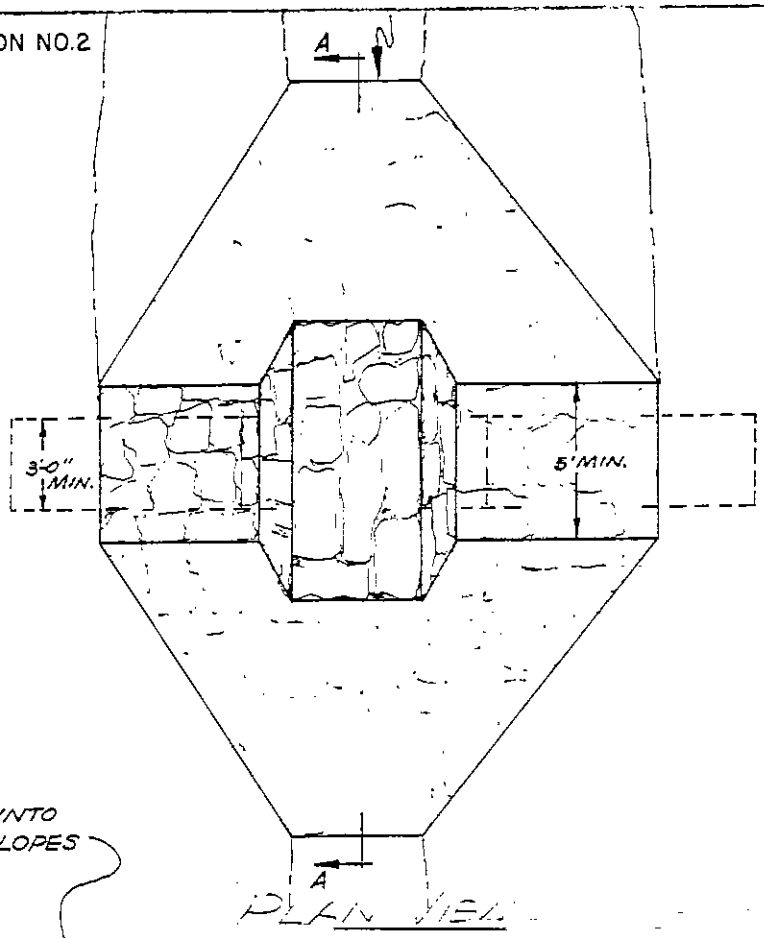


SECTION B-B



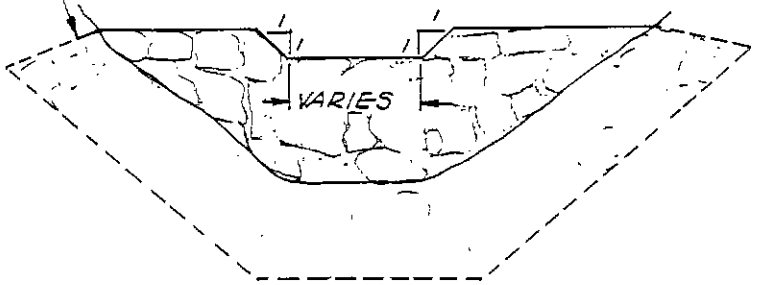
UPSTREAM VIEW

ILLUSTRATION NO.2

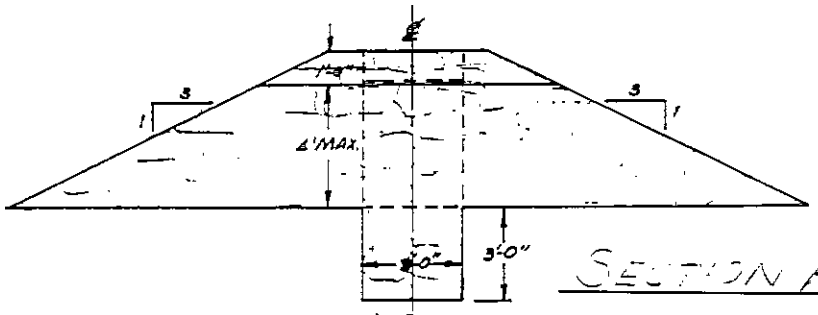


PLAN VIEW

KEY 3' INTO SIDE SLOPES

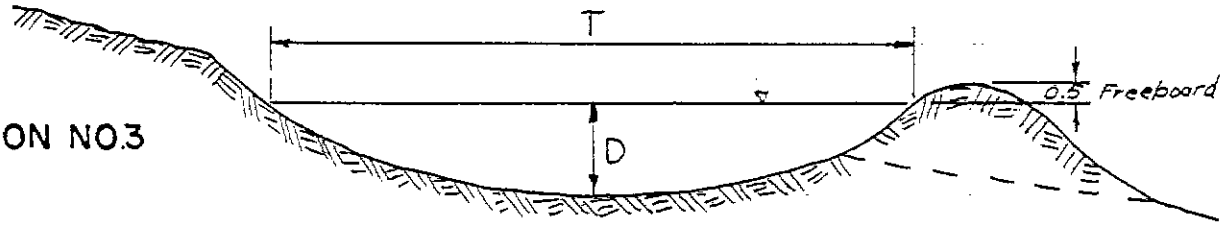


SECTION A-A

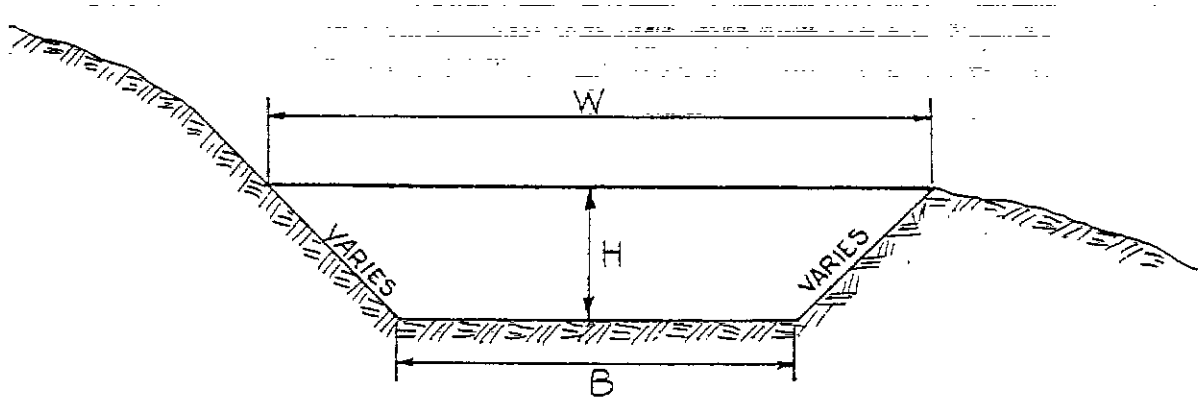


SECTION A-A

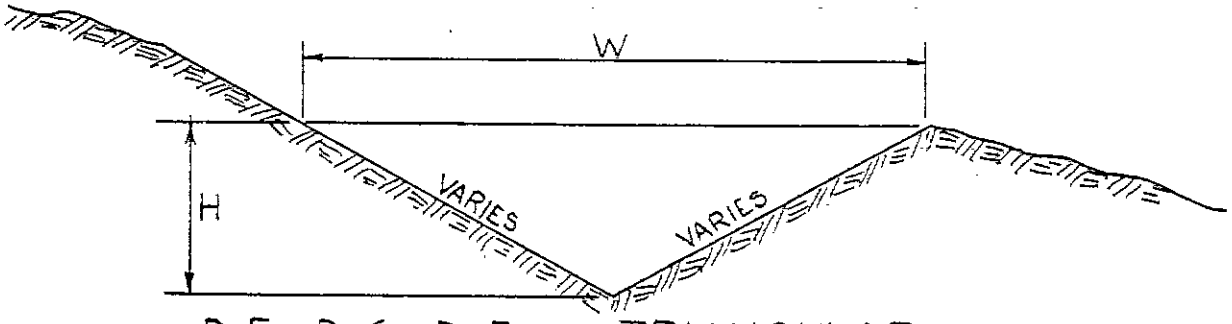
ILLUSTRATION NO.3



PARABOLIC



D-1, D-2, D-3, D-4 TRAPEZOIDAL



D-5, D-6, D-7 TRIANGULAR

APPENDIX II

SAMPLE DESIGNS OF SEDIMENT CONTROL STRUCTURES

EMBANKMENT SEDIMENT POND

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

DAM NUMBER 3

Sediment Storage Requirements

Drainage Area = 51.4 Ac. Average Land Slope = 45 %
Area Disturbed = 26.6 Ac. = 52 % of drainage area
Sediment Volume = .125 Ac. Ft./Ac. x area disturbed = 3.33Ac. Ft.
Sediment Pool Elevation = 97.1 Ft. = principal spillway crest

Principal Spillway Design

Principal Spillway Diameter = 18 In.
Type Corrugated Metal Pipe pH
Principal Spillway Length 197.0 Ft.
Principal Spillway Slope 3.0 Percent

Drop Inlet

Type Base Concrete Type Riser C.M.P.
Dimensions = 30 In. diameter of Ft.^{2}
Height of Riser (base to crest) = 12.5 Ft.
Perforated X Yes No

Drainpipe N/A

Diameter = In. Type
Length = Ft. Height of Riser Ft.

Emergency Spillway Design

Emergency Spillway Elevation = Principal Spillway Elevation + 1.5 Ft. (min.) = 97.1 + 1.5 = 98.6

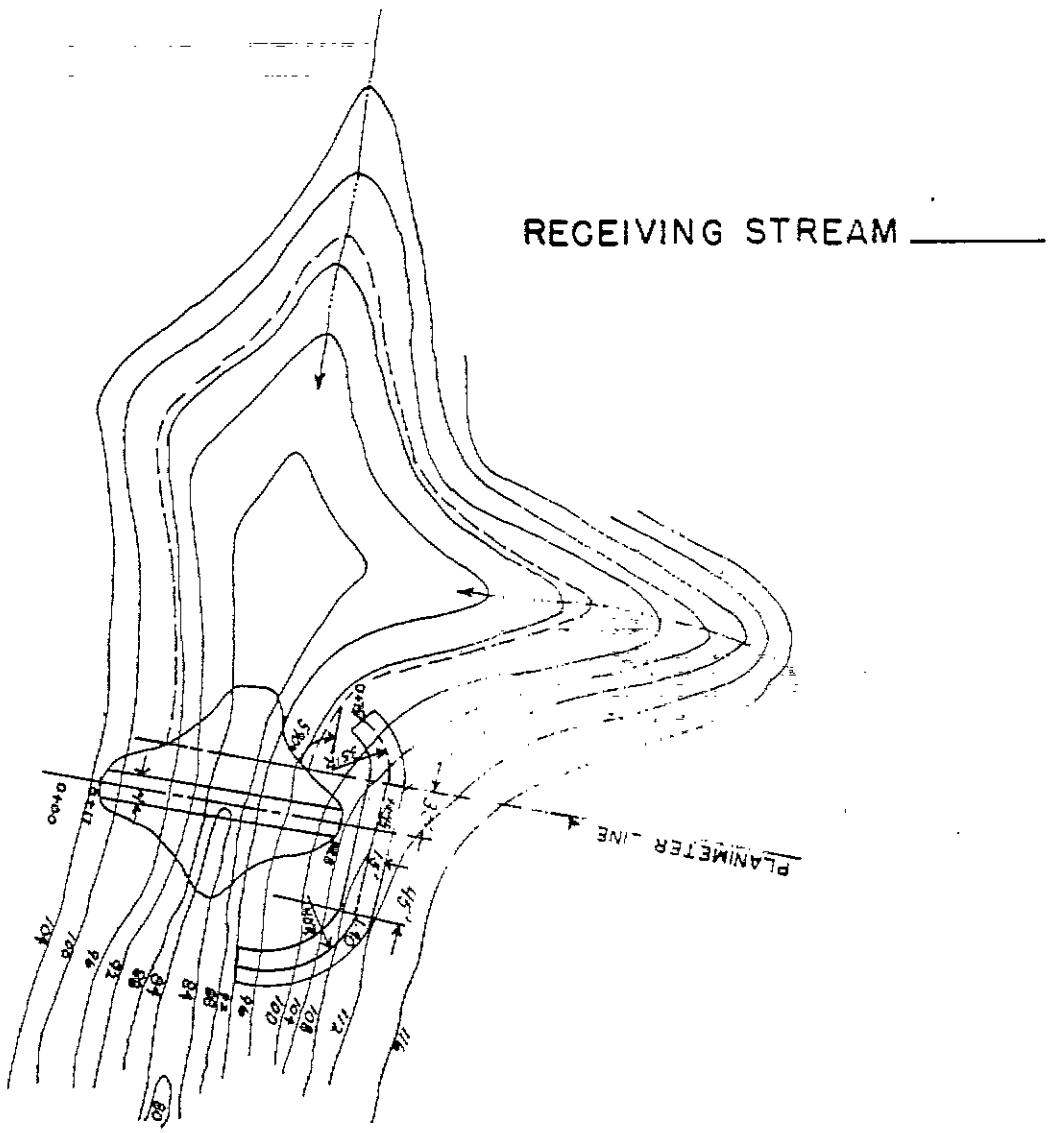
Peak Discharge (Figure 2) = 148 c.f.s. x 1.3 (slope factor) = 192.4 c.f.s.

Emergency Spillway Proportions (Table 2)

Bottom Width, b = 15 Ft.
Emergency Spillway Stage, Hp = 3.0 Ft.

$\frac{\text{Peak Discharge}}{\text{Bottom Width}} = \frac{Q}{b} =$ 12.8

Slope of Exit Channel, S_e = 2.65% (Chart 1)
Velocity in Exit Channel, V_e = 8.2 f.p.s. (Chart 1)
Spillway Material Rock Rip Allowable V_e = 12 f.p.s.
Top of Dam Elevation = Emergency Spillway Elevation + Hp + 1.0 Ft. =
98.6 + 3.0 + 1.0 = 102.6 (Settled Elevation)

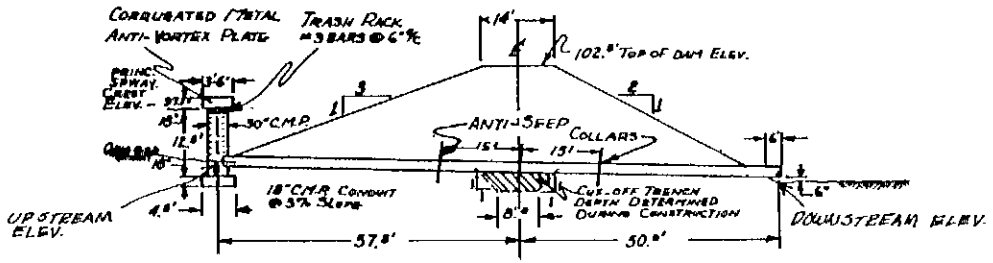


DAM NO.1

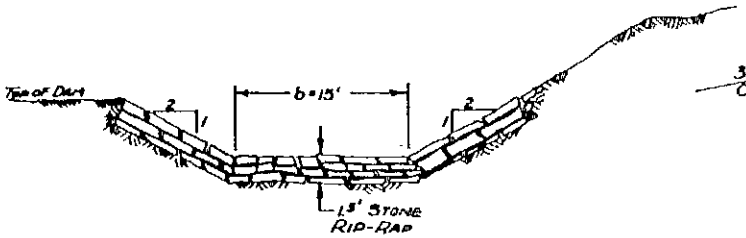
SCALE 1" = 50'

CONTOUR INTERVAL 4'

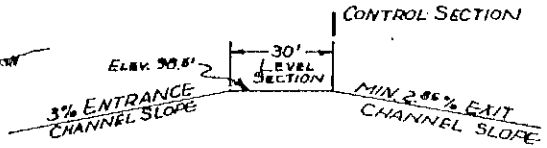
II-2



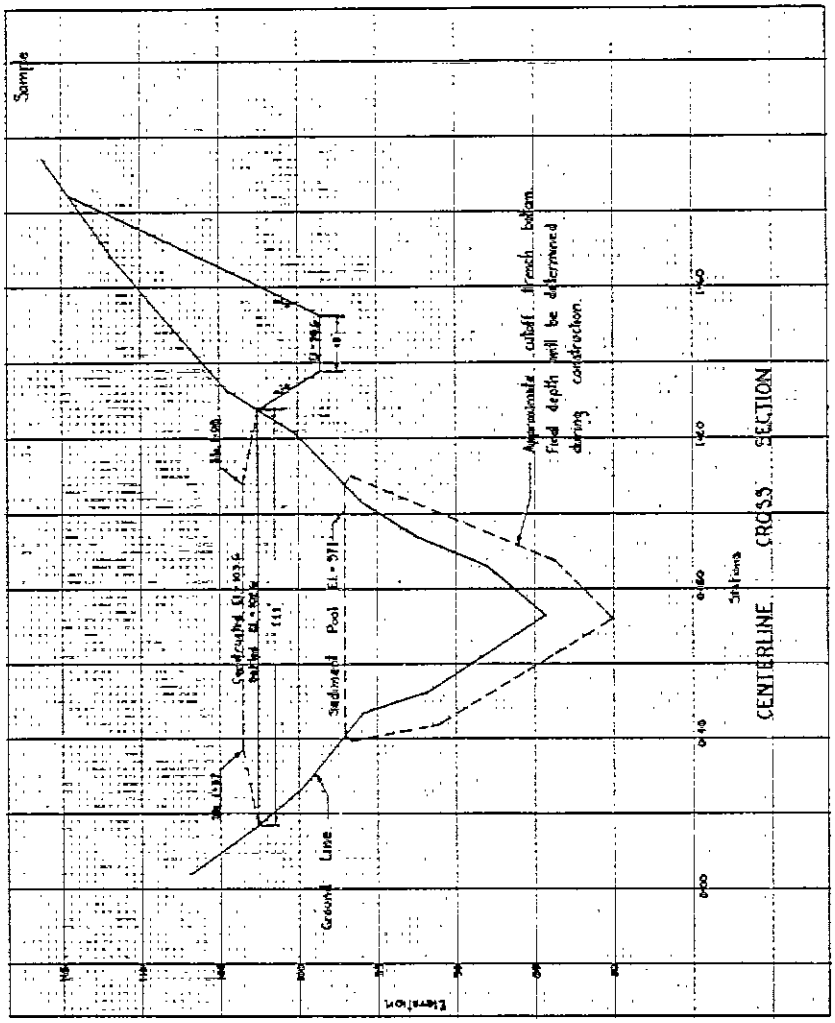
EMBANKMENT PROFILE ALONG PRINCIPAL SPILLWAY ℄



EMERGENCY SPILLWAY SECTION



EMERGENCY SPILLWAY PROFILE


Sample
Approximate cutoff trench bottom. Field depth will be determined during construction.
Sedimentation Pool El. = 971
Ground Line
CENTERLINE CROSS SECTION

Sample

STAGE-AREA-STORAGE COMPUTATIONS

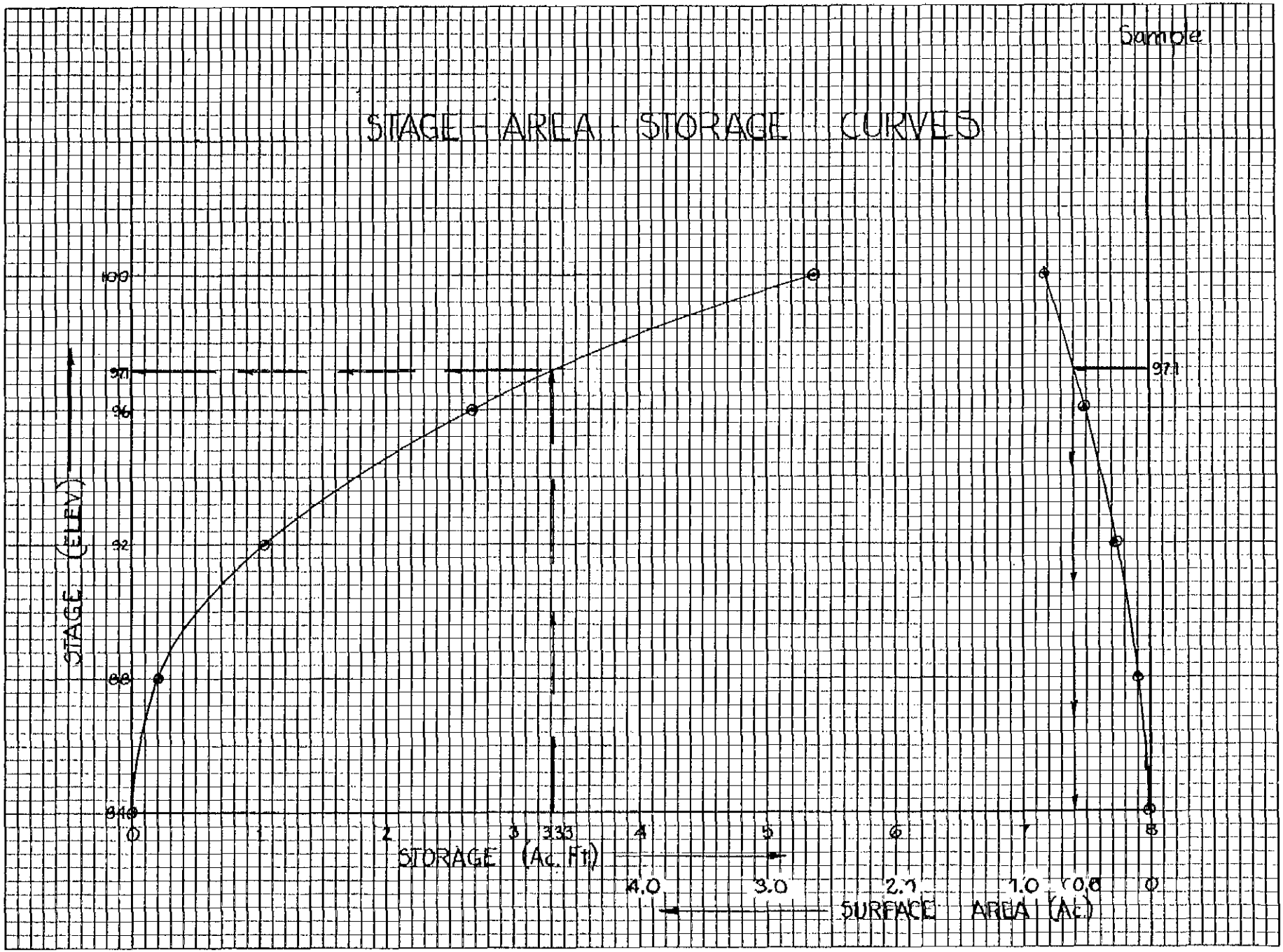
Dam No. 3

Elev. (ft.)	Area ($in.^2$)	Area (Ac.)	Area (Ac.)	Average Area (Ac.)	Diff. in Elev. (ft.)	Storage (Ac. ft.)	Storage (Ac. ft.)
84	0	0					0
			.112	.056	4	.224	
88	1.96	.112					.224
			.410	.205	4	.820	
92	5.20	.298					1.044
			.820	.410	4	1.640	
96	9.10	.522					2.684
			1.355	.678	4	2.712	
100	14.52	.833					5.396

NOTE: 1 $in.^2$ = .0573 Ac. for scale of 1" = 50'

Sample

STAGE - AREA - STORAGE CURVES



EXCAVATED SEDIMENT POND

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

POND NUMBER ____

Sediment Storage Requirements

Drainage Area = 53.0 Ac. Average Land Slope = 15 %
Disturbed Area = 13.5 Ac. = 25.5 % of drainage area
Sediment Volume = _____ .125 Ac. Ft./Ac. x area disturbed = 1.69 Ac. Ft.

Emergency Spillway Design (If Required)

(See EMERGENCY SPILLWAYS - SEDIMENT DAMS, EMBANKMENT TYPE)

Peak Discharge (Figure 2) = 110 c.f.s. x 1.0 (slope factor) = 110 c.f.s.

Emergency Spillway Proportions (Table 2)

Emergency Spillway Elevation = 100.0 Sediment Pool Elevation
Bottom Width, b = 15 Ft.
Emergency Spillway Stage, Hp = 2.14 Ft.

$\frac{\text{Peak Discharge}}{\text{Bottom Width}} = \frac{Q}{b} =$ _____ = 7.3

Slope of Exit Channel, S_e = 30 % (Chart 1)
Velocity in Exit Channel, V_e = 6.8 f.p.s. (Chart 1)
Spillway Material Rock Riprap
Allowable V_e = 12 f.p.s.
Top of Embankment Elevation = Emergency Spillway Elevation + Hp + 1.0 = 100.0 + 2.14 + 1.0 = 103.14 (Settled Elevation)

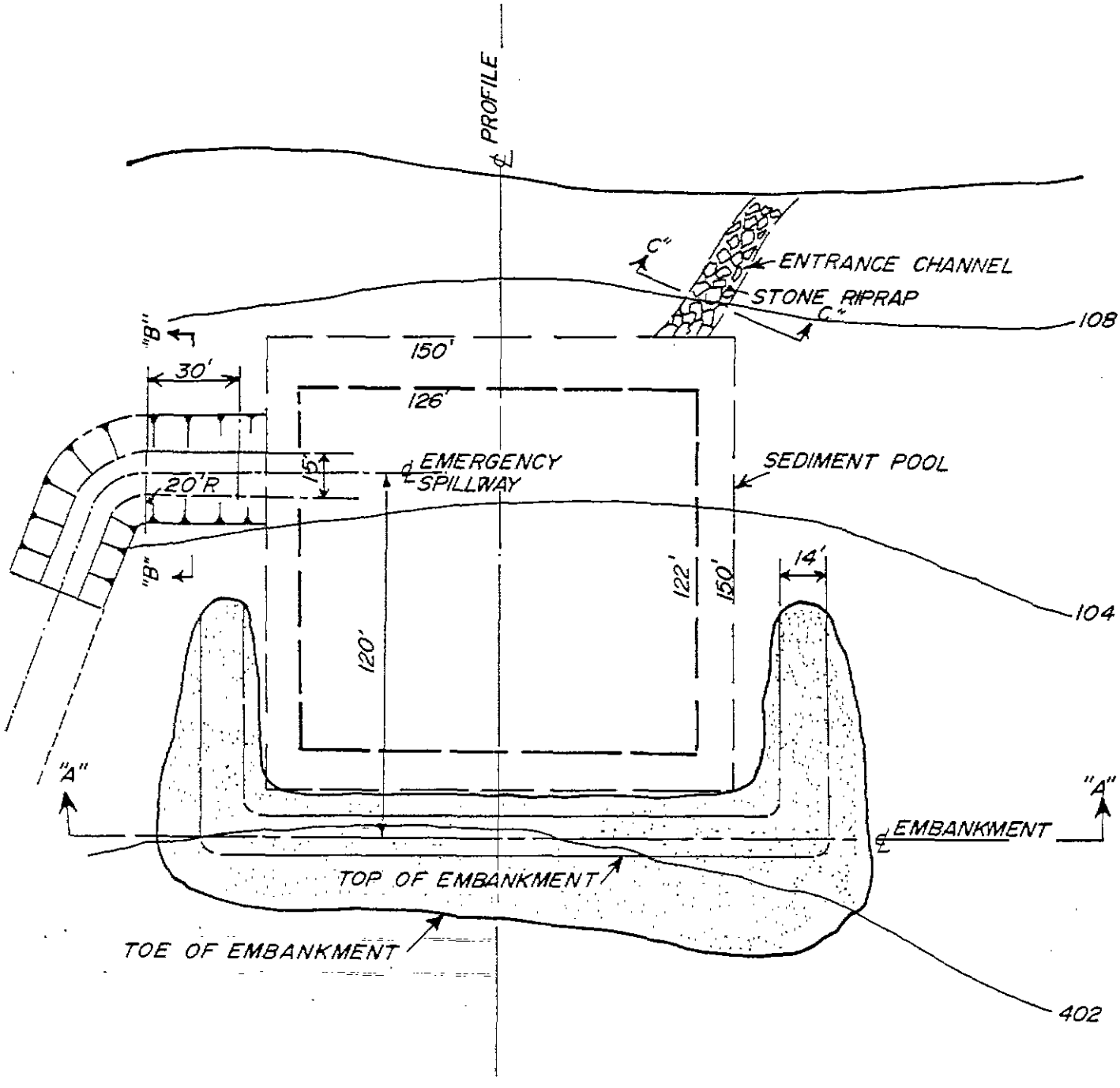
or

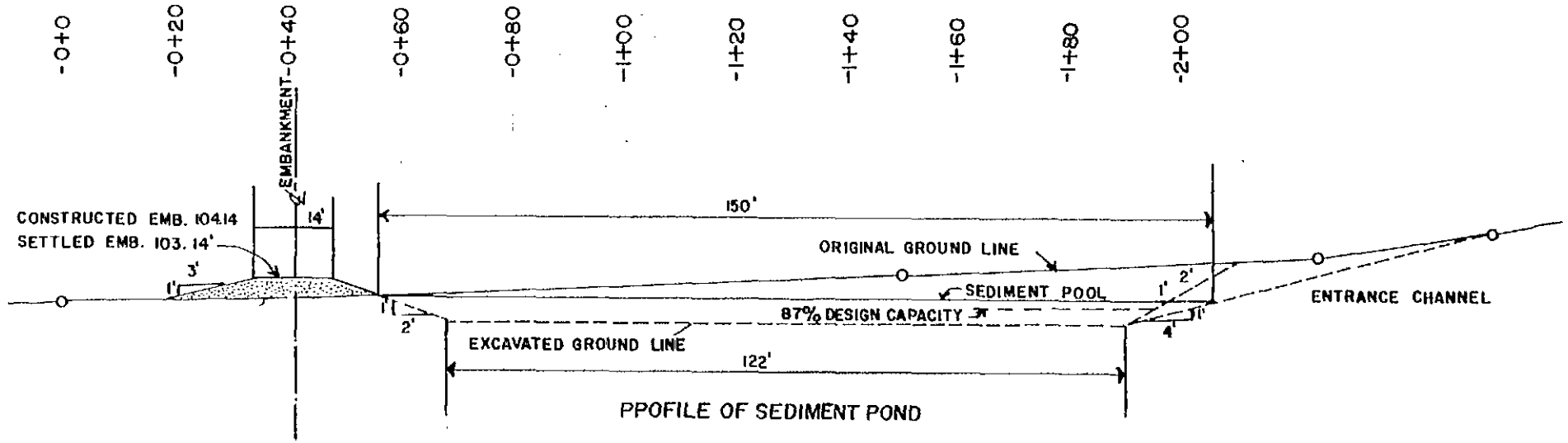
Top of Embankment = Sediment Pool Elevation + 2.0' = _____ + _____ = _____ (Settled Elevation)

NOTE:

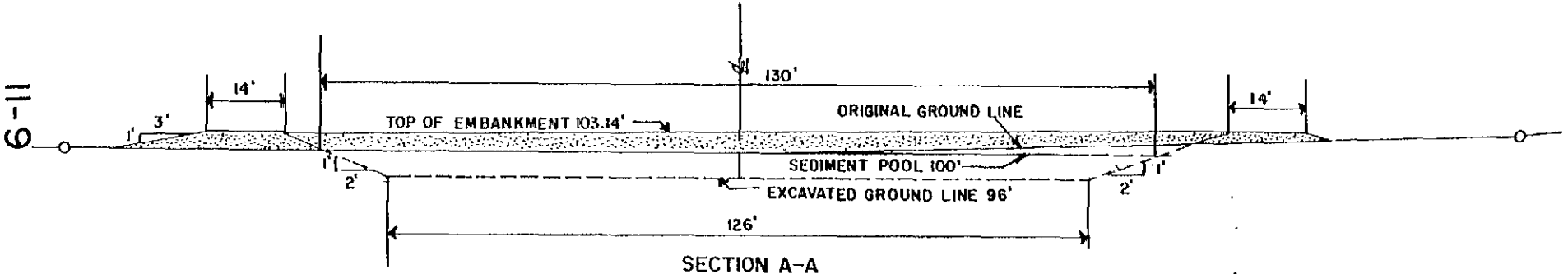
If pond is to be a regular shape and constructed on relatively flat terrain (less than 20% slope), fill in the following:

Bottom Length = 122 Ft.
Bottom Width = 126 Ft.
Water Depth = 4 Ft.
Side Slopes = 2:1 Ft.
Volume (in $ft.^3$, taking into account side slopes) = 75744 $Ft.^3$ = 1.74 Ac.-Ft. (1 Acre Foot = 43560 $Ft.^3$)

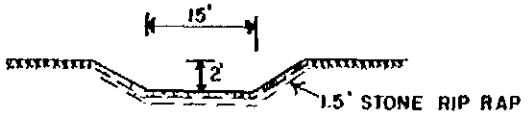

℄ PROFILE
"C"
ENTRANCE CHANNEL
STONE RIPRAP
"C"
108
"B"
150'
30'
126'
15'
℄ EMERGENCY SPILLWAY
SEDIMENT POOL
20'R
"B"
14'
122'
150'
104
120'
"A"
"A"
℄ EMBANKMENT
TOP OF EMBANKMENT
TOE OF EMBANKMENT
402



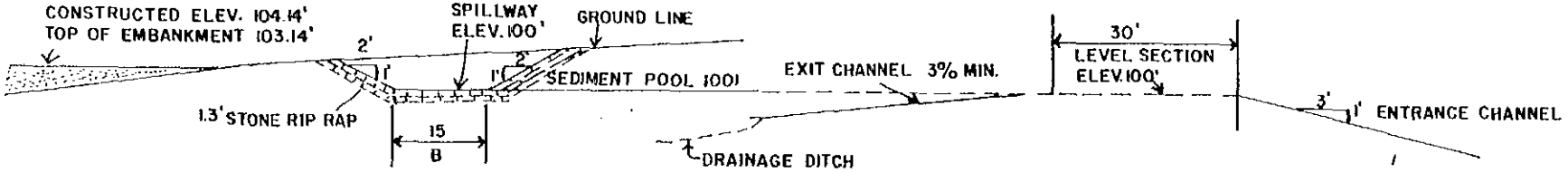
PPOFILE OF SEDIMENT POND



SECTION A-A

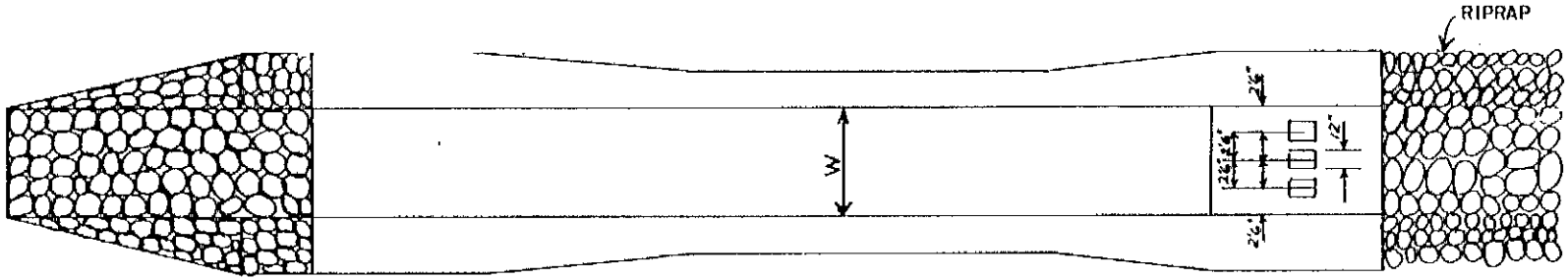


ENTRANCE CHANNEL
SECTION C-C



EMERGENCY SPILLWAY
SECTION B-B

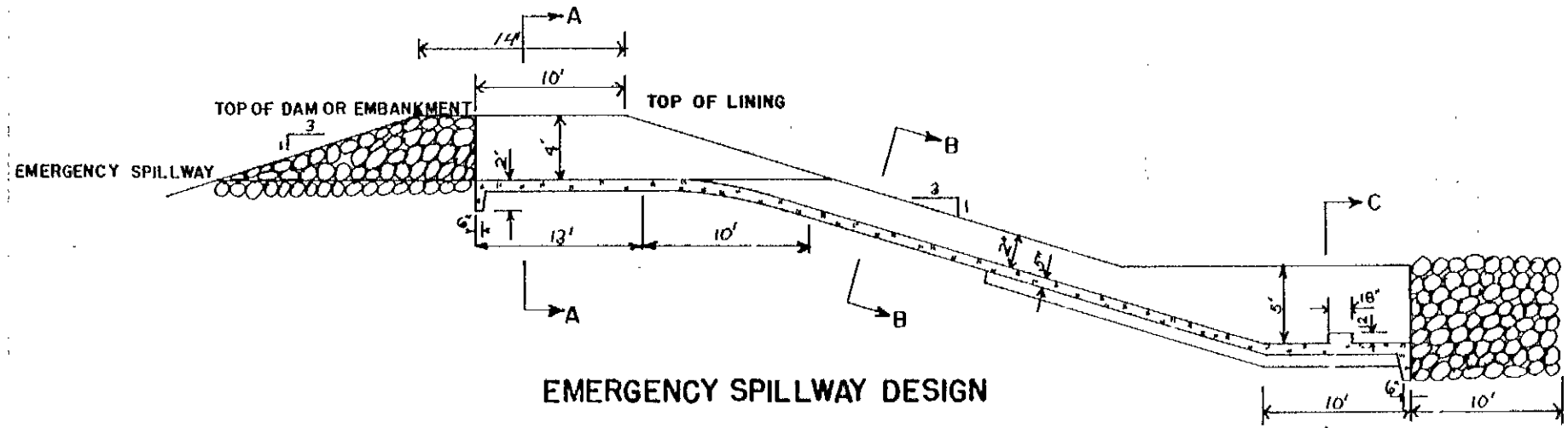
EMERGENCY SPILLWAY
PROFILE



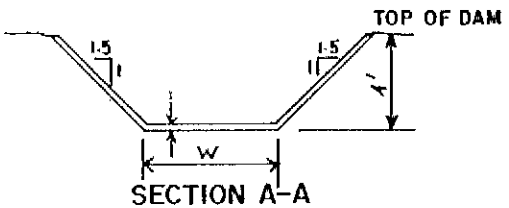
PLAN

W-FT	Q-CFS
5	110
10	220
15	330
20	440
25	550
30	660

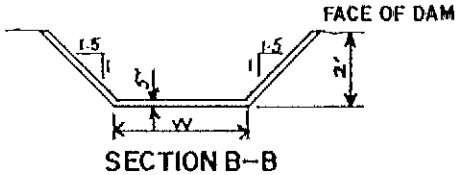
RIPRAP GRADED FROM 1" TO 3" CONCRETE TO BE REINFORCED WITH 6 X 6 X 2 1/2 WELDED WIRE FABRIC OR NO. 3 BARS 12" CENTERS BOTH DIRECTIONS



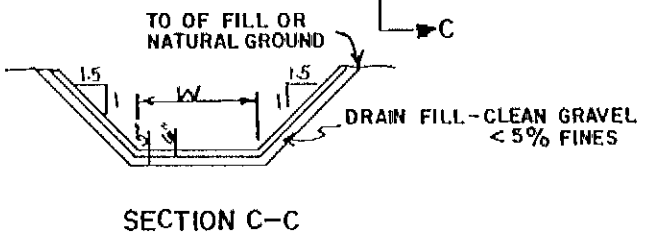
EMERGENCY SPILLWAY DESIGN



SECTION A-A



SECTION B-B



SECTION C-C

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

Gabion Sediment Dam No. 4

Sediment Storage Requirements

Drainage Area = 225 Acres Average Land Slope = 20 %
Area Disturbed = 4.16 Acres = 5 % of Drainage Area
Sediment Volume = .125 Ac. Ft./Ac. x Area Disturbed = 0.52 Act. Ft.
Sediment Pool Elevation = 2233.75 Ft. = Emergency Spillway Elevation = Principal Spillway Crest

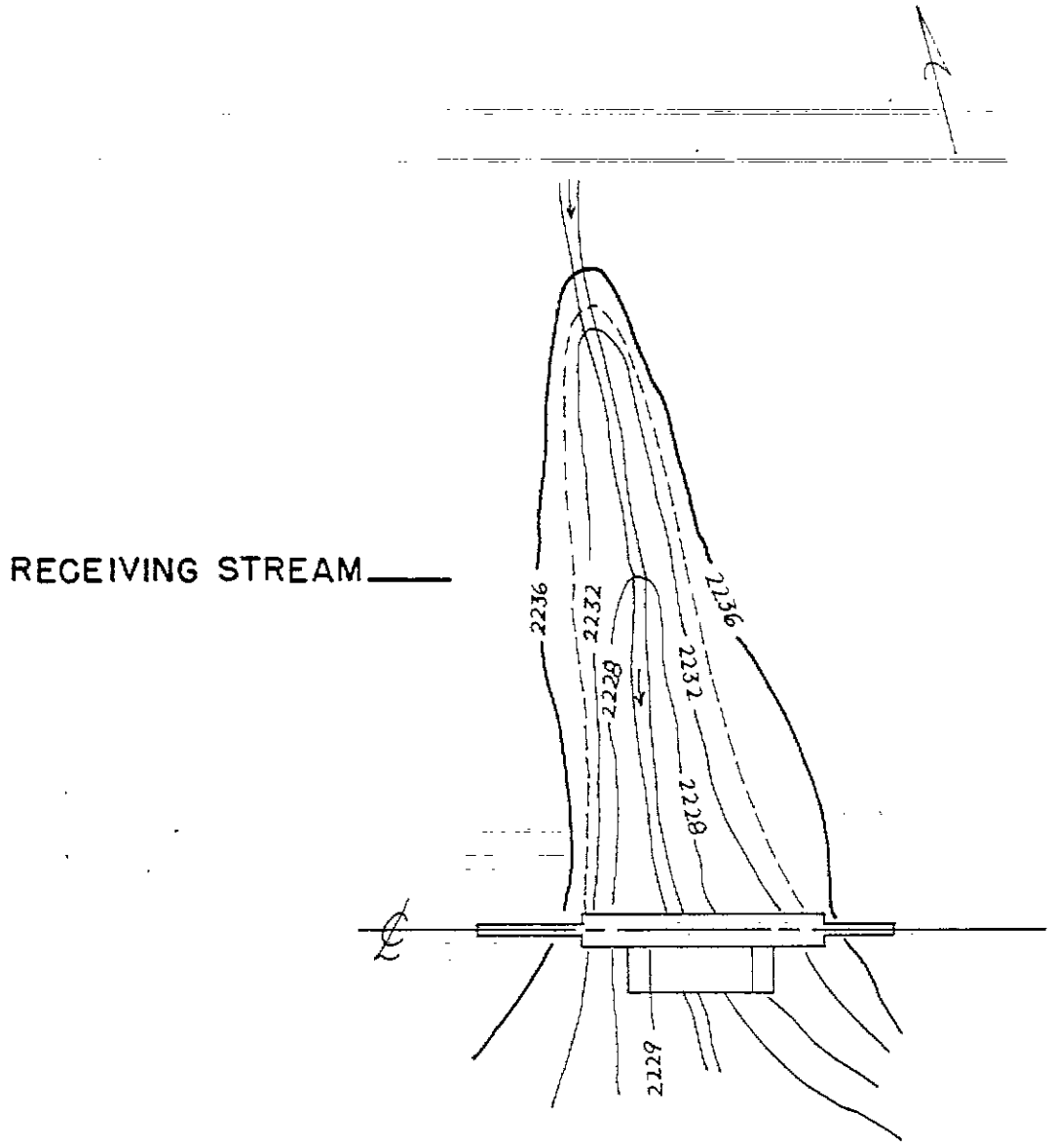
Spillway Design

Peak Discharge, Q (Figure 3) = 320 c.f.s. x 1.1 (slope factor) = 352 c.f.s.

Spillway Breadth = 3.25 Ft.
Spillway Height minus 0.5 ft., h = 3.25 - 0.5 ft. = 2.75 Ft.
Coefficient of Discharge, C (Table 5) = 2.78
Minimum Spillway Length, L = Q/Ch 3/2* = 25.20 Ft.
Planned Spillway Length = 29.25 Ft.
Top of Dam Elevation = Spillway Elevation + Spillway Height =

2233.75 + 3.25 = 2237.00

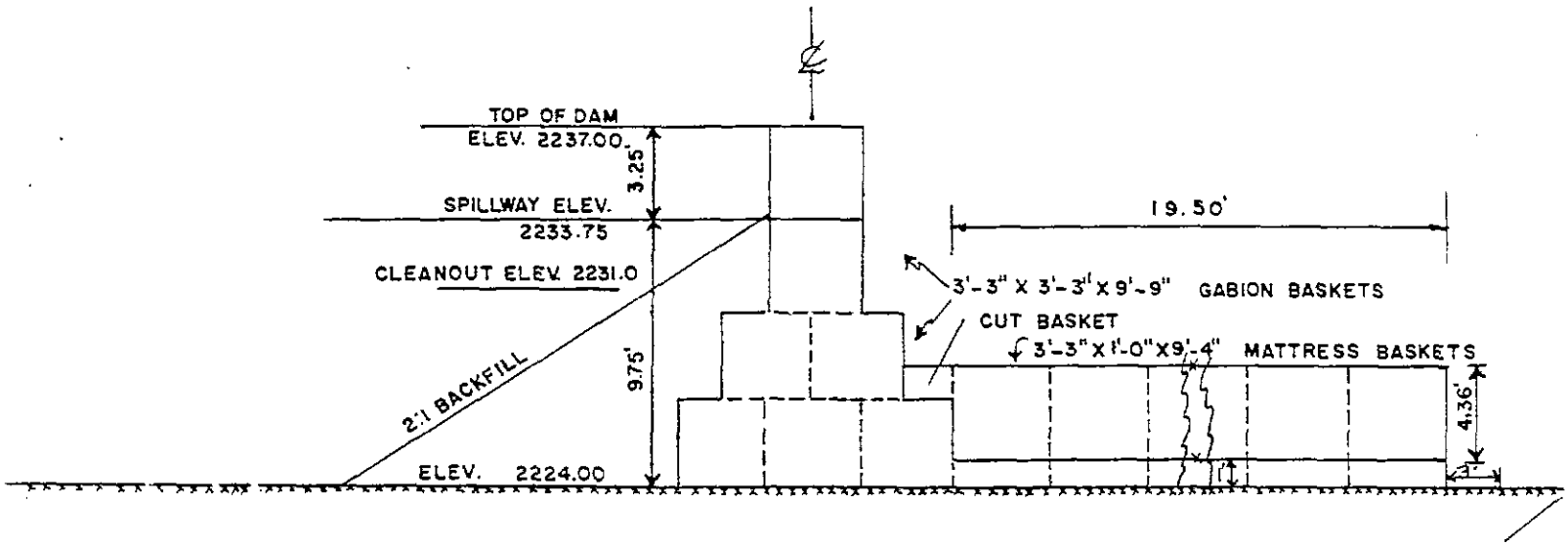
*The three-halves power of h may be obtained from Table 6, Appendix I.



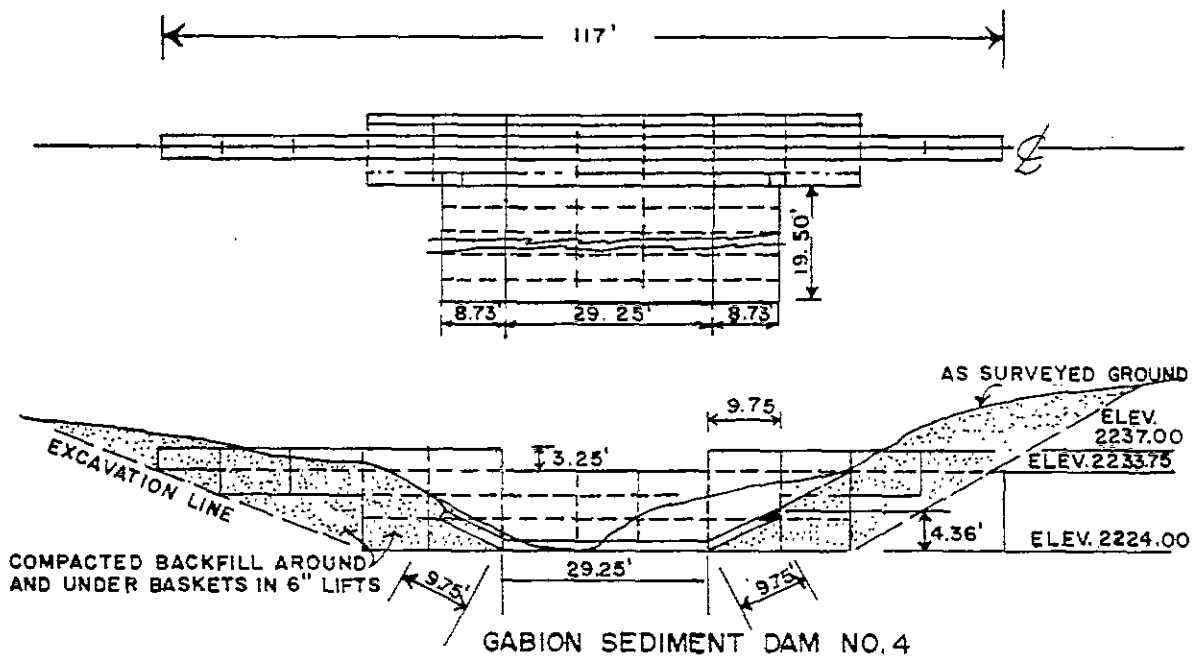
GABION SEDIMENT DAM NO. 4

SCALE 1" = 50'

CONTOUR INTERVAL 4'



GABION SEDIMENT DAM NO. 4
CROSS SECTION VIEW



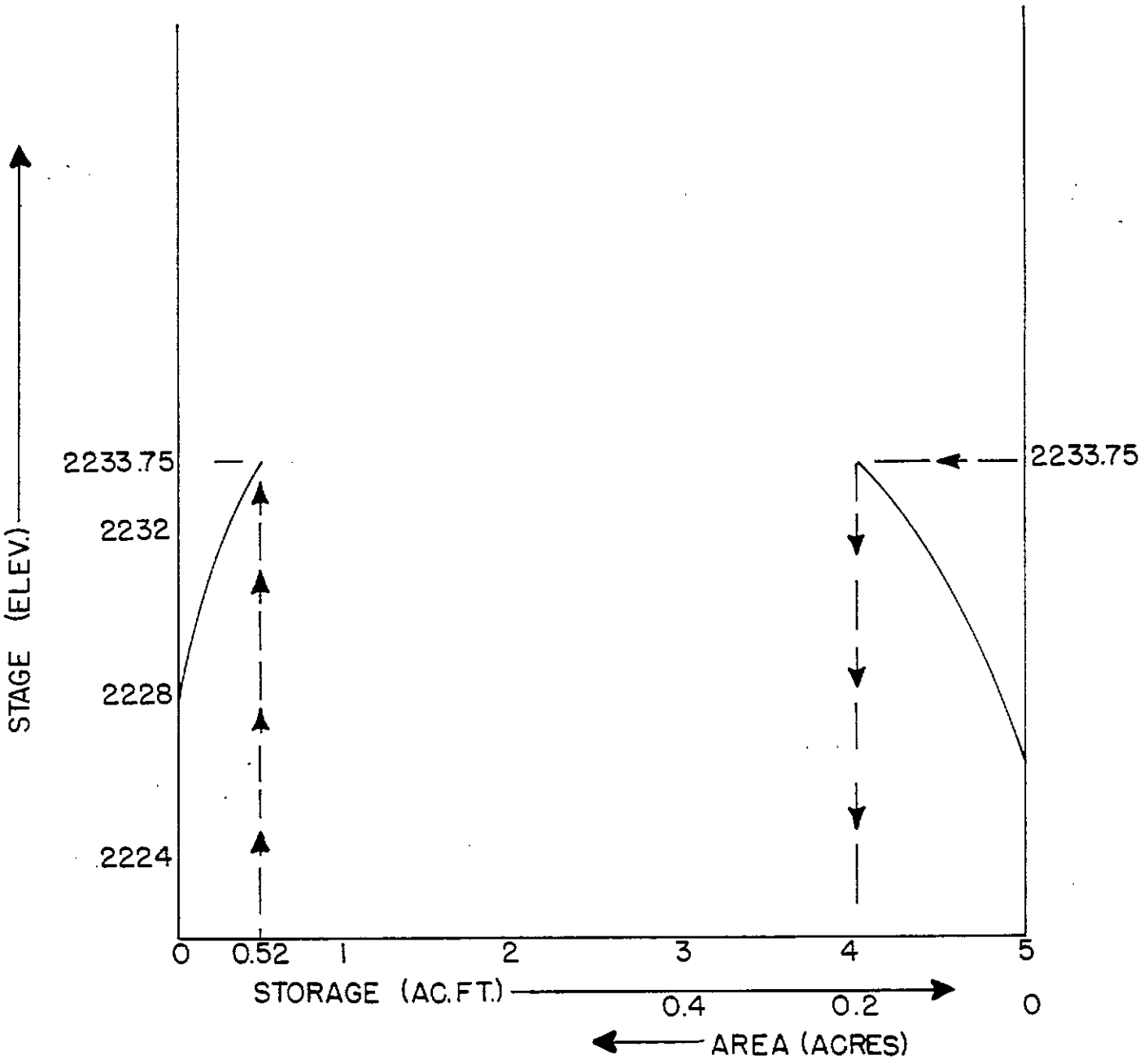
GABION SEDIMENT DAM NO. 4
PLAIN VIEW AND
CENTERLINE CROSS SECTION VIEW

STAGE-AREA-STORAGE COMPUTATIONS

GABION DAM NO. 4

Elev. (Ft.)	Area ($In.^2$)	Area (Ac.)	Area (Ac.)	Average Area (Ac.)	Diff. in Elev. (Ft.)	Storage (Ac. Ft.)	Storage (Ac. Ft.)
2224	0	0					0
			.036	.015	4	.072	
2228	.62	.036					.072
			.123	.062	4	.248	
2232	1.51	.087					.320
			.202	.101	2	.202	
2233.75	2.00	.115					.522

NOTE: 1 $in.^2$ = .0573 Ac. for scale of 1" = 50'



STAGE AREA STORAGE CURVES
GABION SEDIMENT DAM NUMBER 4

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

Crib Sediment Dam No. 2

Sediment Storage Requirements

Drainage Area = 105 Acres Average Land Slope = 32 %
Area Disturbed = 4.2 Acres = 4 % of Drainage Area
Sediment Volume = .125 Ac. Ft./Ac. x Area Disturbed = 0.53 Act. Ft.
Sediment Pool Elevation = 2310.75 Ft. = Emergency Spillway Elevation = Principal Spillway Crest

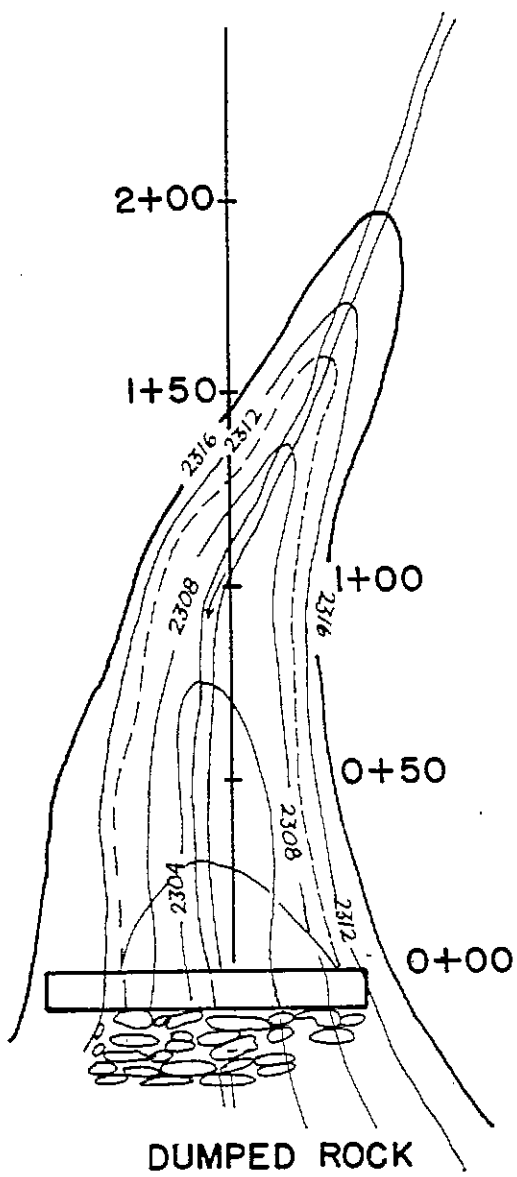
Spillway Design

Peak Discharge, Q (Figure 3) = 150 / 180 c.f.s. x 1.2 (slope factor) =

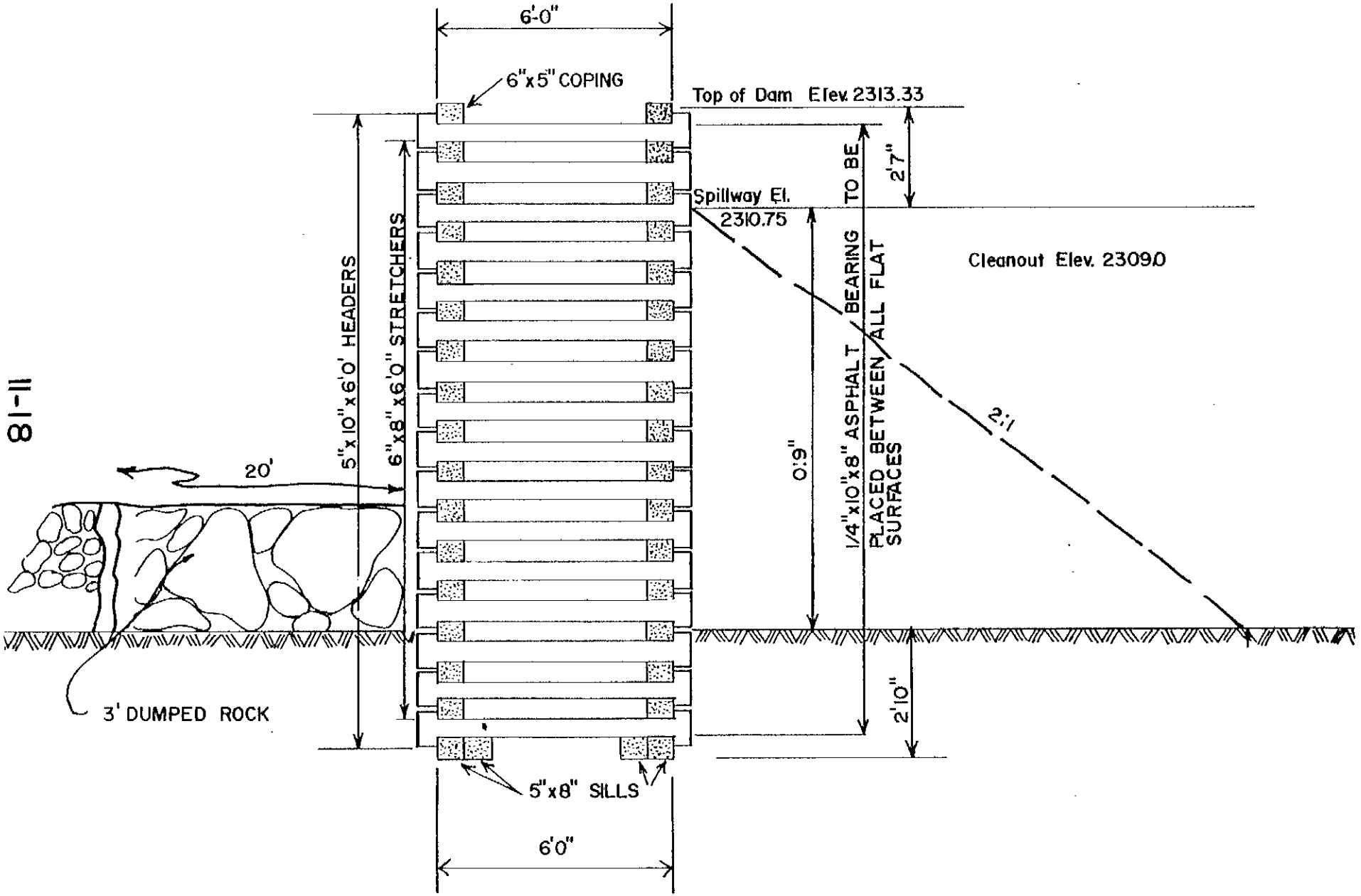
Spillway Breadth = 6.0 Ft.
Spillway Height minus 0.5 ft., h = 2.58 - 0.5 ft. = 2.08 Ft.
Coefficient of Discharge, C (Table 5) = 2.65
Minimum Spillway Length, L = Q/Ch 3/2* = 28.9 Ft.
Planned Spillway Length = 30.0 Ft.
Top of Dam Elevation = Spillway Elevation + Spillway Height =

2310.75 + 2.58 = 2312.33

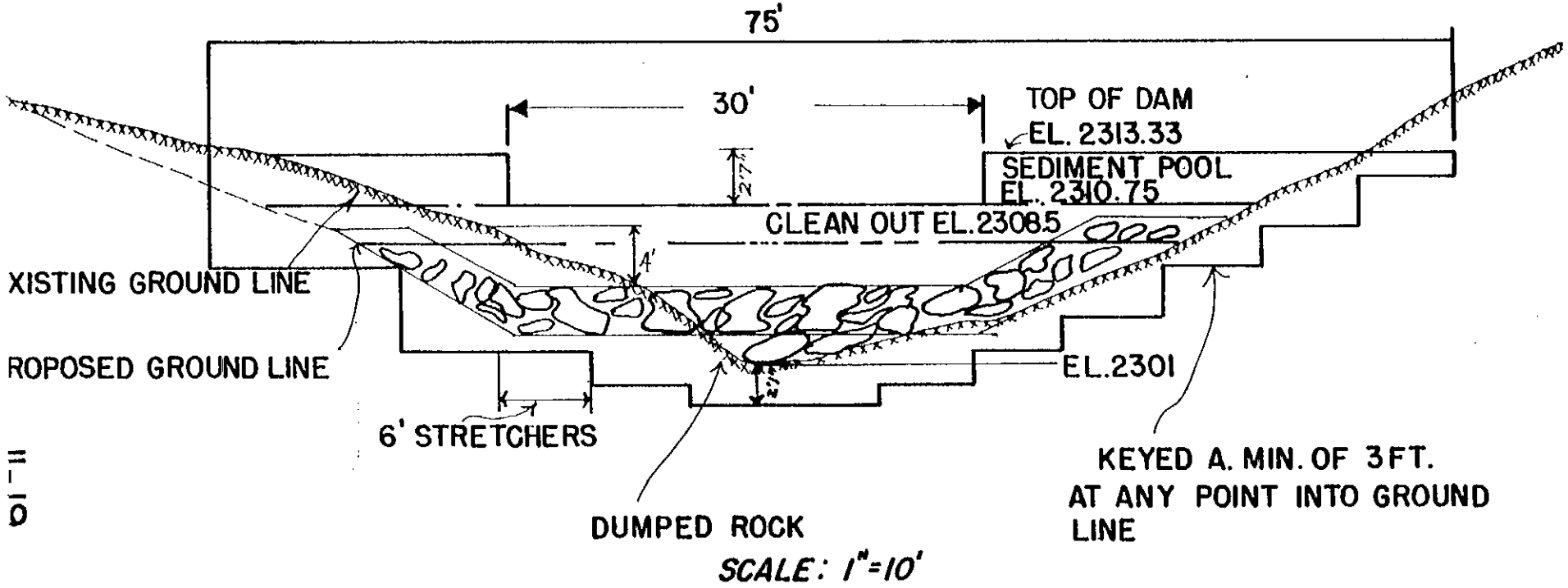
*The three-halves power of h may be obtained from Table 6, Appendix I.

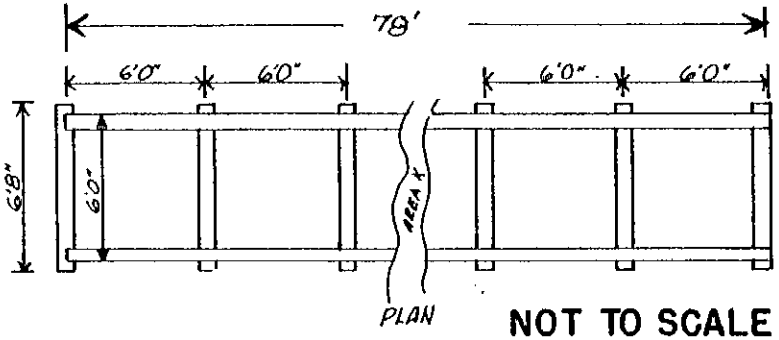


CRIB DAM NO. 2
SCALE 1" = 50'
CONTOUR INTERVAL 4'



CROSS SECTION VIEW OF CRIB DAM NO.2





NOT TO SCALE

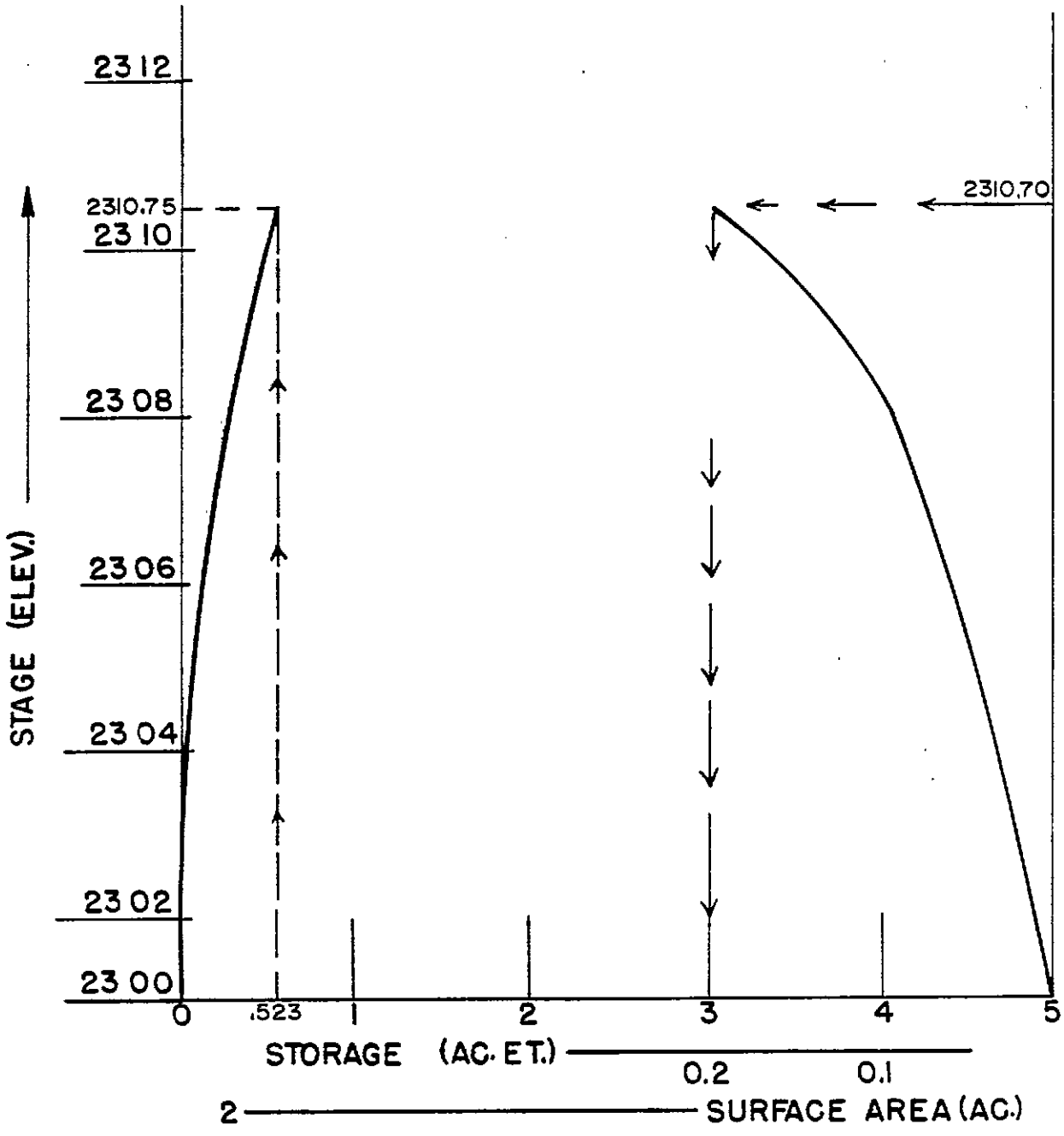
PLAN VIEW
&
CENTERLINE CROSS SECTION
CRIB DAM NO.2

SOIL CONSERVATION SERVICE

CRIB DAM NO. 2

Elev. (ft.)	Area (in.²)	Area (Ac.)	Area (Ac.)	Average Area (Ac.)	Dist. in Elev. (ft.)	Storage (Ac. ft.)	Storage (Ac. ft.)
2301	0	0					0
			.036	.018	3	.054	
2304	0.62	.036					.054
			.098	.049	4	.196	
2308	1.43	.082					.250
			.201	.101	2.75	.278	
2310/75	2.08	.119					.528

NOTE: 1 in.² = .0573 Ac. for scale of 1" = 50'


2312
2310.75
2310
2308
2306
2304
2302
2300
STAGE (ELEV.)
2310.70
0
.523
1
2
3
4
5
STORAGE (AC. FT.)
0.2
0.1
2
SURFACE AREA (AC.)

CRIB DAM NO. 2

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

Excavated Sediment Channel No. _____

Outslope Disturbed Area = 12.8 Acres

Maximum expected horizontal length of spoil slope = 100 Feet

Maximum existing ground slope on which the channel is to be constructed = 30 %

Required sediment storage capacity per transverse foot of outslope

= Maximum length of spoil slope x .125

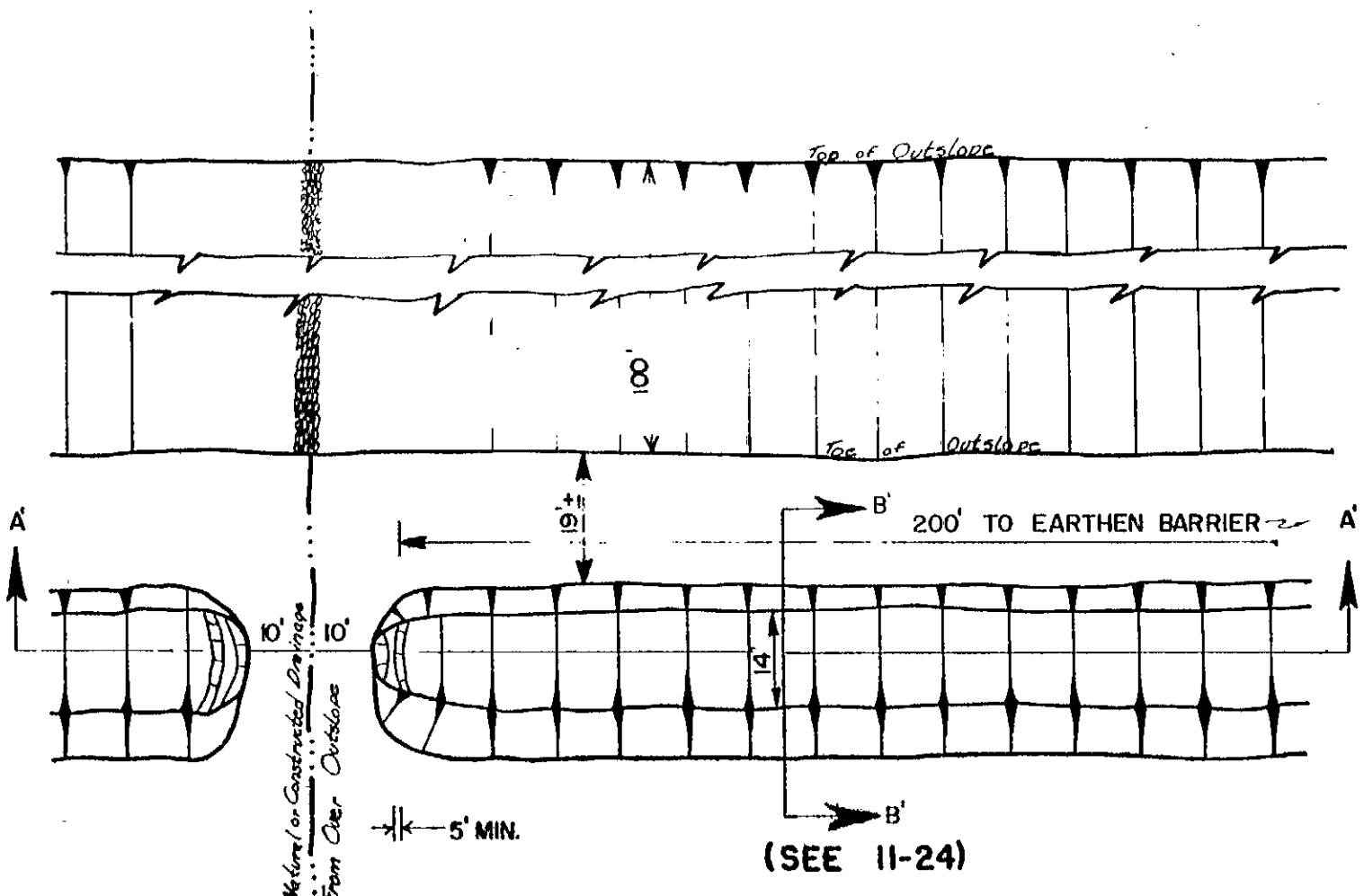
= 100 x .125 = 12.5 Cu. Ft.

Planned sediment storage capacity per transverse foot of outslope, approximately,

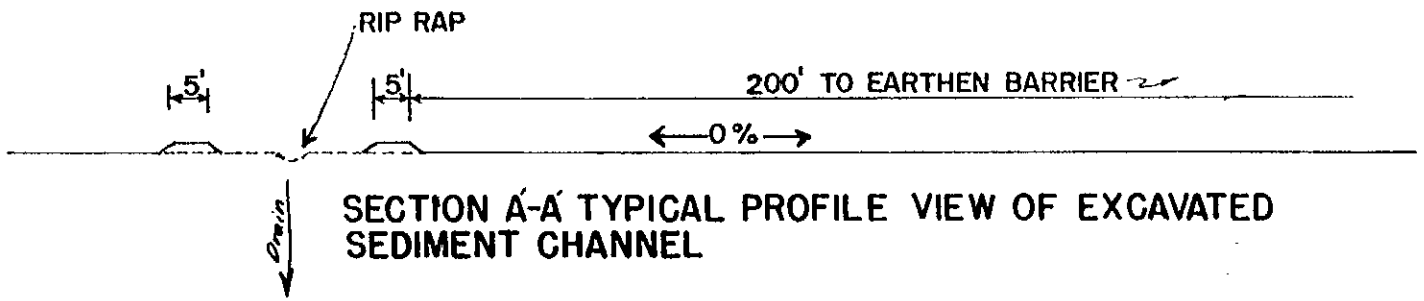
= 1/2 x Depth, Ft. x Width, Ft.

= 1/2 x 2.0 x 14.0

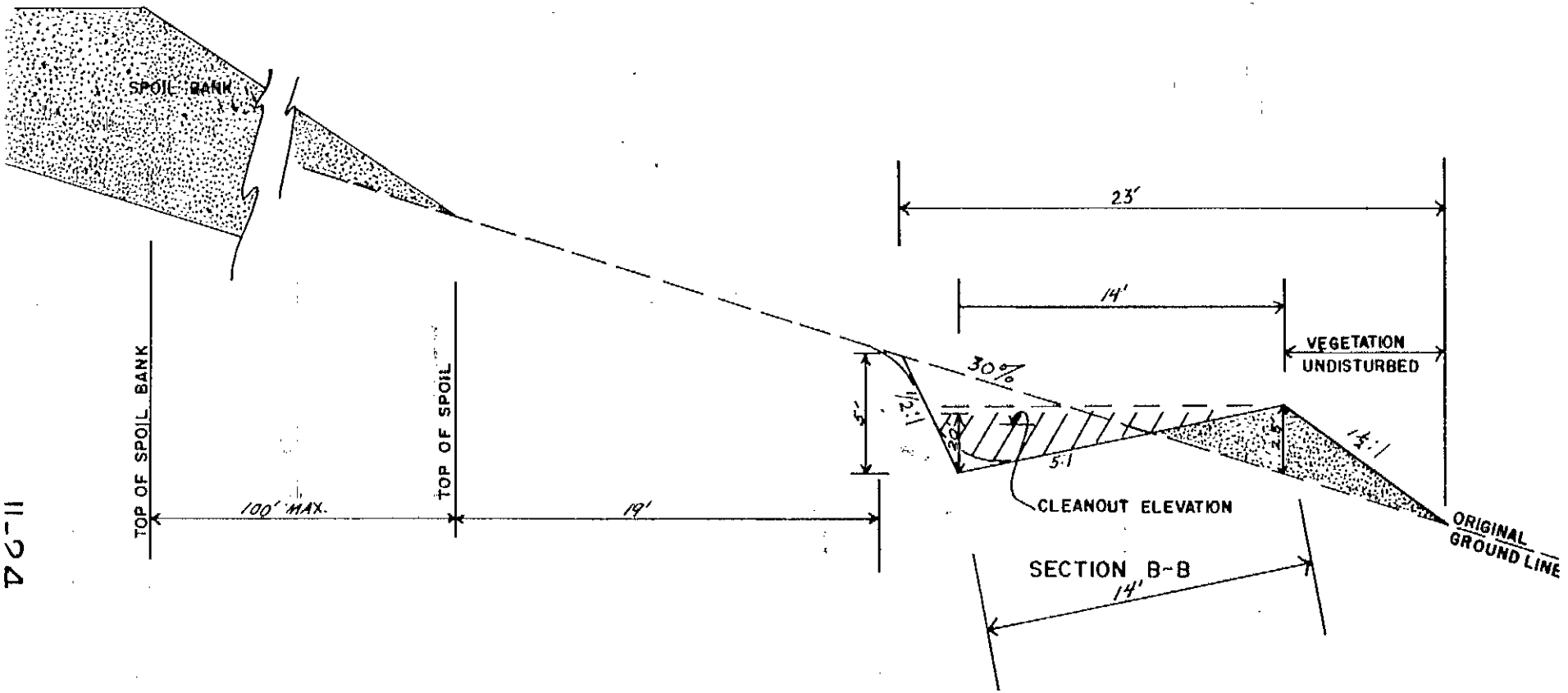
= 14.0 Cu. Ft.



TYPICAL PLAN VIEW OF EXCAVATED SEDIMENT CHANNEL



SECTION A-A' TYPICAL PROFILE VIEW OF EXCAVATED SEDIMENT CHANNEL



TYPICAL CROSS SECTION OF EXCAVATED SEDIMENT CHANNEL

APPENDIX III

STRUCTURE PROPORTIONING COMPUTATION SHEETS

EMBANKMENT SEDIMENT POND

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

DAM NUMBER ____

Sediment Storage Requirements

Drainage Area = _____ Ac. Average Land Slope = _____%
Area Disturbed = _____ Ac. = _____% of drainage area
Sediment Volume = .125 Ac. Ft./Ac. x area disturbed = _____Ac. Ft.
Sediment Pool Elevation = _____ Ft. = principal spillway crest

Principal Spillway Design

Principal Spillway Diameter = _____ In.
Type_____ pH_____
Principal Spillway Length _____Ft.
Principal Spillway Slope _____ Percent

Drop Inlet

Type Base_____ Type Riser_____
Dimensions = _____In. diameter of _____Ft.^{2}
Height of Riser (base to crest) = _____ Ft.
Perforated _____ Yes _____ No

Drainpipe

Diameter = _____ In. Type _____
Length = _____ Ft. Height of Riser _____ Ft.

Emergency Spillway Design

Emergency Spillway Elevation = Principal Spillway Elevation + 1.5 Ft. (min.) = _____ + _____ = _____

Peak Discharge (Figure 2) = _____ c.f.s. x _____ (slope factor) = _____ c.f.s.

Emergency Spillway Proportions (Table 2)

Bottom Width, b = _____ Ft.
Emergency Spillway Stage, Hp = _____ Ft.

$\frac{\text{Peak Discharge}}{\text{Bottom Width}} = \frac{Q}{b}$ = _____

Slope of Exit Channel, S_e = _____% (Chart 1)
Velocity in Exit Channel, V_e = _____ f.p.s. (Chart 1)
Spillway Material _____ Allowable V_e = _____ f.p.s.
Top of Dam Elevation = Emergency Spillway Elevation + Hp + 1.0 Ft. = _____ + _____ + _____ = _____ (Settled Elevation)

EXCAVATED SEDIMENT POND

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

POND NUMBER ____

Sediment Storage Requirements

Drainage Area = _____ Ac. Average Land Slope = _____%
Disturbed Area = _____ Ac. = _____% of drainage area
Sediment Volume = _____ .125 Ac. Ft./Ac. x area disturbed = _____ Ac. Ft.

Emergency Spillway Design (If Required)

(See EMERGENCY SPILLWAYS - SEDIMENT DAMS, EMBANKMENT TYPE)

Peak Discharge (Figure 2) = _____ c.f.s. x _____ (slope factor) = _____ c.f.s.

Emergency Spillway Proportions (Table 2)

Emergency Spillway Elevation = _____ Sediment Pool Elevation
Bottom Width, b = _____ Ft.
Emergency Spillway Stage, Hp = _____ Ft.

$\frac{\text{Peak Discharge}}{\text{Bottom Width}} = \frac{Q}{b}$ = _____ = _____

Slope of Exit Channel, S_e = _____% (Chart 1)
Velocity in Exit Channel, V_e = _____ f.p.s. (Chart 1)
Spillway Material _____
Allowable V_e = _____ f.p.s.
Top of Embankment Elevation = Emergency Spillway Elevation + Hp + 1.0 = _____ + _____ + _____ = _____ (Settled Elevation)

or

Top of Embankment = Sediment Pool Elevation + 2.0' = _____ + _____ = _____ (Settled Elevation)

NOTE:

If pond is to be a regular shape and constructed on relatively flat terrain (less than 20% slope), fill in the following:

Bottom Length = _____ Ft.
Bottom Width = _____ Ft.
Water Depth = _____ Ft.
Side Slopes = _____ Ft.
Volume (in $ft.^3$, taking into account side slopes) = _____ $Ft.^3$ = _____ Ac.-Ft. (1 Acre Foot = 43560 $Ft.^3$)

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

Gabion Sediment Dam No. _____

Sediment Storage Requirements

Drainage Area = _____ Acres Average Land Slope = _____%
Area Disturbed = _____ Acres = _____% of Drainage Area
Sediment Volume = .125 Ac. Ft./Ac. x Area Disturbed = _____ Act. Ft.
Sediment Pool Elevation = _____ Ft. = Emergency Spillway Elevation = Principal Spillway Crest

Spillway Design

Peak Discharge, Q (Figure 3) = _____ c.f.s. x _____ (slope factor) = _____ c.f.s.

Spillway Breadth = _____ Ft.
Spillway Height minus 0.5 ft., h = _____ - 0.5 ft. = _____ Ft.
Coefficient of Discharge, C (Table 5) = _____
Minimum Spillway Length, L = Q/Ch 3/2* = _____ Ft.
Planned Spillway Length = _____ Ft.
Top of Dam Elevation = Spillway Elevation + Spillway Height =

_____ + _____ = _____

*The three-halves power of h may be obtained from Table 6, Appendix I.

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

Crib Sediment Dam No. _____

Sediment Storage Requirements

Drainage Area = _____ Acres Average Land Slope = _____ %
Area Disturbed = _____ Acres = _____ % of Drainage Area
Sediment Volume = .125 Ac. Ft./Ac. x Area Disturbed = _____ Act. Ft.
Sediment Pool Elevation = _____ Ft. = Emergency Spillway Elevation = Principal Spillway Crest

Spillway Design

Peak Discharge, Q (Figure 3) = _____ c.f.s. x _____ (slope factor) = _____ c.f.s.

Spillway Breadth = _____ Ft.
Spillway Height minus 0.5 ft., h = _____ - 0.5 ft. = _____ Ft.
Coefficient of Discharge, C (Table 5) = _____
Minimum Spillway Length, L = Q/Ch 3/2* = _____ Ft.
Planned Spillway Length = _____ Ft.
Top of Dam Elevation = Spillway Elevation + Spillway Height =

_____ + _____ = _____

*The three-halves power of h may be obtained from Table 6, Appendix I.

STRUCTURE PROPORTIONING COMPUTATIONS SHEET

Excavated Sediment Channel No. _____

Outslope Disturbed Area = _____ Acres

Maximum expected horizontal length of spoil slope = _____ Feet

Maximum existing ground slope on which the channel is to be constructed = _____ %

Required sediment storage capacity per transverse foot of outslope

= Maximum length of spoil slope x .125

= _____ x .125 = _____ Cu. Ft.

Planned sediment storage capacity per transverse foot of outslope, approximately,

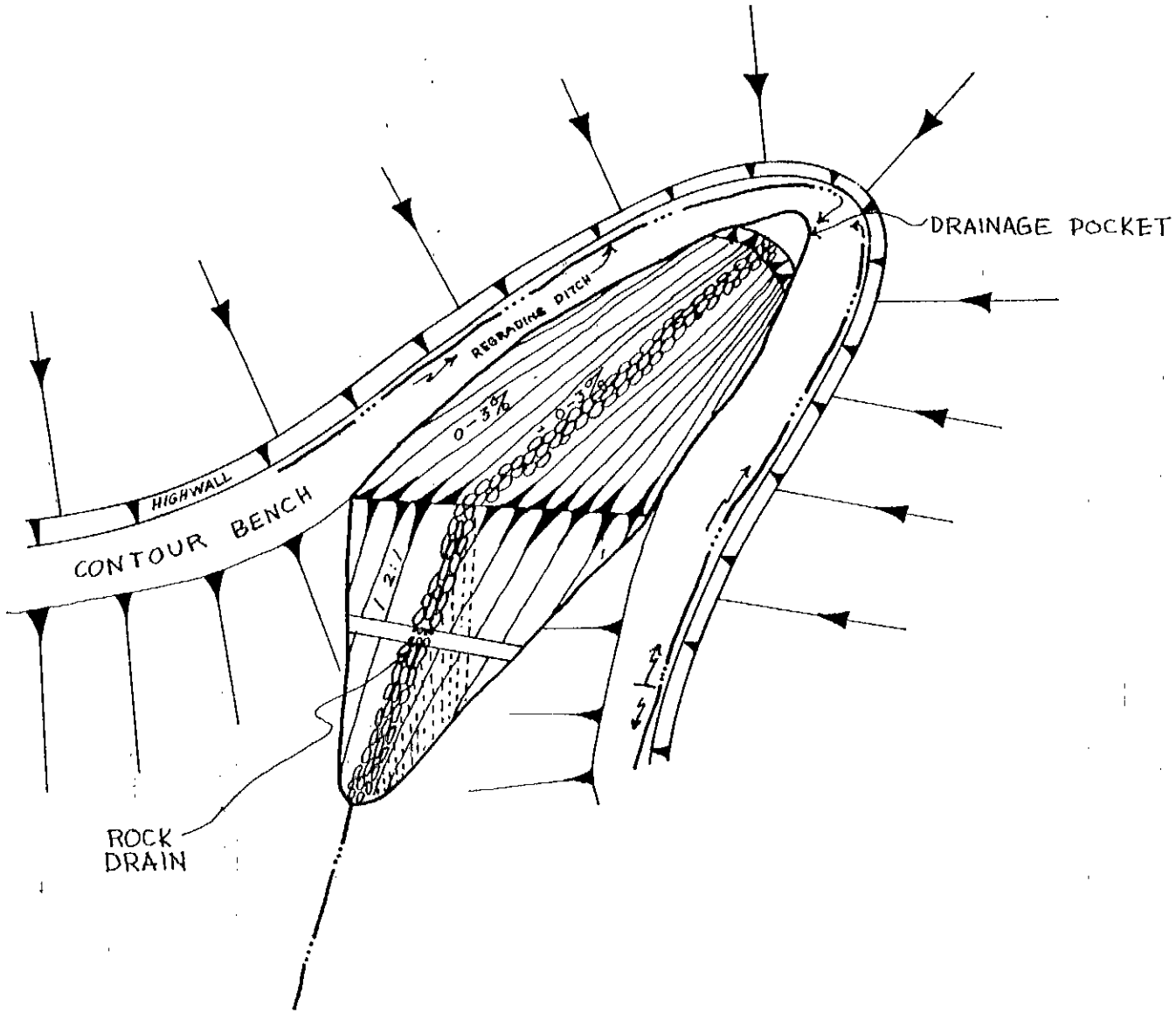
= 1/2 x Depth, Ft. x Width, Ft.

= 1/2 x _____ x _____

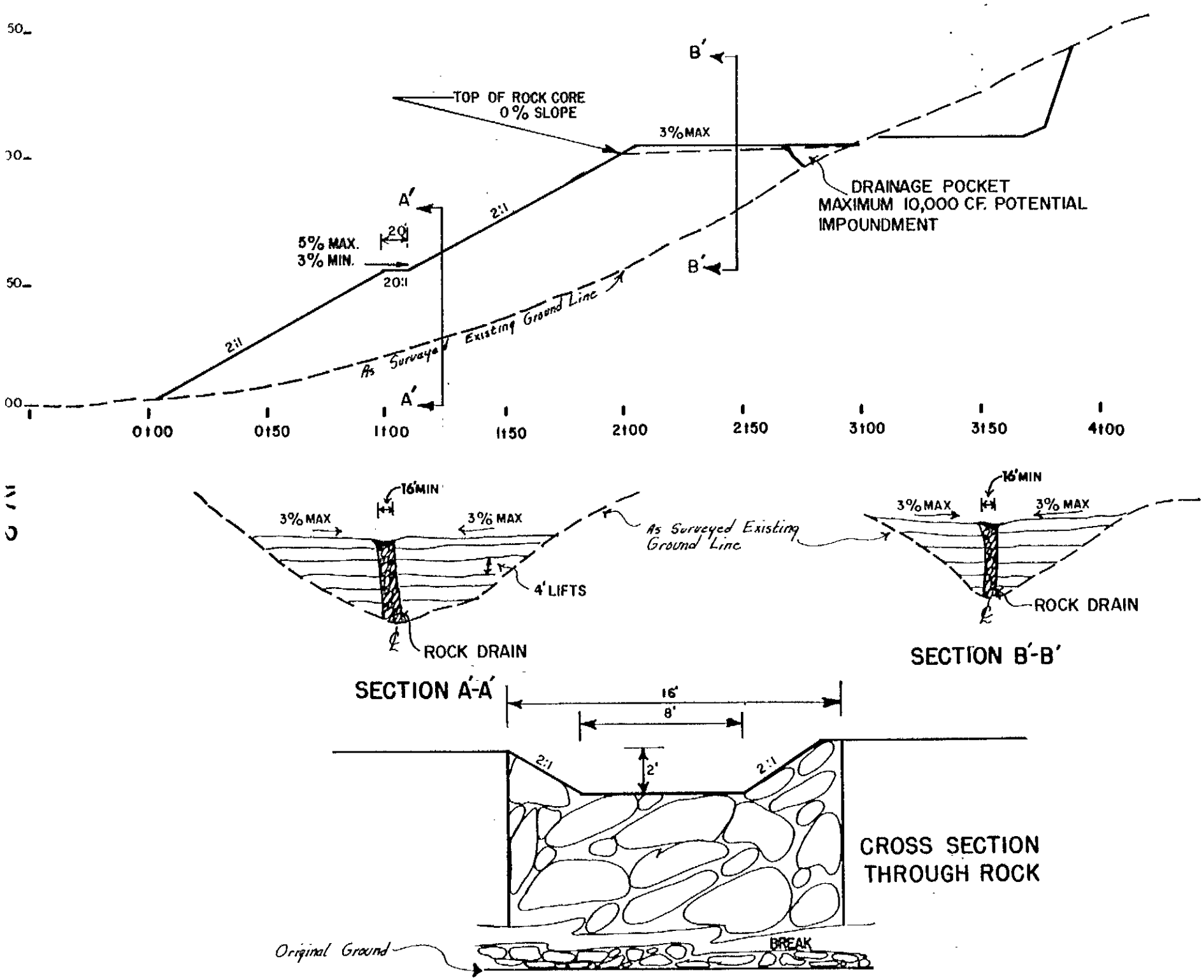
= _____ Cu. Ft.

APPENDIX IV

SAMPLE DESIGN OF VALLEY FILL



THREE DIMENSIONAL SKETCH OF VALLEY FILL


50
00
50
00
TOP OF ROCK CORE
0% SLOPE
3%MAX
B'
B'
A'
A'
2:1
20'
5% MAX.
3% MIN.
20:1
2:1
As Surveyed Existing Ground Line
DRAINAGE POCKET
MAXIMUM 10,000 CF. POTENTIAL
IMPOUNDMENT
0100
0150
1100
1150
2100
2150
3100
3150
4100
16'MIN
3% MAX
3% MAX
As Surveyed Existing
Ground Line
4' LIFTS
ROCK DRAIN
SECTION A'-A'
16'MIN
3% MAX
3% MAX
ROCK DRAIN
SECTION B'-B'
16'
8'
2:1
2'
2:1
CROSS SECTION
THROUGH ROCK
Original Ground
BREAK

LEGEND

- TOTAL DRAINAGE AREA AFFECTED - 619.8 AC
- TOTAL DISTURBED AREA - 127.3 AC
- DRAINAGE AREA DIVISION
- NATURAL DRAINWAY
- CONSTRUCTED DRAINWAY (DIVERSION DITCH IF BELOW TOE OF SPOIL OR ABOVE HIGHWALL)
- SEDIMENT DAM (EMBANKMENT, GABION, OR CONCRETE CRIB TYPE)
- EXCAVATED POND
- LOG & POLE SILT STRUCTURE
- STONE CHECK DAM
- WATER TEST SITE
- ROCK RIP RAP
- PIPE CULVERTS

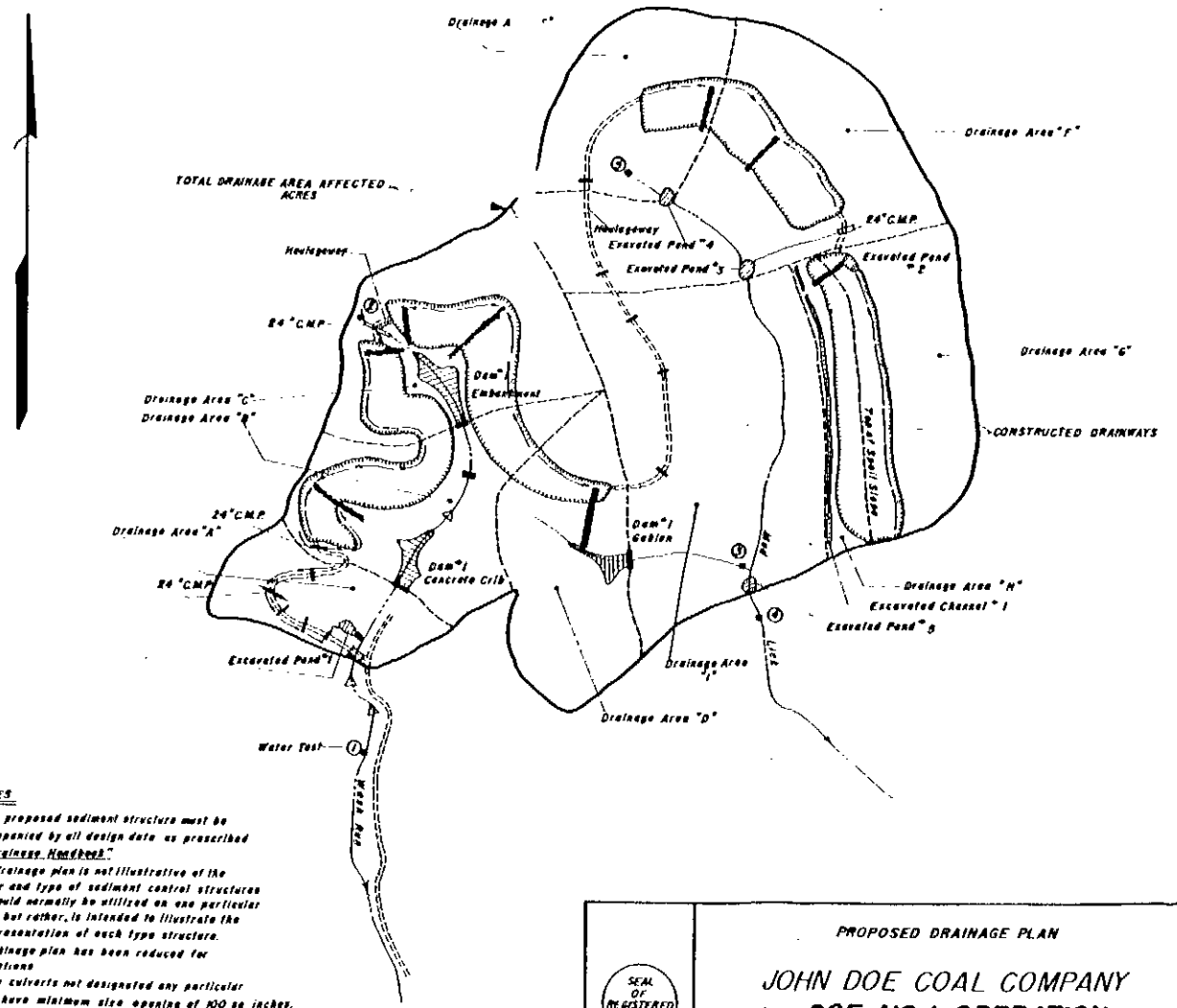
COMPONENT DRAINAGE AREAS

Drainage Area	Acres	Acres Disturbed
"A"	34.4	3.4
"B"	66.7	23.8
"C"	78.4	30.4
"D"	60.8	7.1
"E"	53.4	6.5
"F"	112.5	18.4
"G"	63.5	16.7
"H"	23.8	16.7
"I"	126.3	2.3
TOTALS	619.8	127.3

WATER TEST RESULTS

Test No	pH	Iron	Turbidity (Jackson Units)
1	7.0	10	150 JU
2	6.9	10	130 JU.
3	6.2	7	100 JU
4	6.5	12	175 JU.
5	6.7	10	150 JU.

Sediment Control Structure	Total Contributing Drainage Area To Structure. AC	Disturbed Acreage Controlled By Structure. Acres	Required Storage Capacity
Embankment Dam 1	78.4	30.4	3.8 AC-FT
Concrete Crib Dam 1	145.1	23.8	3.0 "
Gabion Dam 1	60.8	7.1	0.9 "
Excavated Pond " 1	34.4	3.4	0.4 "
" " " 2	63.5	16.7	2.1 "
" " " 3	145.9	18.4	2.3 "
" " " 4	53.4	8.5	1.1 "
" " " 5	440.3	2.3	0.3 "
" Channel "1	23.8	16.7	2.1 "
	TOTALS	127.3	16.0 "



NOTES

Each proposed sediment structure must be accompanied by all design data as prescribed in "Drainage Handbook."

This drainage plan is not illustrative of the number and type of sediment control structures that would normally be utilized on one particular permit, but rather, is intended to illustrate the plan presentation of each type structure.

The drainage plan has been reduced for illustrations.

All pipe culverts not designated any particular size to have minimum size opening of 100 sq. inches.

RECEIVING STREAM — BUCHANNON RIVER

SEAL OF REGISTERED ENGINEER

PROPOSED DRAINAGE PLAN

JOHN DOE COAL COMPANY
DOE NO. 1 OPERATION

BUCKHANNON DISTRICT — UPSHUR COUNTY

APRIL 30, 1971 — SCALE 1" = 500'

L. B WILSON

Registered Professional Engineer