WEST VIRGINIA
SECRETARY OF STATE
KEN HECHLER
ADMINISTRATIVE LAW DIVISION

Form #1

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OFFICE OF WEST VIRGINIA SECRETARY OF STATE

NOTICE OF PUBLIC HEARING ON A PROPOSED RULE

AGENCY: West Virginia Division of Forestry TITLE NUMBER: 22

RULE TYPE: Legislative ; CITE AUTHORITY 19-1B

AMENDMENT TO AN EXISTING RULE: YES____ NO X

IF YES, SERIES NUMBER OF RULE BEING AMENDED: _____

TITLE OF RULE BEING AMENDED: _____

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: 3

TITLE OF RULE BEING PROPOSED: Sediment Control During Commercial Timber-Harvesting Operation - Logger Certification

DATE OF PUBLIC HEARING: September 17, 1992 TIME: 1000-1100 hours

LOCATION OF PUBLIC HEARING: Forestry offices as follows:

1304 Goose Run Road, Fairmont, WV 26554 (District 1)
One Depot Street, Romney, WV 26757 (District 2)
State Route 20, French Creek, WV 26218 (District 3)
Route 16, MacArthur, WV 25873 (District 4)
878 East Main Street, Rear, Milton, WV 25541 (District 5)
2309 Gibon Road, Parkersburg, WV 26101 (District 6)

COMMENTS LIMITED TO: ORAL____, WRITTEN____, BOTH X

COMMENTS MAY ALSO BE MAILED TO THE FOLLOWING ADDRESS: W.Va. Division of Forestry
1900 Kanawha Boulevard, East
State Capitol (Guthrie, Bldg. 13)
Charleston, WV 25305-0180

The Department requests that persons wishing to make comments at the hearing make an effort to submit written comments in order to facilitate the review of these comments.

X

The issues to be heard shall be limited to the proposed rule.

2-90

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL — Attached

DEPARTMENT OF COMMERCE, LABOR & ENVIRONMENTAL RESOURCES
OFFICE OF THE SECRETARY
State Capitol, Room R-151
Charleston, West Virginia 25305-0310
Telephone: (304) 558-3255
Fax No.: (304) 558-4983

GASTON CAPERTON
Governor

JOHN M. RANSO
Cabinet Secretar

August 18, 1992

Mr. William H. Gillespie
Administrative Forester
Division of Forestry
Guthrie Agriculture Center
Charleston, West Virginia 25305-0570

RE: Proposed Rule - Title 22, Series 3 (Sediment Control During Commercial Timber-Harvesting Operations [Certification])

Dear Bill:

Pursuant to West Virginia Code 5F-2-2(a)(12), I hereby consent to the proposal of the rule specified above.

You may attach a copy of this letter to your filing with the Secretary of State as evidence of my consent.

Sincerely yours,

John M. Ranson
Cabinet Secretary

JMR:mcl

LEGISLATIVE

WEST VIRGINIA LEGISLATIVE REGULATIONS
DIVISION OF FORESTRY
DEPARTMENT OF COMMERCE, LABOR
AND ENVIRONMENTAL RESOURCES
Title 22
Series 3

SEDIMENT CONTROL DURING COMMERCIAL TIMBER-HARVESTING OPERATIONS - LOGGER CERTIFICATION

§22-3-1. General

1.1. Scope. - These regulations establish procedures by which the certification necessary before a person may directly supervise timbering operations in West Virginia may be acquired, suspended or revoked.

1.2. Authority. - West Virginia Code §19-1B-7.

1.3. Filing Date.

1.4. Effective Date.

§22-3-2. Definitions.

2.1. "Best Management Practices" or "BMP's" - means the technically feasible and economically reasonable procedures, as currently used in the state's silvicultural water quality management plan and as are adopted from time to time by the director, upon recommendation of the BMP Committee specified in §19-1B-7(h), used to reduce sedimentation of the waters of the state by soil erosion coming from the establishment and/or use of haul roads, skid roads, log landings, or other activities associated with the commercial harvesting of timber.

2.2. "Chief" - means the administrator of the office of water resources of the division of environmental protection or his or her agent.

2.3. "Certified Logger" - means an individual engaged in the business of severing trees for commercial purposes who has successfully completed the program prescribed by the director to ensure competency in the safe conduct of timbering operations, in first aid, and in the use of BMP's.

2.4. "Commercial" - means that which is done for a wage, fee, commission, agent or profit.

2.5. "Compliance Order" - means a written order of the director specifying

how a situation that is contributing, or has the potential to contribute, to soil erosion or water pollution, be corrected; and further specifying a reasonable and practical number of days in which the corrective action(s) must be taken.

2.6. "Conference Panel" - means the entity comprised of those persons selected by the director and the chief, as specified in §19-1B-11-a, and who, upon the request of an aggrieved person or upon petition of the chief, meet to affirm, modify or vacate orders of the director relating to commercial timber harvesting.

2.7. "Director" - means the director, also termed the state administrative forester, of the West Virginia division of forestry or his or her agent.

2.8. "Haul Road" - means a road, other than roads built under an active permit to comply with other laws or regulations, constructed or used for the transportation of logs from a landing to a state road or highway.

2.9. "Landing" - means an area, integral to the logging operation, in or near a forest where logs are first accumulated and/or prepared for loading onto or into carriers for transportation to a wood-processing facility.

2.10. "Logger Certification" - means the issuance of a numbered certificate and a wallet-sized photo identification card to individuals successfully completing a regularly scheduled program of education, training and examination prescribed by the director in the safe conduct of timbering operations, in first aid procedures, and in the use of best management practices.

2.11. "Skid Road" - means a road over which trees and logs are carried or dragged from the point where severed to a landing.

2.12. "Timbering Operations" - means all aspects of logging, including but not limited to severing and delimbing of trees, cutting of the delimbed tree into logs either at the point of severing or at a landing, the preparation of any skid and haul roads and the skidding or otherwise moving of logs to landings.

2.13. "Water Pollution Control Act" - means Article 5A, Chapter 20, of the West Virginia Code or the successor citation.

§22-3-3. Procedures for certifying loggers; supervisory activities; carrying Photo Identification Card.

3.1. Any individual engaged in the supervision of a logging crew shall, after July 1, 1993, be certified as a certified logger by the director. Logging crew members not involved in supervision may be certified, but certification is not mandatory.

3.2. The chief or any agent of the chief engaged in the review of logging operations to ascertain compliance with appropriate statutes shall be specially certified by the director upon successful completion of the BMP training portion of the program.

3.3. Any individual applying for certification as a certified logger shall first complete the course of instruction prescribed by the director for that purpose and shall then complete an application form supplied by the director.

3.4. A fee of fifty dollars shall be submitted with each application for certification or for certification renewal. There shall be no prorating of the fee for partial-year certification.

3.5. Certified loggers must apply for renewal by completing a renewal form each year. A renewal form shall be sent by the director to the last known address of the certified logger at least thirty days prior to the renewal deadline. Certifications may be renewed only for two succeeding years. For the third renewal and every third renewal thereafter, the certified logger shall first complete a regularly scheduled program designed by the director to update the education and training that the logger originally completed for certification.

3.6. Certifications not renewed for two successive years shall be deemed vacant, and the number shall be available for reassignment.

3.7. Any person found guilty of supervising a logging crew without a valid certification shall be eligible for certification upon satisfactory completion of the next regularly scheduled course of instruction prescribed by the director.

3.8. A certified logger shall not directly supervise more than one crew at a time.

3.9. A certified logger shall, when supervising an active logging operation, be at the operation each day, but does not have to be continuously present.

3.10. Certified loggers shall have their certified logger photo identification cards on their person at any time they are supervising a logging crew.

§22-3-4. Logger Certification Suspension.

4.1. The certification of any certified logger may be suspended for no less than thirty nor more than ninety days when found to be in violation of the provisions of either the logging sediment control act or the water pollution control act for a second time within any two-year period. A single incident, regardless of the number of citations, shall constitute a single violation.

4.2. Violations to be considered as cause for certification suspension shall include, but shall not be limited to:

4.2.1. Providing invalid or misleading information on an application form.

4.2.2. Failure to use appropriate best management practices.

4.2.3. Failure to observe compliance orders from the director.

4.2.4. Failure to observe a timbering operation suspension order from the director.

4.2.5. Failure to keep first aid certification current.

4.2.6. Interfering with the director's or chief's access to the operation for inspection purposes during reasonable working hours or for emergencies.

§22-3-5. Logger Certification Revocation.

5.1. An individual's certified logger certification may be revoked for any of the following reasons. Recertification shall be contingent upon again successfully completing the general certification procedures, but in no event shall a recertification be issued prior to one year after the revocation.

5.1.1. Providing false data on the application for certification.

5.1.2. Being found in violation of either the logging sediment control act or the water pollution control act for a third time within any two-year period. Violations to be considered as causes for certification revocation shall include, but aren't necessarily limited to, the listing set forth in 4.1(a) through 4.1(e) of this regulation.

§22-3-6. Reciprocity With Other States.

6.1. Reciprocity with other states with similar certification programs shall be on the basis of a written agreement signed by the director and the appropriate official of the other state.

6.2. Before signing a reciprocal agreement with another state, the director shall first determine that the program or aspect of the program under consideration is at least equal to that of the West Virginia logger certification program.

6.3. Standard first aid cards; i.e., Red Cross, Emergency Medical Technician, etc., showing competency in a course of first aid at least equal to that prescribed by the director, shall be acceptable as proof of competency for that part of the training.

§22-3-7. Right of Appeal.

7.1. Any person aggrieved by a decision of the director relative to his or her certification as a certified logger shall have the right to appeal the order to the district conference panel who shall, in writing, affirm, modify or vacate the order.

These regulations establish procedures under which loggers may become certified to supervise timbering operations in West Virginia. The regulations also specify how such certification may be suspended or revoked. Reciprocity with other states is also addressed.

APPENDIX B

FISCAL NOTE FOR PROPOSED RULES

Rule Title: Sediment Control During Commercial Timber-Harvesting Operations - Logger Certification

Type of Rule: X Legislative _____ Interpretive _____ Procedural

Agency West Virginia Division of Forestry Address 1900 Kanawha Boulevard, East State Capitol (Guthrie, Bldg. 13), Charleston, WV 25305-0180

1. Effect of Proposed Rule	ANNUAL Increase	ANNUAL Decrease	FISCAL YEAR Current	FISCAL YEAR Next	FISCAL YEAR Thereafter
Estimated Total Cost	$	$	$ 116,000	$ 116,000	$ Impossible to estimate now
Personal Services			$ 80,000	$80,000	
Current Expense			$ 21,000	$21,000	
Repairs and Alterations					
Equipment			$ 10,000	$10,000	
Other			$ 5,000	$ 5,000	

2. Explanation of above estimates: 4 weeks of logging safety classes - $3,000+ for consultantant plus $2,500 for staff; 60 eight-hour classes on Sediment Control - 3 staff minimum $36,000; 200 classes on first aid (minimum of 2 staff) $40,000; needed materials - clinometers, abney levels, printing, etc., $15,000 = $116,000 first year.

3. Objectives of these rules: To implement a logger certification program as called for in 19-1B (House Bill 4669, 1992 session) so as to provide for safer and environmentally less harmful logging. A 12-person, statewide, industry-legislative-environmental committee worked throughout the summer in preparing these rules.

4. Explanation of Overall Economic Impact of Proposed Rule.

A. Economic Impact on State Government.

Detracts from providing landowner assistance. Won't be able to estimate for at least a year, but will probably cut current levels by one third.

B. Economic Impact on Political Subdivisions; Specific Industries; Specific groups of citizens.

Will cost each firm a minimum of $500 for getting a logger certified for each crew, and the recommendation has been made that each firm certify two for each crew.

C. Economic Impact on Citizens/Public at Large.

May result in less sediment in streams and less payout of Workers' Compensation.

Date: 8-18-92

Signature of Agency Head or Authorized Representative

William H. Gillespie

William H. Gillespie

Memo to: Judy Cooper

Date September 3, 1992

The BMP's in this manual are the ones in current use. A committee is now studying whether they need to be revised.

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Attachment

CLEAN STREAMS
HANDBOOK FOR FOREST LANDOWNERS

KEEPING MUD OUT OF THE STREAMS

INTRODUCTION

Loggers can have a big effect on whether or not mud from logging operations gets into the streams. This manual has been revised so the forest landowner can learn the best methods of keeping mud out of streams. These methods may also make logging more efficient and profitable.

This manual explains the general methods that loggers can use to reduce stream pollution from logging. The exact standards for logging are contained in the 208 Silviculture Water Quality Management Plan of West Virginia. In addition, the State of West Virginia has adopted water standards which apply to the streams.

Methods in this manual are presented in a step-by-step fashion. The steps are planning, constructing, maintaining, and retiring the operations (this includes all roads and landings). We focus most on roads because they can cause the biggest problems. Every forest landowner should know what is necessary in each step. Understanding and following these steps will enable you to do a better job and keep mud out of the streams.

ACKNOWLEDGEMENTS

In preparing this manual we have drawn freely from the references listed and received assistance and suggestions from state, federal and industry foresters. Original art work is by Barry Nehr, U.S. Department of Agriculture—Forest Service, and L. Whalen, courtesy of Forest Engineering Research Institute of Canada. This publication was made possible by a grant from the U.S. Department of Agriculture—Forest Service. This is a part of the educational program of the West Virginia Forest Water Quality Voluntary Compliance Committee.

CONTENTS

CLEAN STREAMS AND BETTER LOGGING

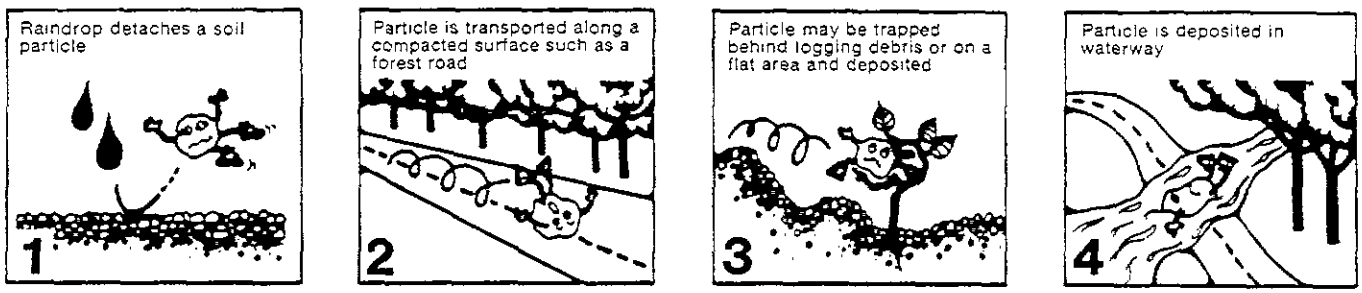
CLEAN STREAMS AND BETTER LOGGING

Mud In The Stream—What Causes It?

The biggest water pollution problem from logging operations is mud in the stream. It is caused by erosion of soil. Erosion takes place in four parts:

1. A soil particle is detached by a raindrop or flowing water.
2. The detached particle is moved with the flowing water, which is now muddy water.
3. The particle catches on logging debris, brush, leaves, or grass, or is left on a flat area.
4. If the particle does not get caught, it continues in the flowing water into the stream, causing water pollution. Mud in the stream is water pollution.

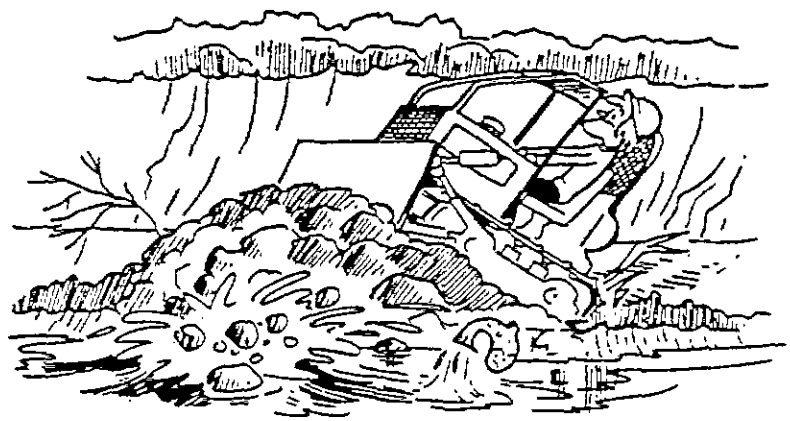
PROCESS OF EROSION



Courtesy of Florida Division of Forestry

Where Does the Mud Come From?

Haul roads and skid roads cause the biggest problem. Most mud comes from road building and roads. Mud does not usually come from leaf-covered or undisturbed parts of logging jobs.



What Damage Does Mud In The Stream Cause?

* Fills in stream and riverbeds and lakes and reservoirs, which can cause flooding or require expensive dredging.

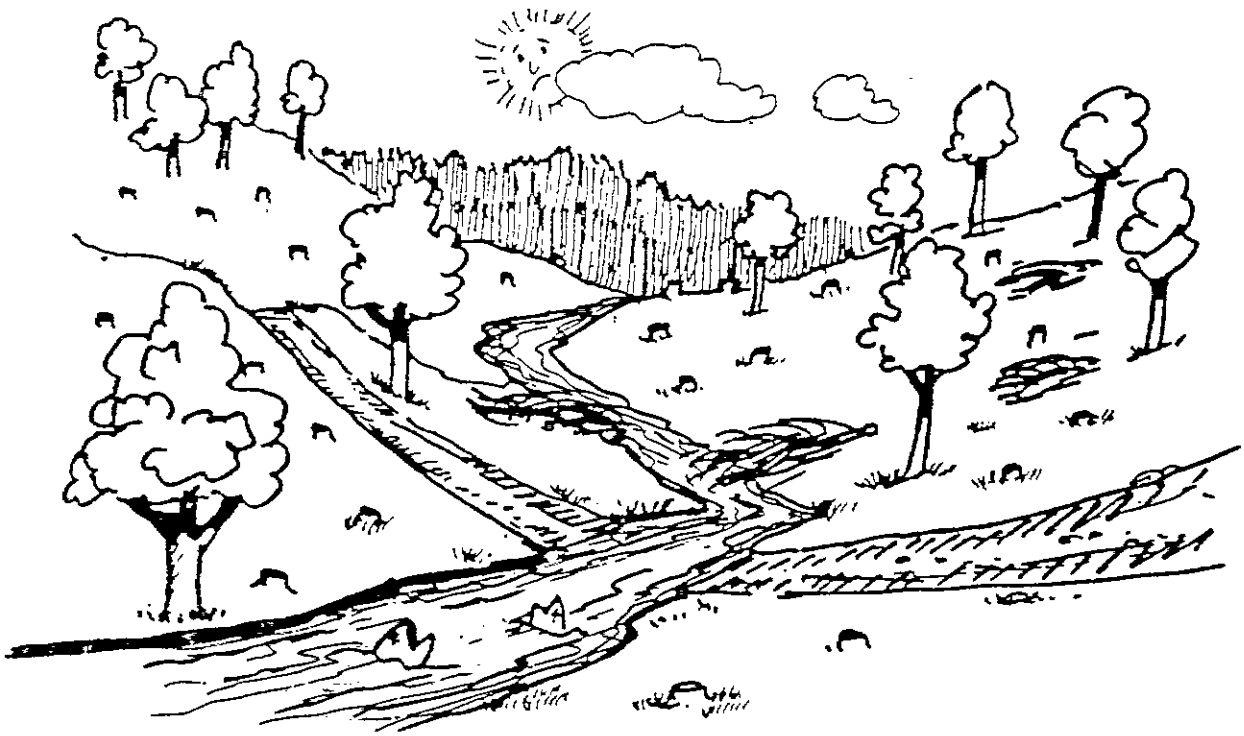
* Causes dirty drinking water supplies; it costs a lot to remove the mud.

* Kills tiny plants and animals (fish food) living on stream bottoms and makes it hard for fish to see food, fewer fish can live in the water.

* Kills larger water plants.

* Makes fishing and swimming poor.

* Looks bad.



What Happens When A Citizen Complains About Mud In the Stream?

Complaints are usually investigated jointly by a service forester and a water inspector. Sometimes it is determined that the logging is not the cause of mud in the stream. When logging is the cause of the mud, the logger is normally first given an opportunity to clean up the job. If corrective action is not taken by the logger, a warrant may be issued by the water inspector. Fines can be severe: willful violation of water quality standards carries a fine of $2,500 to $25,000 per day.

How Can You Avoid A Fine For Getting Mud In The Stream?

Streams, rivers, and lakes must be kept clean. This is enforced by the West Virginia Division of Water Resources. Using "best management practices" (BMPs) on your land will help prevent mud in the stream and avoid complaints by citizens and fines to the contractor for water pollution from mud in the stream.

Will Logging Be Regulated?

Loggers in West Virginia are improving their methods to keep streams clean. Control of mud from logging operations is up to the logger. Logging in West Virginia could become further regulated if the landowners and loggers are not effective in keeping mud out of the stream.

You can help keep the mud out of the stream by insuring the use of BMPs on logging operations. BMPs are practices such as proper road and landing location and construction, and the use of culverts and water bars. A landowner should have BMPs included in any contract. A booklet explaining recommended BMPs is available from the West Virginia Forestry Division and your local service forester. The logger can also use ingenuity and any new technology (such as road stabilization fabrics and filter mats) so that the result is clean streams.

Five BMPs You And Your Logger Can Use To Keep Mud Out Of The Stream.

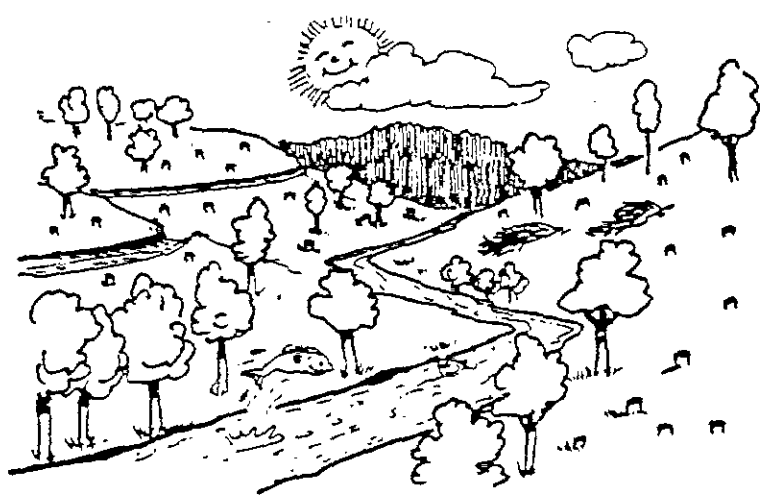
1. **Plan the job.** The landowner and logger should mutually spend time planning and laying out roads and landings to prevent potential problems. This includes fitting the roads to the lay of the land and keeping grades low. Well planned and properly located roads can be a great asset to the landowner's property. Permanent roads can greatly enhance woodland activities such as hiking and hunting. Permanent roads permit access for fire protection, firewood cutting, future timber management, and harvesting.

2. **Stay away from streams.** You should try to plan and build roads and landings at least 100 feet from streams. Equipment should be kept out of streams. A filterstrip of vegetation should be left along the stream.

3. **Great care should be used in crossing streams.** When a stream must be crossed, a culvert or bridge should be used; crossing should be at a right angle, and the approaching roads should not drain water into the stream.

4. **Water should be drained off roads and landings.** The logger should use ditches, culverts, dips, and grade breaks, and log in favorable weather when possible. These drainage structures need to be maintained during operation to keep them working. To prevent water from washing down long stretches of road or standing in landings or dips, the logger should inspect ditches, culverts, etc., periodically to make sure they are effective. If muddy water is noticed entering a stream, or if there is a possibility of this, steps need to be taken to correct the problem.

5. **Roads should be retired as soon as they are not needed.** Water bars and seed or slash-cover may be used.



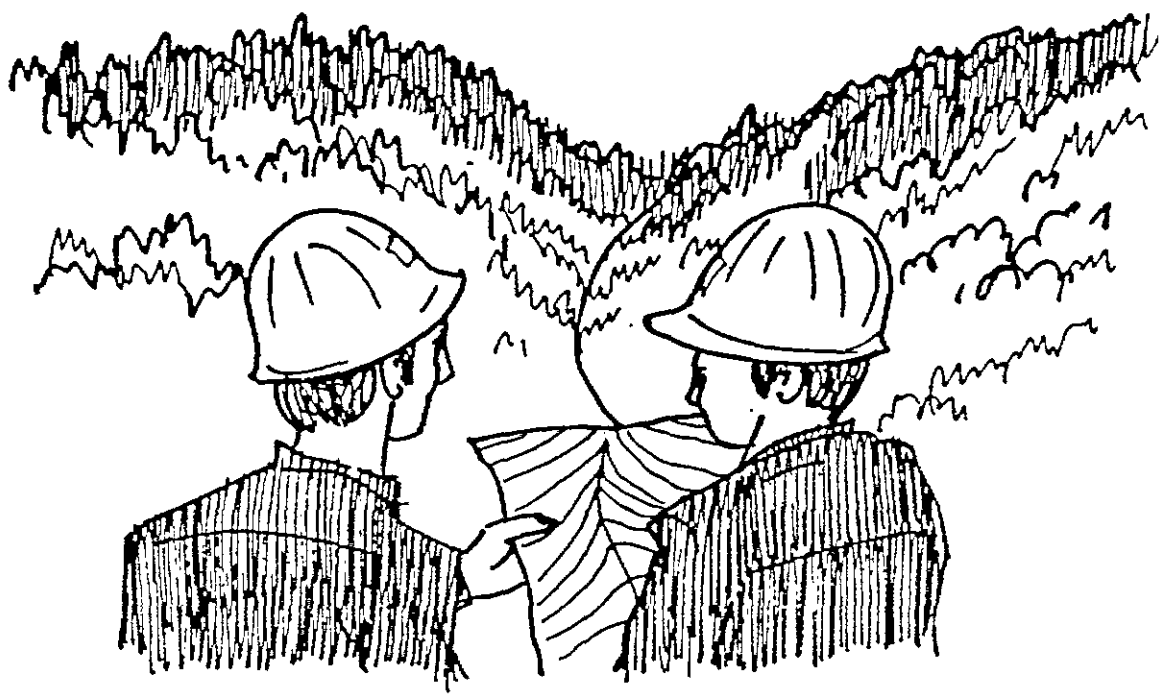
What Materials Are Needed To Keep Mud Out Of The Stream?

Your concern for clean water is shown by how prepared you are when you log. Some items which will help you keep mud out of the stream are:

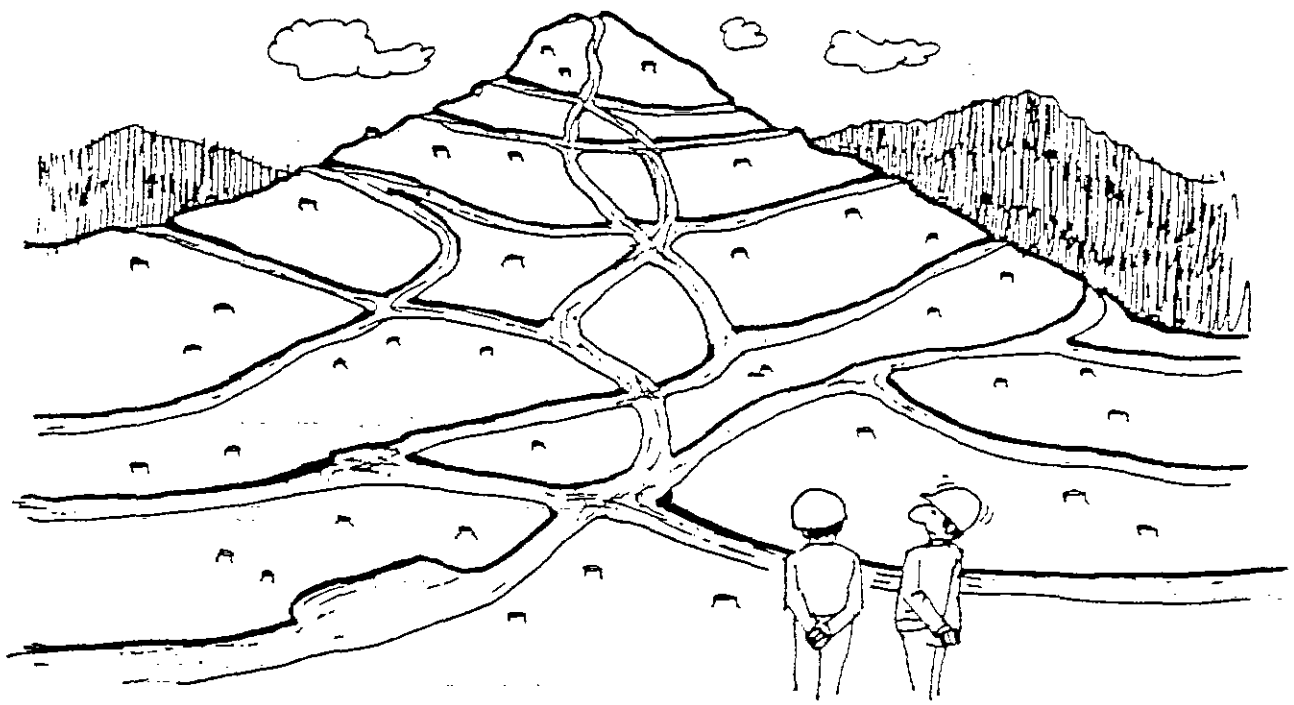
1. **Maps** for planning your logging job.
2. A **device for measuring road grade** such as an Abney level, clinometer or grade meter.
3. **Flagging tape** for marking roads and drainage structures.
4. **Culverts** for crossing streams and draining roads.
5. **Seed** for planting steep roads and banks.

Where Can You Get Help In Using BMPs and Planning Your Logging?

Contact your service forester, consulting forester or industry (company) forester. See list of foresters at end of this manual.



PLANNING LOGGING ROADS



"MAYBE WE SHOULD HAVE PLANNED OUR ROAD SYSTEM."

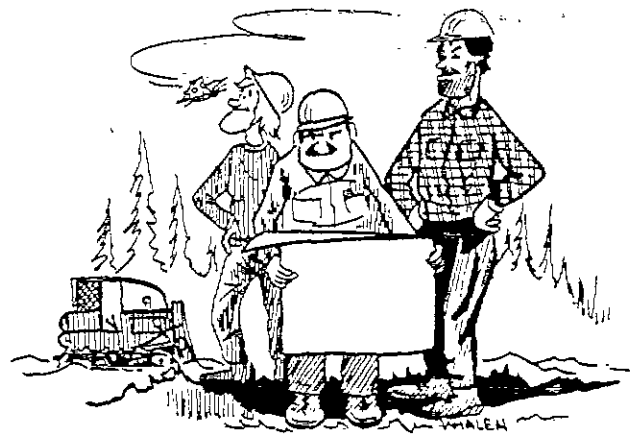
PLANNING LOGGING ROADS

Why Plan Your Road System?

With proper planning you can save time, money and effort and also prevent mud in the stream.

Advantages of Planning Your Road System:

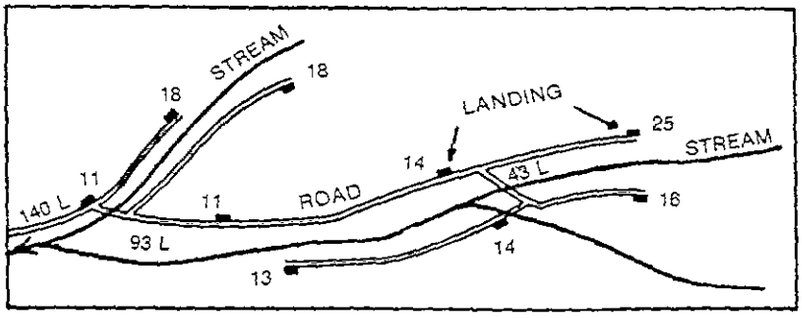
* Fewer Miles of Roads Needed
* Less Time to Build—Planning takes time but may **save time** and **money** in the long run
* Less Construction Cost
* Increased Hauling Efficiency
* Less Maintenance on Roads and Equipment
* More Use in Bad Weather
* Looks Better—Better Public Image
* Provides for Future Access
* Less Mud in the Stream From Erosion



Things To Consider On All Jobs

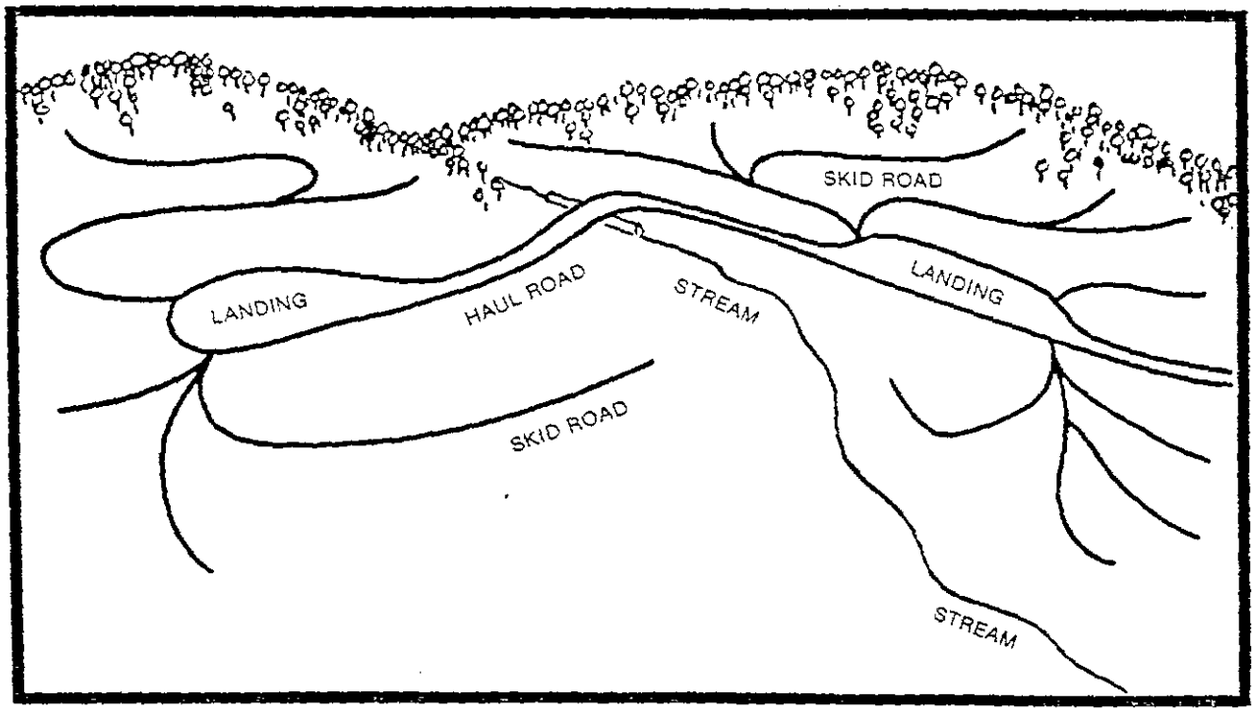
a. **Consider layout of road system.** Often this is a climbing main haul road with skid roads leading off the haul road. Plan roads to fit the lay of the land. You will also have to keep in mind the property boundary lines, concentrations of timber, and stream location. Locate landings first. Skid road approaches to landings should have low grades so that water will not be likely to flow down into a landing. Space skid roads as far apart as practical.

Method for sizing up road use on a planned logging job in terms of number of loads that will be hauled over the road.

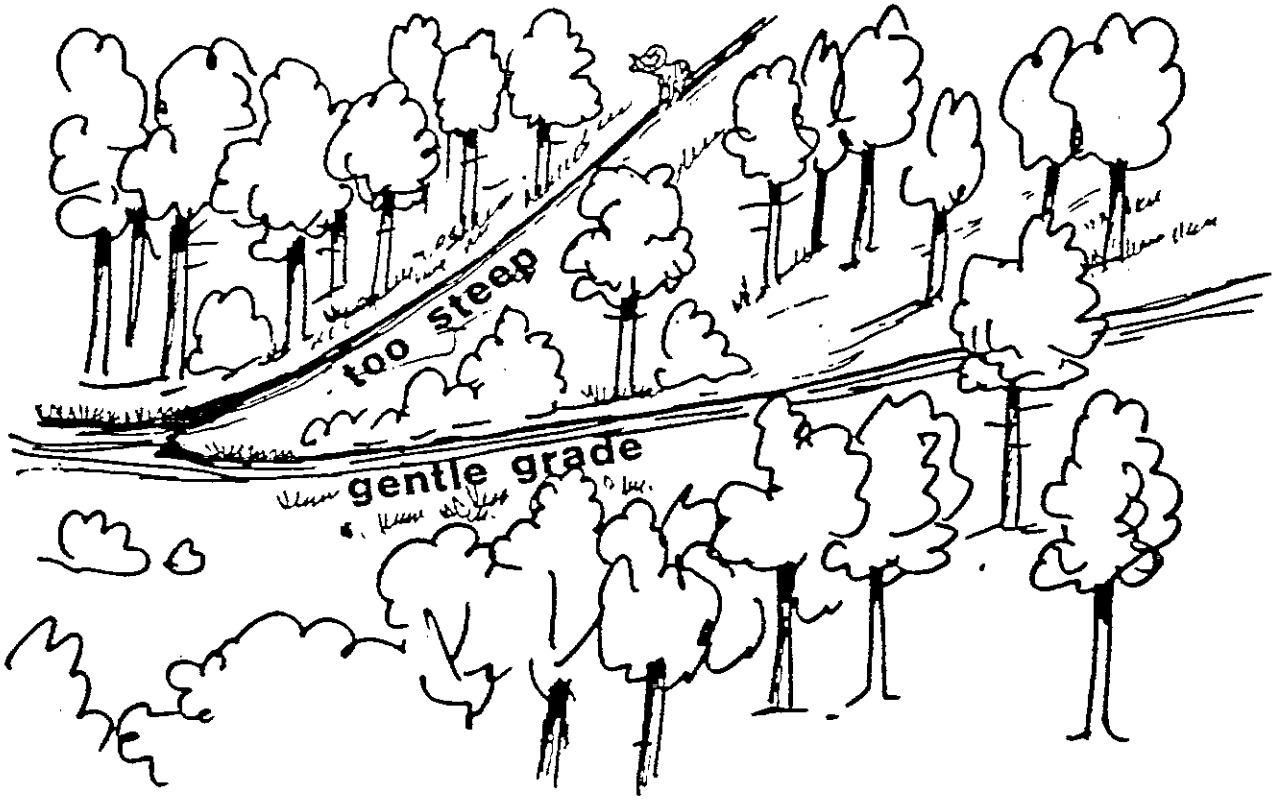


Loads at landings are computed from estimate of timber that will be skidded to each landing. Where timber is uniformly distributed, this can be determined from the area served by each landing.

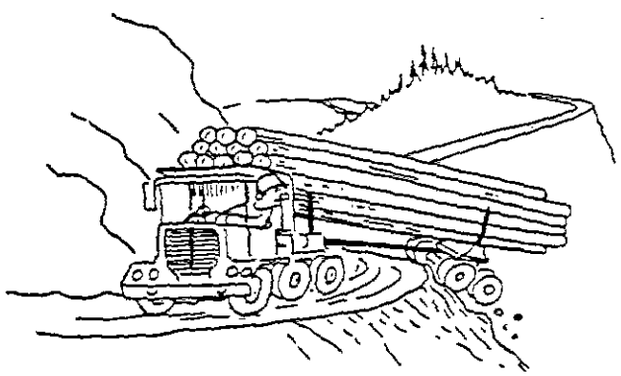
Expressing the proposed use of a logging road in terms of number of loads that will be hauled over it can serve as a guide to the design and standards to which the various sections and spurs need to be constructed.

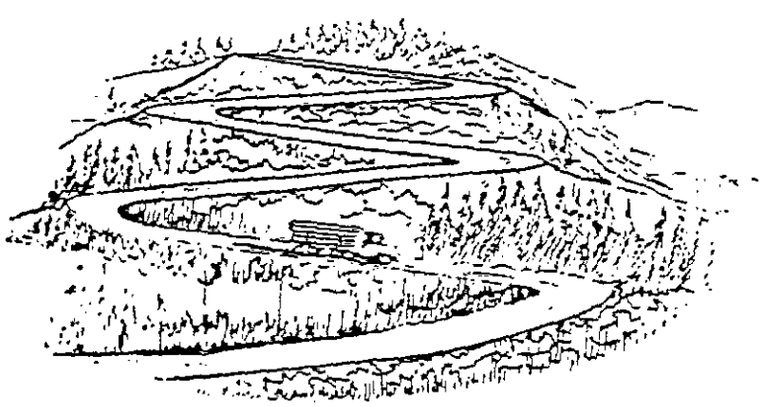


b. **Consider grade of road.** Grade is shown in this manual in percentage. A 10% grade has a rise of 10 feet per 100 feet of length. Haul Roads should be 3-10% (to 15% with special treatment). Skid Roads may be up to 15% (to 20% for short segments). Keep road grades as low as possible. Do not go straight up the slope, but proceed slanting up the hill. Break the grade occasionally to avoid long straight grades which permit runoff water to build up and cause erosion. Dips, grade breaks or other drainage structures should be installed on main skid roads. Wherever possible, build the road from the top down—it is much easier. The only way to reduce road grades is to build longer roads; in other words, "go the long way around." Often this does not mean building more miles of road on the whole job, since the area would be roaded anyway. It is also important to provide a cross-drain immediately above extra steep pitches in the road and below bank seepage spots. If you plan to upgrade wheeled skidder roads into roads suitable for other vehicles at a future date, they must be laid out with that in mind.



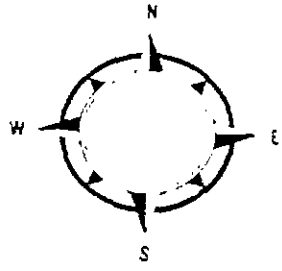
c. **Consider road curves.** Curves should have a minimum 35-foot radius and nearly level grade. A slight slope on the grade will help provide drainage. Fender logs or high stumps are recommended on the edge of skid roads on steep slopes, and also at turns and switchbacks, to prevent logs from rolling off the skid road (causing more side casting of earth) and to protect adjacent standing timber from damage.



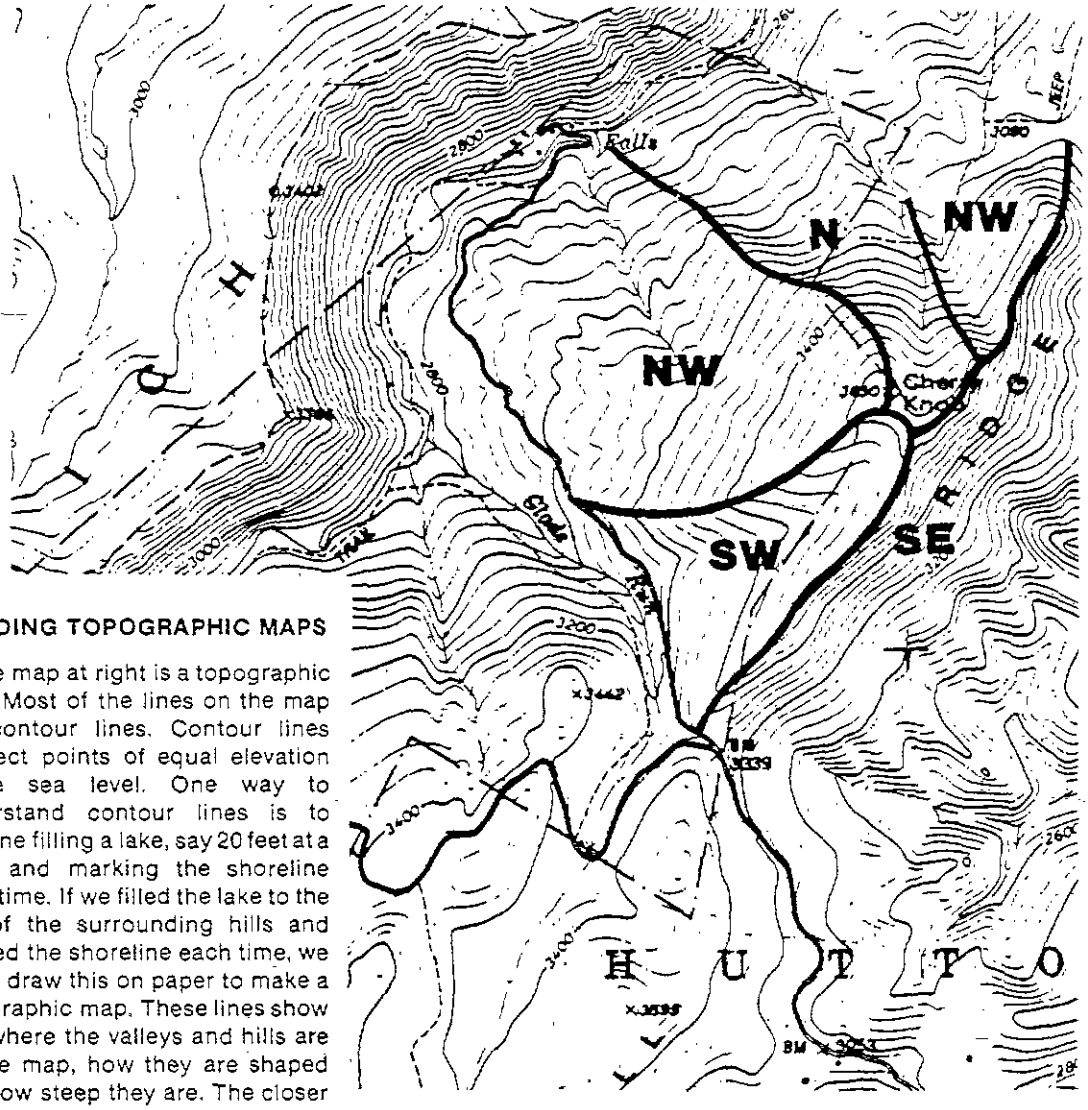


d. **Consider slope and aspect (compass direction) of hillside.** South and west-facing hillsides are driest; north and east hillsides are wettest and normally steepest. Locate major haul roads on sunny south and west slopes whenever possible. They dry faster than shady north and east slopes.

The topographic map below shows a mountain divided into major slopes. We would expect the southwestern (SW) slope to be driest.



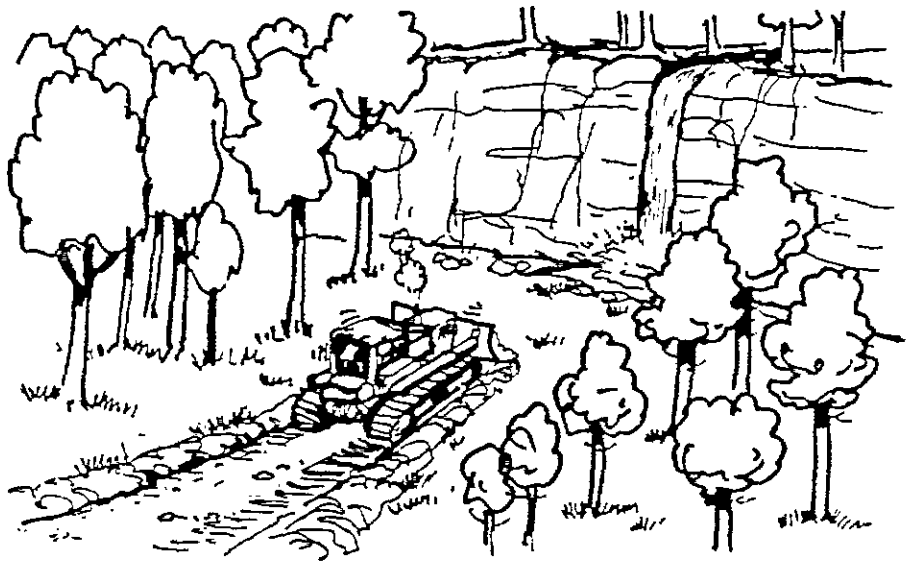
COMPASS ROSE shows compass direction



READING TOPOGRAPHIC MAPS

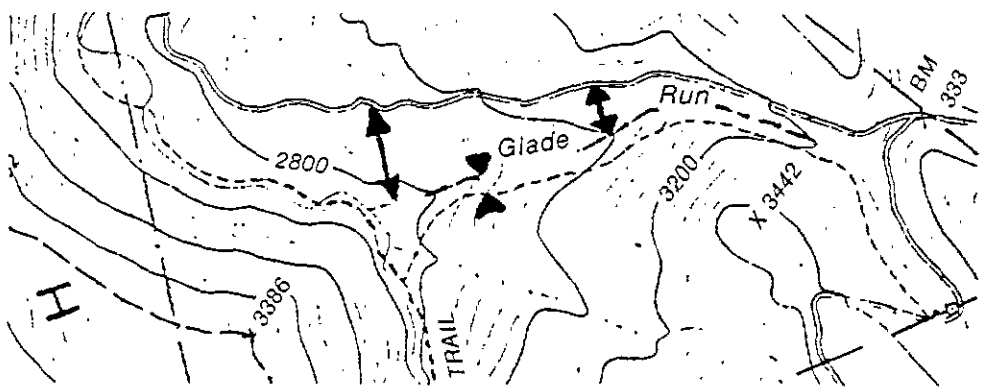
The map at right is a topographic map. Most of the lines on the map are contour lines. Contour lines connect points of equal elevation above sea level. One way to understand contour lines is to imagine filling a lake, say 20 feet at a time, and marking the shoreline each time. If we filled the lake to the top of the surrounding hills and marked the shoreline each time, we could draw this on paper to make a topographic map. These lines show you where the valleys and hills are on the map, how they are shaped and how steep they are. The closer the contour lines, the steeper the slope. The contour interval is the vertical distance between contour lines. In the example above, the lake was filled 20 feet at a time, so the contour interval is 20 feet.

e. **Avoid obstacles.** Rock (cliffs), easily eroded soils (such as clay), seeps, swampy places, flat ridgetops. All may affect ease of road design and the likeliness of water pollution (mud in the stream).

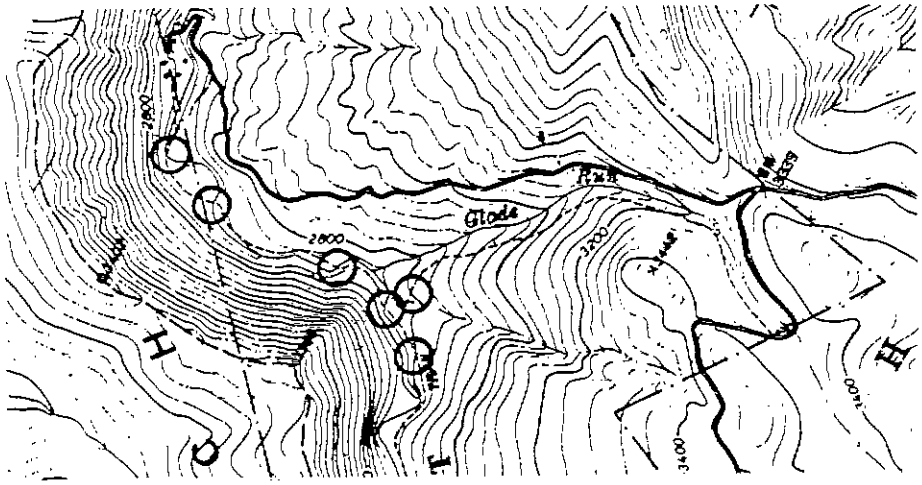


**"THIS IS A REAL DEAD END—
WE SHOULD HAVE MARKED THE ROAD BEFORE CONSTRUCTION."**

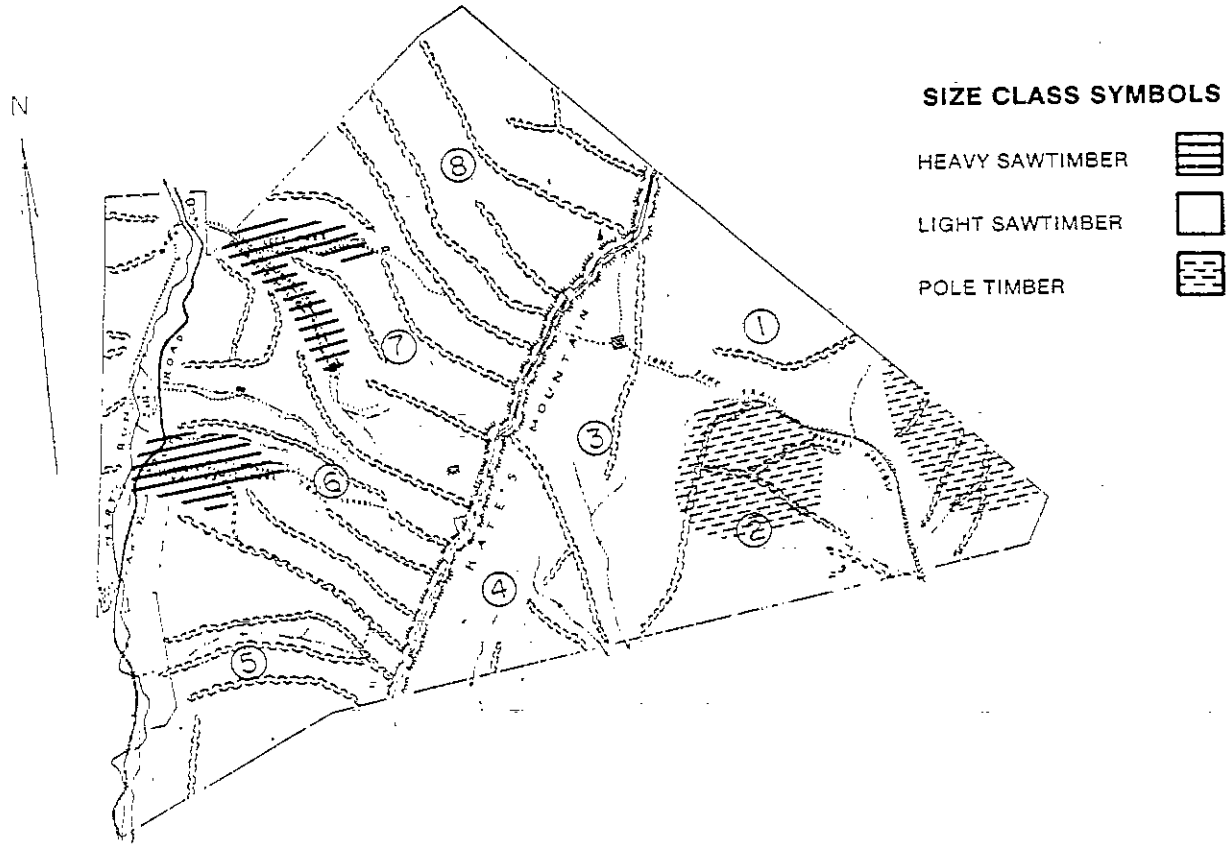
f. **Consider distance from streams.** You should stay at least 25 feet from streams on level ground and stay further away on slopes. It is good to stay at least 100 feet from streams if possible. This means keeping land disturbance (roads and fills) away from streams by providing filterstrip areas between road or landing and the stream to absorb any muddy water which could enter the stream. Trees may be removed from the filterstrip area, but no roads (or landings) should be built in it, except where proper stream crossings are made.



g. **Consider stream crossings.** Cross at a right angle if possible. Construct small bridges or install culverts at live stream crossings and seeps (springs). Roads leading down to a stream crossing should be drained so that water will not run down the road into the stream. Logs should not be skidded through flowing streams.



h. **Consider distribution and volume of timber to be removed.** The more timber that is hauled from an area, the better the road that is needed.

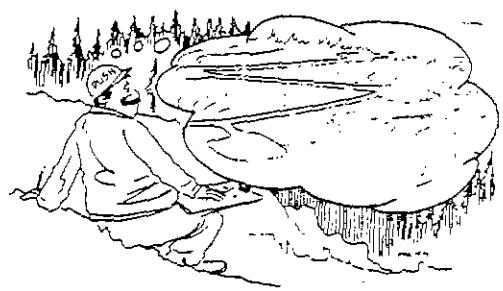


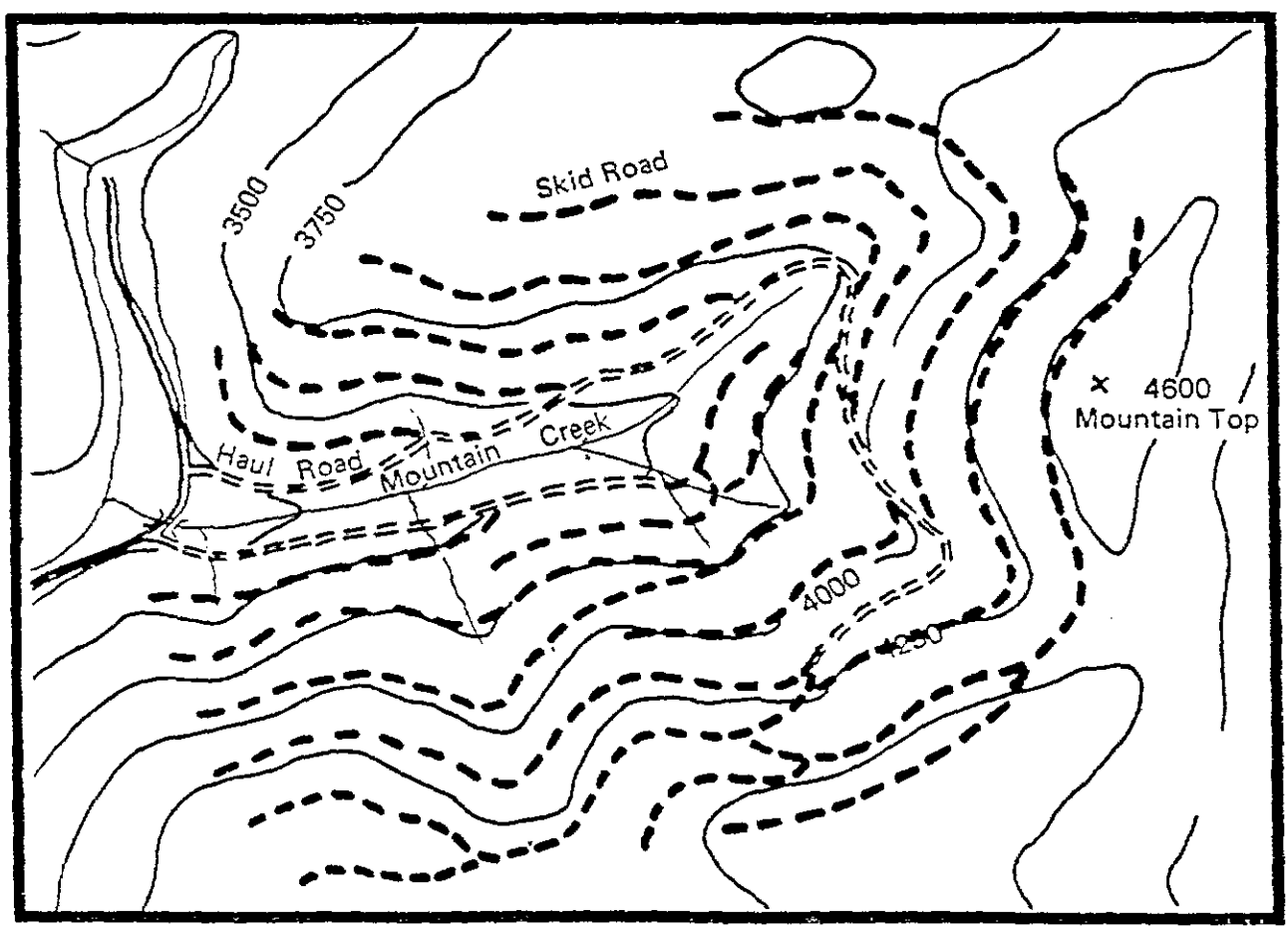
Planning Step #1—Plan on Paper

It may be helpful, especially with large jobs, to locate haul and skid roads on a map. A topographic map works best.

* Draw in proposed haul and skid roads and landings.

* Mark proposed drainage or water control structures: bridges, culverts and dips, outslope or inslope of roads, grade breaks, critical areas to be graveled.



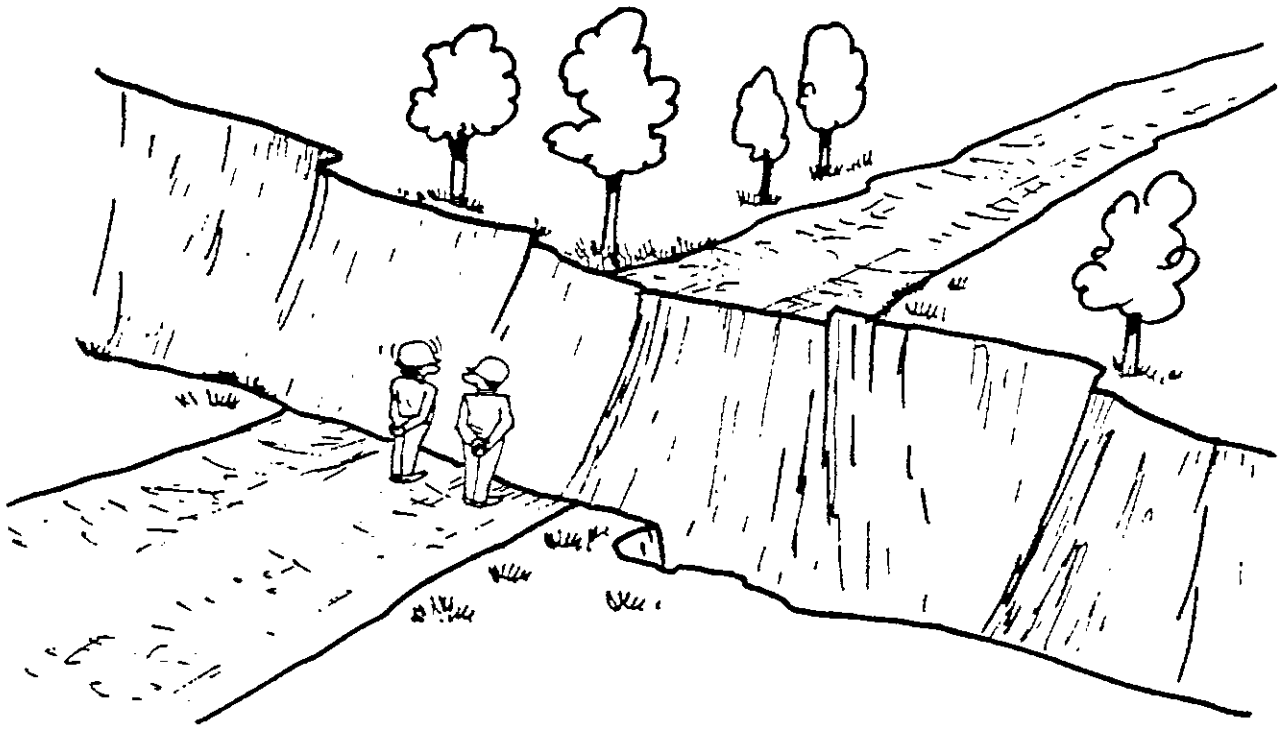


This topographic map shows a logger's plan for his road system. Haul roads are double-dashed lines and main skid roads are single-dashed lines. Numbers on topographic contour lines show elevations in feet.

Planning Step #2—Plan on the Ground

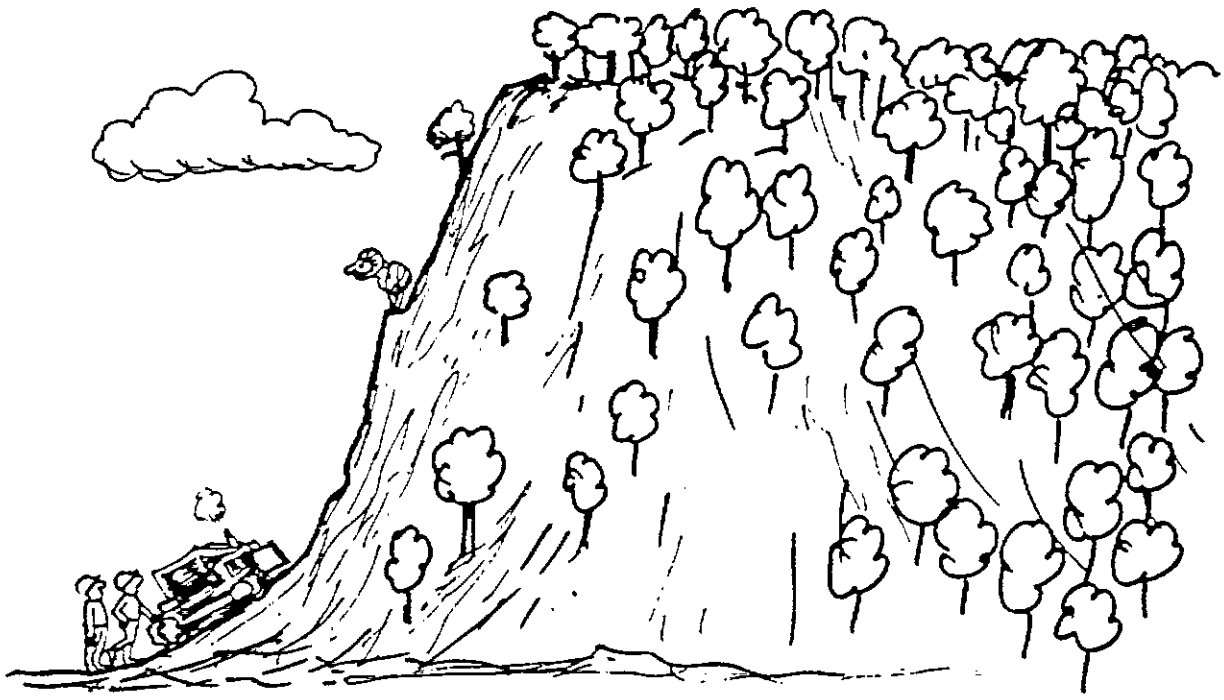
It is very important to locate roads on the ground before construction begins. A Suunto clinometer or Abney level may be helpful in determining grades of roads. A grade meter is provided at the end of this manual.

* Walk entire length of proposed roads. This is very important because it can prevent costly problems later.
* Flag or blaze grade line—It may take several trail runs to get a satisfactory grade. This job is easier after the leaves have fallen.
* Flag proposed drainage structure locations.



"MAYBE WE NEED A BRIDGE."

CONSTRUCTING LOGGING ROADS



"THIS GRADE MAY BE A LITTLE TOO STEEP."

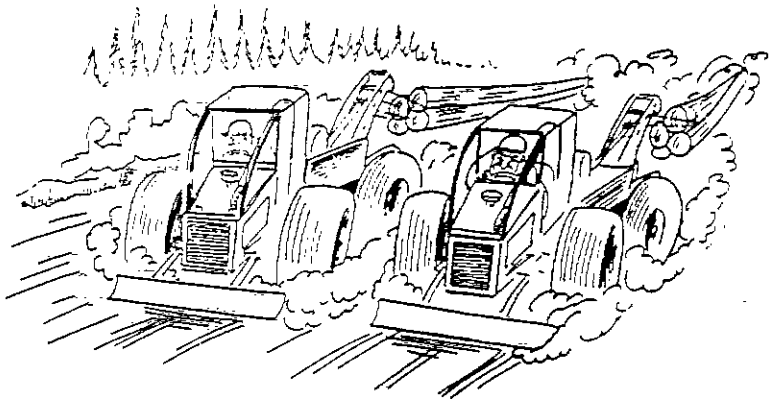
Constructing Logging Roads (and Landings)

1. **Clear right-of-way and daylight where necessary.** Follow flagging or blazes carefully where roads have been marked. Often roadbed construction is done at the same time as clearing.

   * Remove merchantable timber/push away standing trees.
   * Push away nonmerchantable trees and brush.
   * Provide for daylighting (removing trees along the road to allow the sun to dry it).

2. **Construct Roadbeds.** Use the greatest care near streams.

   * Control width—use narrowest width road that will do the job safely.



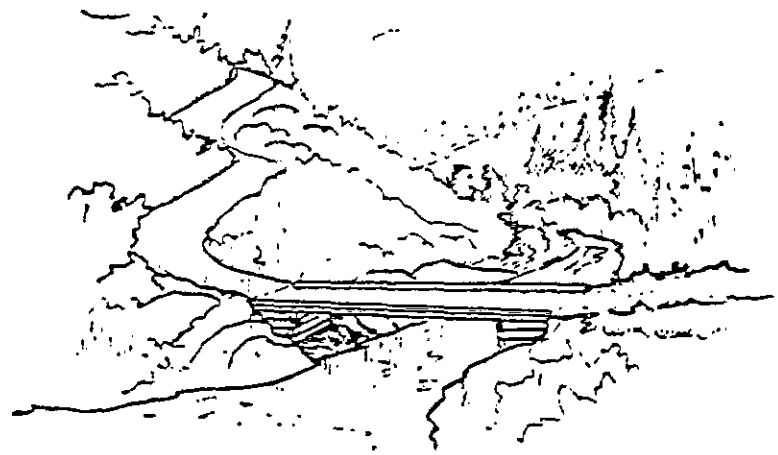
   * Control inslope (or outslope) and ditching for drainage.
   * Maintain temporary water bar during construction on a day-to-day basis in case of a storm.

3. **Install drainage structures.** Drainage structures include bridges, outslope or inslope of road, culverts, water bars, dips, grade breaks and log crossings.

Bridges

Use bridges to cross streams that are too big for culverts. Careful consideration should be given to alternate road locations before deciding that a bridge is really necessary to transport timber out of a certain tract of woodland. It may be less expensive in the long run to move the timber in another direction over a longer route rather than to build a bridge. A bridge should not be constructed if a crossing can be made by less expensive means such as a culvert pipe or stable ford.

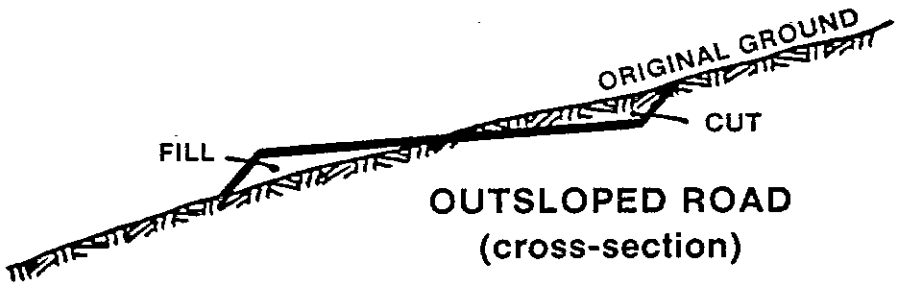
All crossing sites should be selected at right angles to the stream and should not interfere with natural stream flow. Roads should climb away from stream crossings in both directions to prevent high water from running down roads. Streams permitted to overflow onto logging roads can wash tremendous quantities of mud into the streams in a very short time. Open-top culverts or dips on both sides of the crossing site will divert road runoff into filterstrips and prevent dirty water from running directly off roads into streams. Open-topped culverts are not generally recommended.



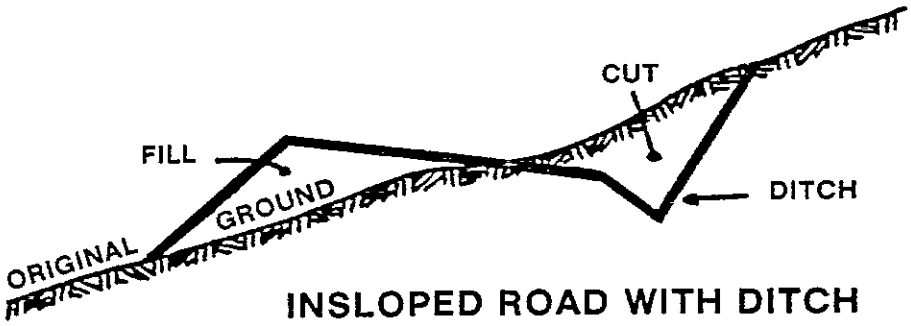
Outslope or Inslope of Road

Outsloping the entire width of the road toward the fill bank provides good surface drainage and may reduce the number of culverts needed, and hence reduce the construction costs. The outslope should be only enough to divert the water, generally ¼-⅜ inch to the foot. If the slope is apparent to the eye, it is usually too great. A road should not be outsloped in steep country. Truck travel becomes hazardous under such conditions.

Insloping the road toward the cut bank may be done to prevent erosion or as a safety precaution. An insloped road requires the installation of culverts or stable dips to remove water from the road.



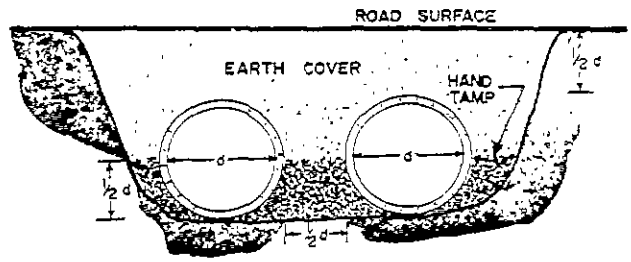
OUTSLOPED ROAD
(cross-section)



INSLOPED ROAD WITH DITCH
(cross-section)

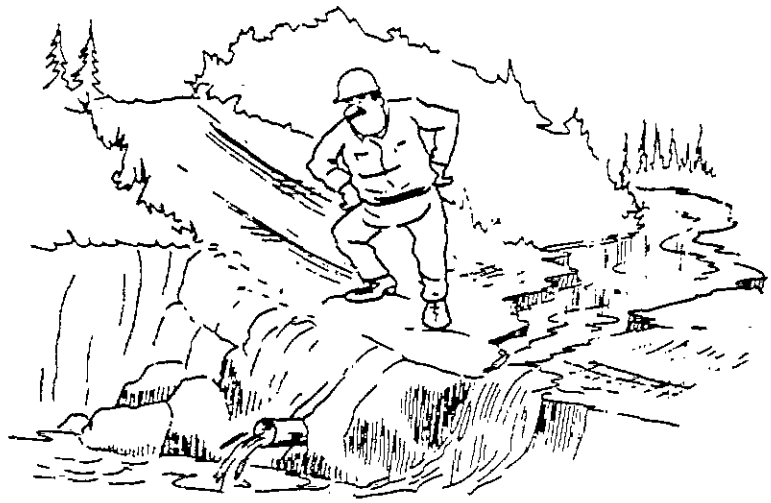
Culverts

Culverts are the most commonly used road drainage structures and are also used for crossing small streams. Culverts used on logging roads are made of corrugated steel, used natural gas pipe, corrugated aluminum, lumber, plastic concrete or hollow logs. Hollow logs should not be considered as permanent structures and must be removed when the road is retired.

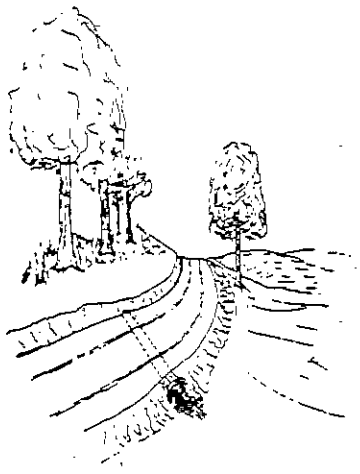


Culvert Installation. Earth (not rock) should be hand-tamped at least halfway up the side of the pipe. Space between pipes in a multiple culvert should be half the pipe diameter. The earth cover over pipes should also be half the culvert diameter in depth, but not less than 1 foot. The larger the culvert the more care required to install it. Heavy steel natural gas pipe is often installed and then pulled up when the logging is finished. This pipe is very strong and can be handled with less care than other kinds of pipe.

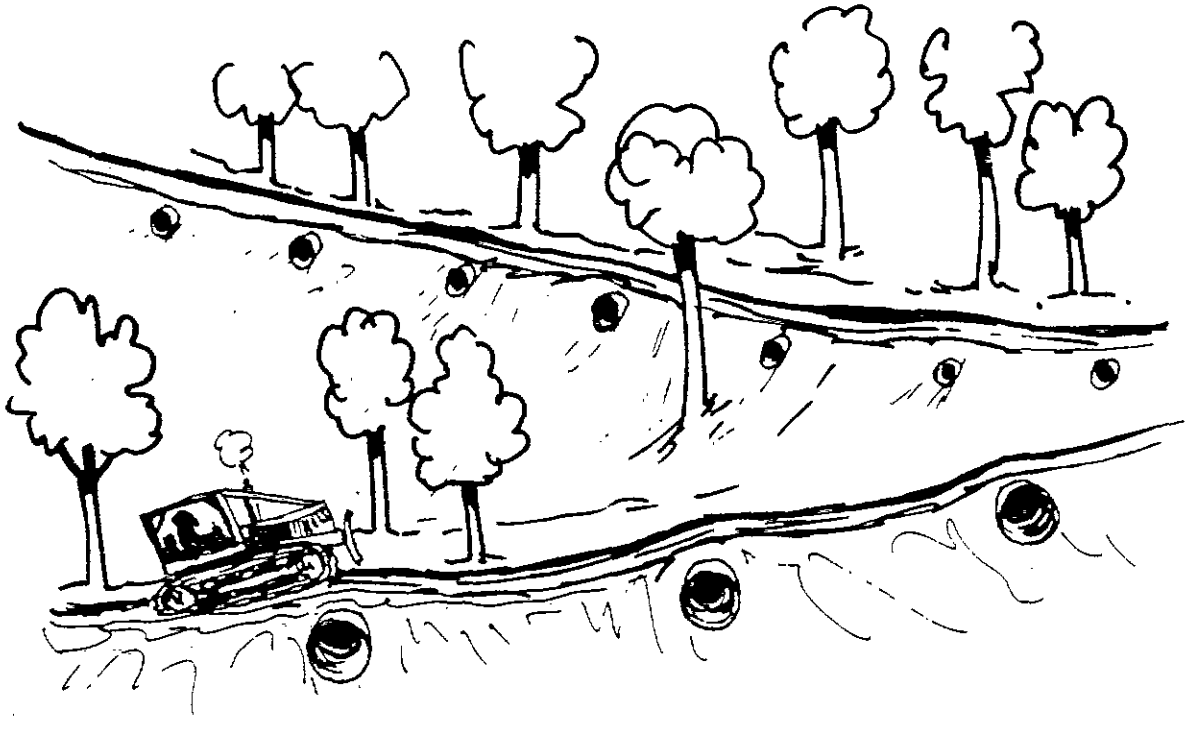
Normally, a culvert is placed on a 2-4 percent grade to prevent clogging. The outlet end of a culvert should be placed at or below the toe of the fill, and an apron of rock or other material should be provided for the outflow to spill on. The culvert should be large enough to handle the water flowing in a heavy rain.



Ditch relief culverts are used to move water under the road before the flow gains sufficient volume or head to erode the ditch. On an 8-10 percent grade, the culverts should be spaced 200-300 feet apart; on a 4 percent grade, about 325 feet apart is sufficient. These figures will vary locally, depending on type of soil, amount of rainfall, and width of road. Ditch relief culverts should cross the road at about a 30-degree angle (culvert outlet downgrade about half the road width) to make water enter the upper end more easily.



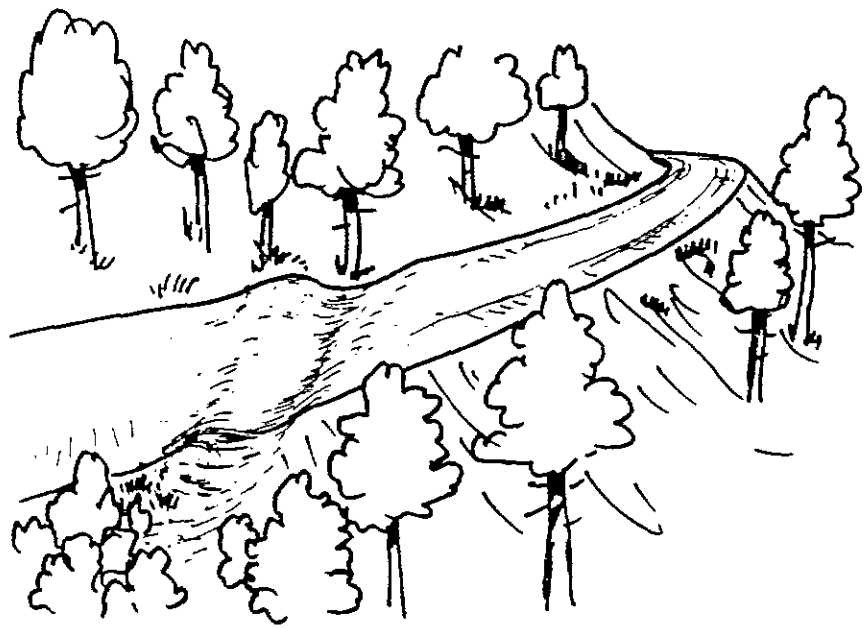
If you expect to continue use of the road after completion of the immediate logging job, it is more economical to install drainage structures of metal or concrete pipe. This will avoid costly maintenance and early replacement of temporary culverts.



"I WONDER IF WE PUT IN ENOUGH CULVERTS?"

Water Bars or Shallow Drainage Dips

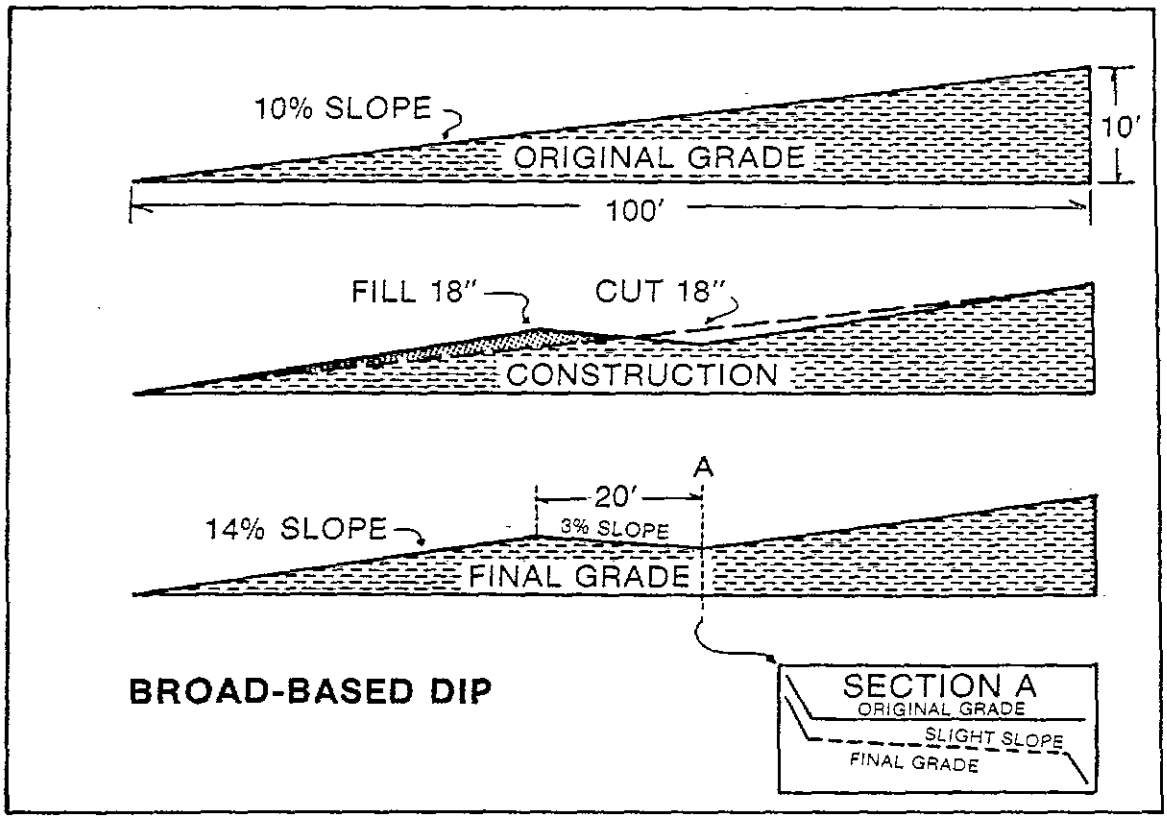
Earth water bars are frequently used on logging roads. These should be placed at an angle to make water flow from the cut bank to the outside of the road and into the leaves and plants on the ground. Rocks or brush may be placed outside the lower end to help slow the flow of water.



It is difficult to properly maintain water bars on skid roads during active logging. These structures are best used to retire roads. The larger broad-based dips and grade breaks are more practical on active skid roads.

Broad-based dips

A frequently used drainage structure on logging roads is the broad-based dip. This is a carefully outsloped section of road which acts as a water catchment and drainage channel. It must be constructed accurately. Length and depth must be adequate to provide drainage, yet not excessive to endanger traffic at normal speeds. Dips should not be installed to handle live (constantly running) streams.



BROAD-BASED DIP

A broad-based drainage dip is constructed by building a 20-foot long, 3-percent reverse grade into the existing roadbed.

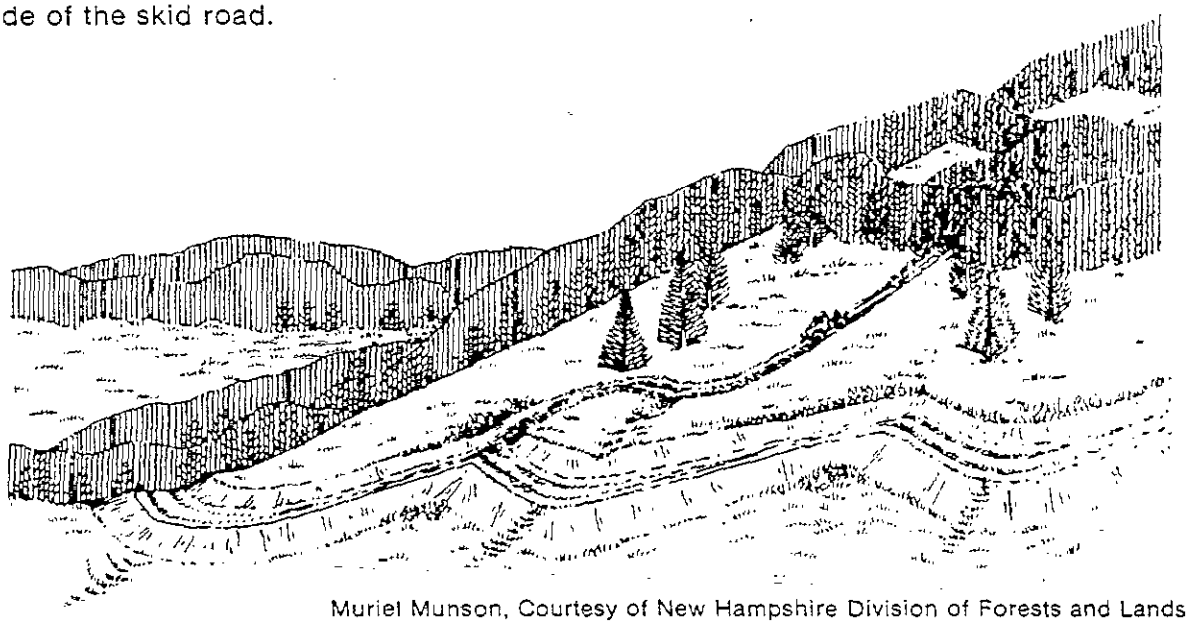
You can use broad-based dips instead of culverts for cross drainage where no streams are present. They can be used effectively on both skid and truck roads when road grades do not exceed 10 percent. Broad-based dips do not increase wear on vehicles or reduce hauling speed when properly installed, and they have the added advantage of providing erosion control, even after intensive use, without much additional work. In addition, you don't have to install water bars on roads protected with a good system of broad-based dips.

The biggest disadvantage of broad-based dips is that bulldozer operators must receive some preliminary training before they can construct them properly. Broad-based dips are often made too small. A properly constructed broad-based drainage dip should be large enough so that a logging truck can be parked in it.

Because of their many advantages, more broad-based dips should be used on logging roads.

Grade Breaks On Skid Roads

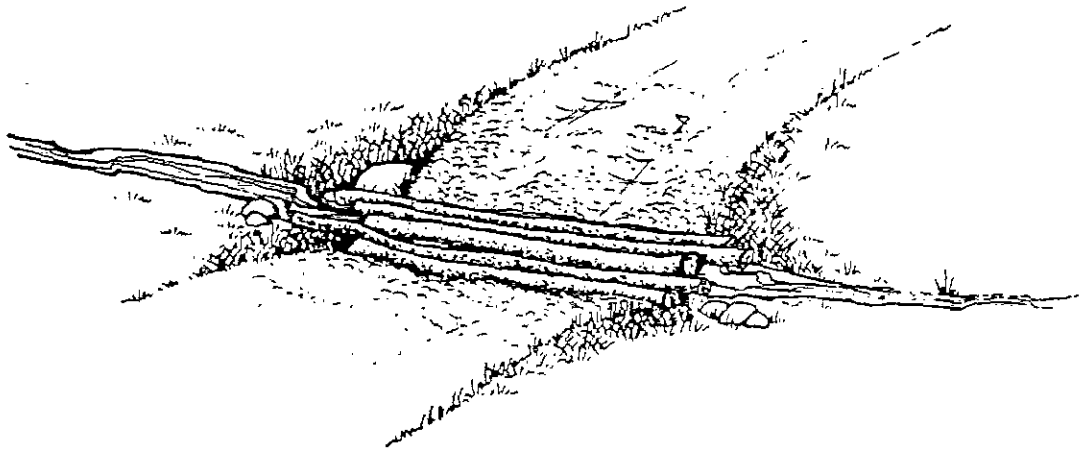
You can take advantage of natural cross drainage by locating skid trails on hillsides and changing (breaking) road grade as the slope changes. Additional drainage can be obtained by turning the skid trail up the hill a few feet, then turning downhill again, where no natural grade breaks exist. By reversing grade in this way, water will run off the downhill side of the skid road.



Muriel Munson, Courtesy of New Hampshire Division of Forests and Lands

Log Crossings of Streams

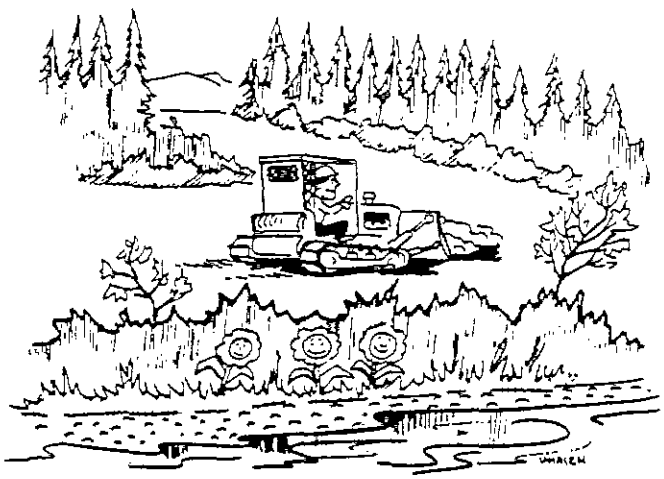
Temporary crossings of **small streams** may be made by placing logs side by side in the stream bed. The logs must be removed immediately after use. Caution should be used with this practice; earth should not be placed on top of the logs or pushed into the stream bed.



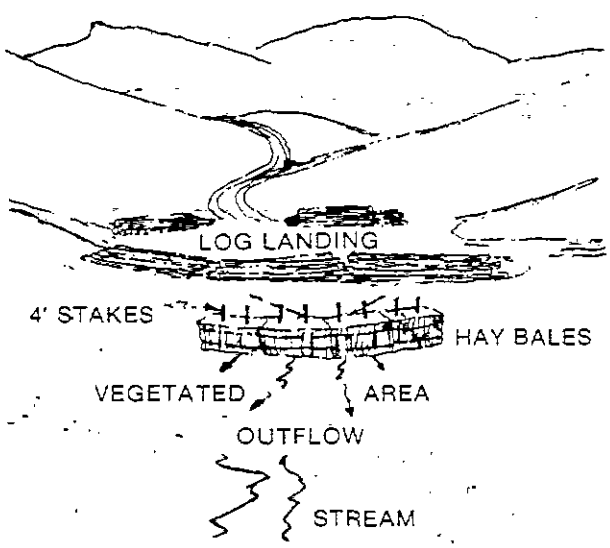
Muriel Munson, Courtesy of New Hampshire Division of Forests and Lands

4. Construct Landings

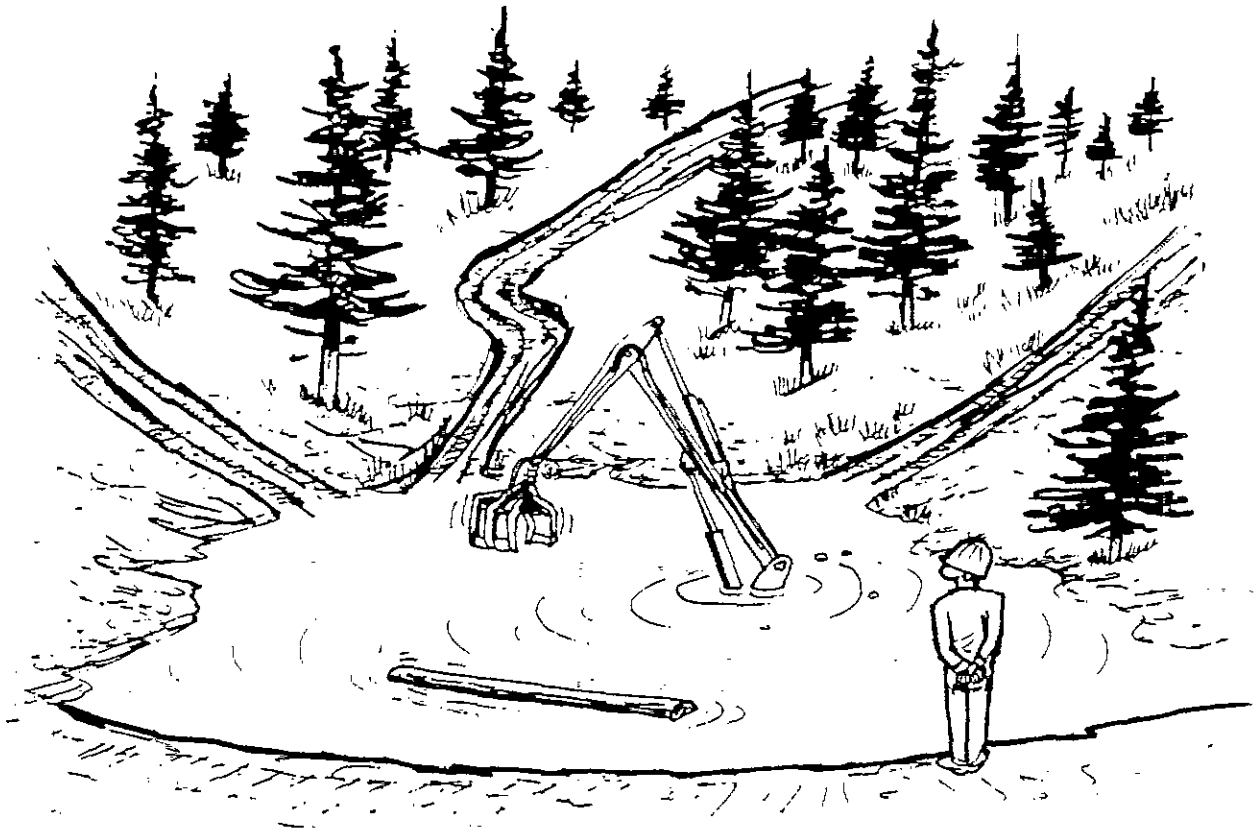
Landings (including spoil and debris) should be placed at least 25 feet away from streams. Placing them 100 feet or more away is better, and locating on dry places like ridgetops or small flats is preferred.



When closer than 25 feet other precautions, such as hay bale barriers between landing and stream, are desirable. The landing surface should have a slight slope to allow for drainage. Drainage dips or culverts should be provided on any approach roads which lead down to the landing, and a diversion ditch is recommended around the uphill side of landings where water would run off a bank into the landing. The idea is to keep water drained off the landing.



Courtesy of Vermont Department of Forests, Parks and Recreation



IT'S IMPORTANT TO PROVIDE DRAINAGE ON LANDINGS

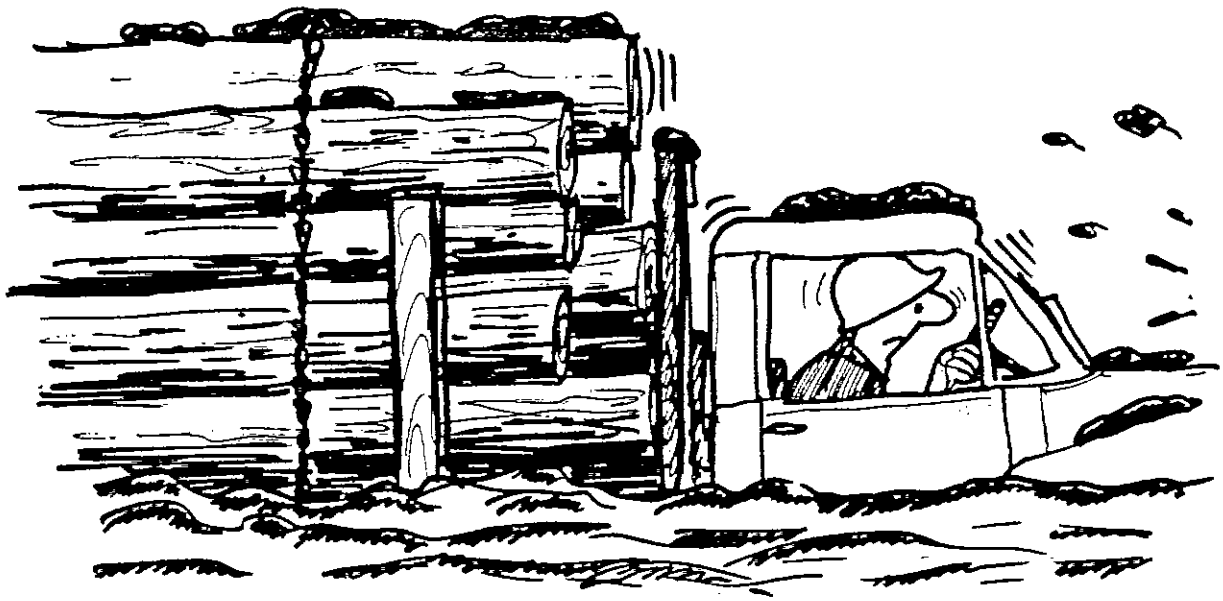
5. **Gravel**

Roads entering onto paved roads should be covered with heavy gravel for about 200 feet to reduce the amount of mud carried onto the highway. Approaches to stream crossings should also be surfaced with gravel to reduce siltation of the stream.

6. **Settling**

If possible, allow newly constructed roads to settle several months before using. This will pack the soil and reduce erosion of the road during logging.

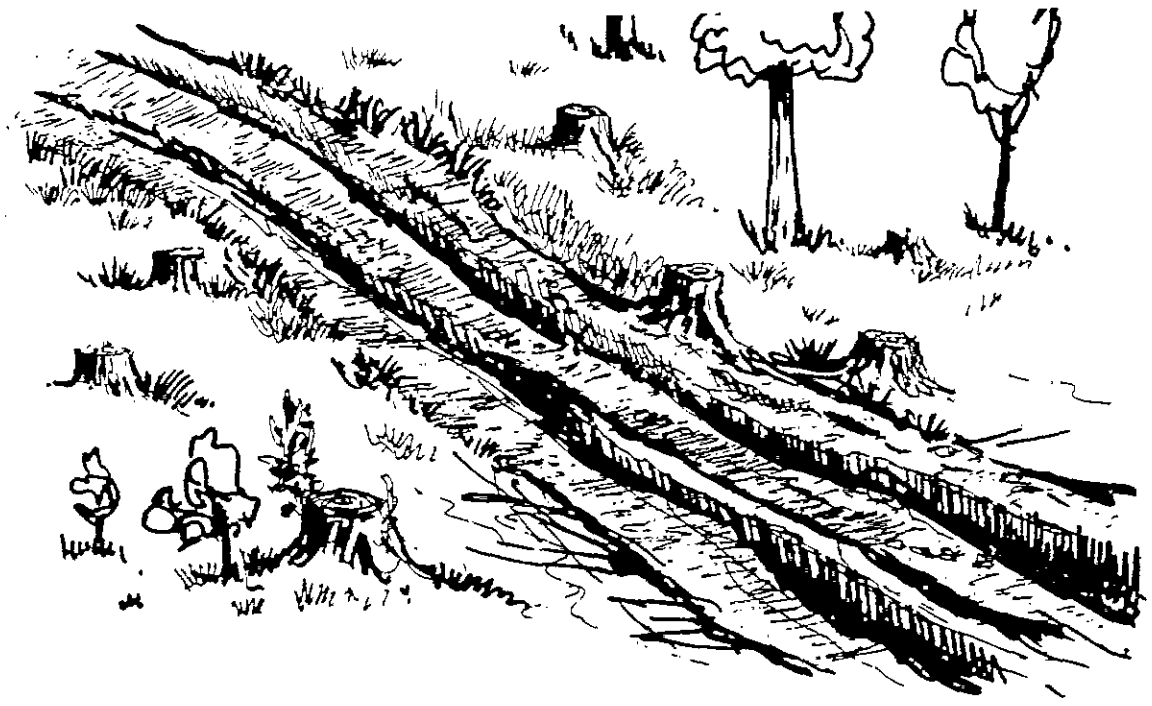
MAINTAINING LOGGING ROADS



"...GUESS I SHOULD HAVE CLEANED THAT CULVERT BEFORE IT RAINED."

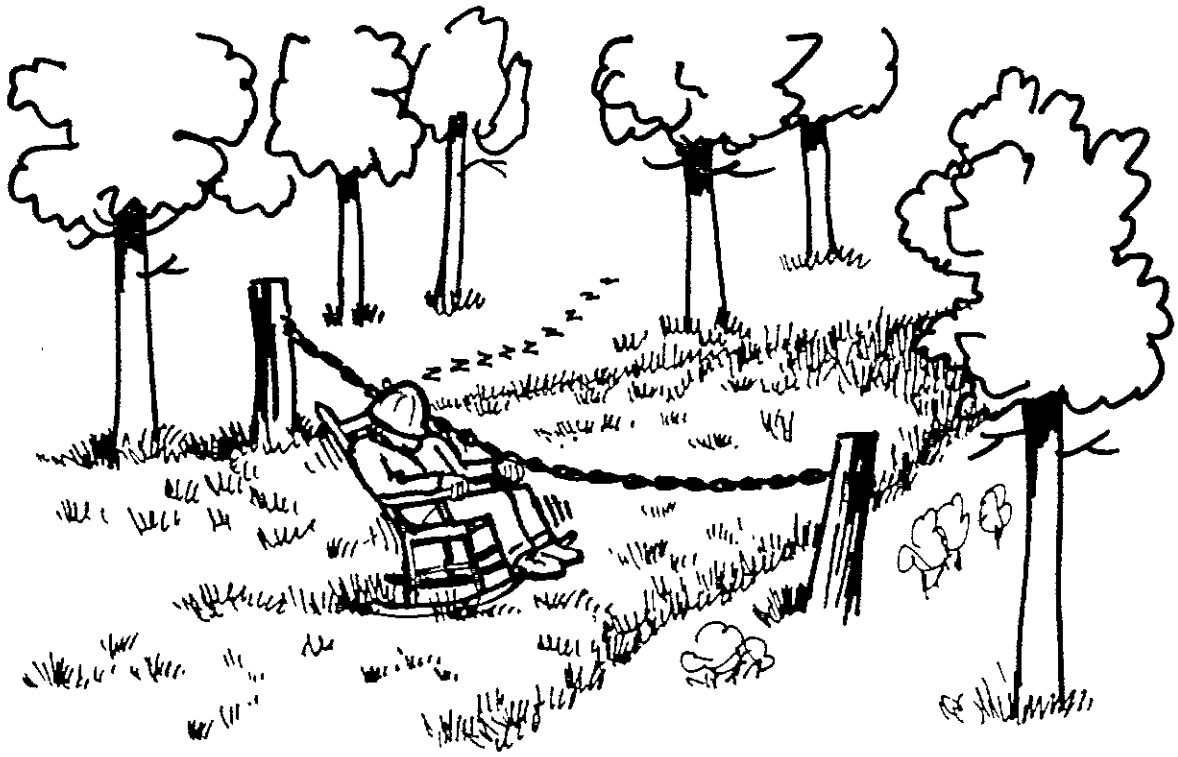
Maintaining Logging Roads (during active operation)

* During the logging operation, roads, ditches, dips and culverts should be maintained to perform properly. If you notice muddy water entering a stream on your logging job, take steps to correct the problem. If all planned BMPs are in place and a pollution problem still exists, a custom solution (such as hay bale barriers or a sediment pond) may have to be designed and constructed. Restrict traffic during unfavorable (wet) weather when possible.



* Regrade periodically to remove deep ruts.
* Do not allow skidding on truck haul roads.
* Inspect drainage structures and water control: clean structures (ditches, dips, culverts, etc.) and install any needed additional measures to limit erosion or improve utility.
* Maintain skid roads during periods of use: Keep the surface water drained off. Maintenance will allow better production. Some operators use the truck driver or anyone else available for filling in holes and cleaning ditch lines and culverts.
* Do not push logging debris from roads or landings toward or into streams.
* Litter such as cans, bottles, old tires, used oil, and equipment should never be put in streams. It should be removed from the job and disposed of properly.
* Tree tops and slash felled into a stream can cause increased stream bank erosion. For this reason it is desirable to use directional felling near streams: fell at a right angle to the stream. When directional felling is not possible, yard the felled tree uphill before delimbing or pull the tops from the stream.

RETIRING LOGGING ROADS

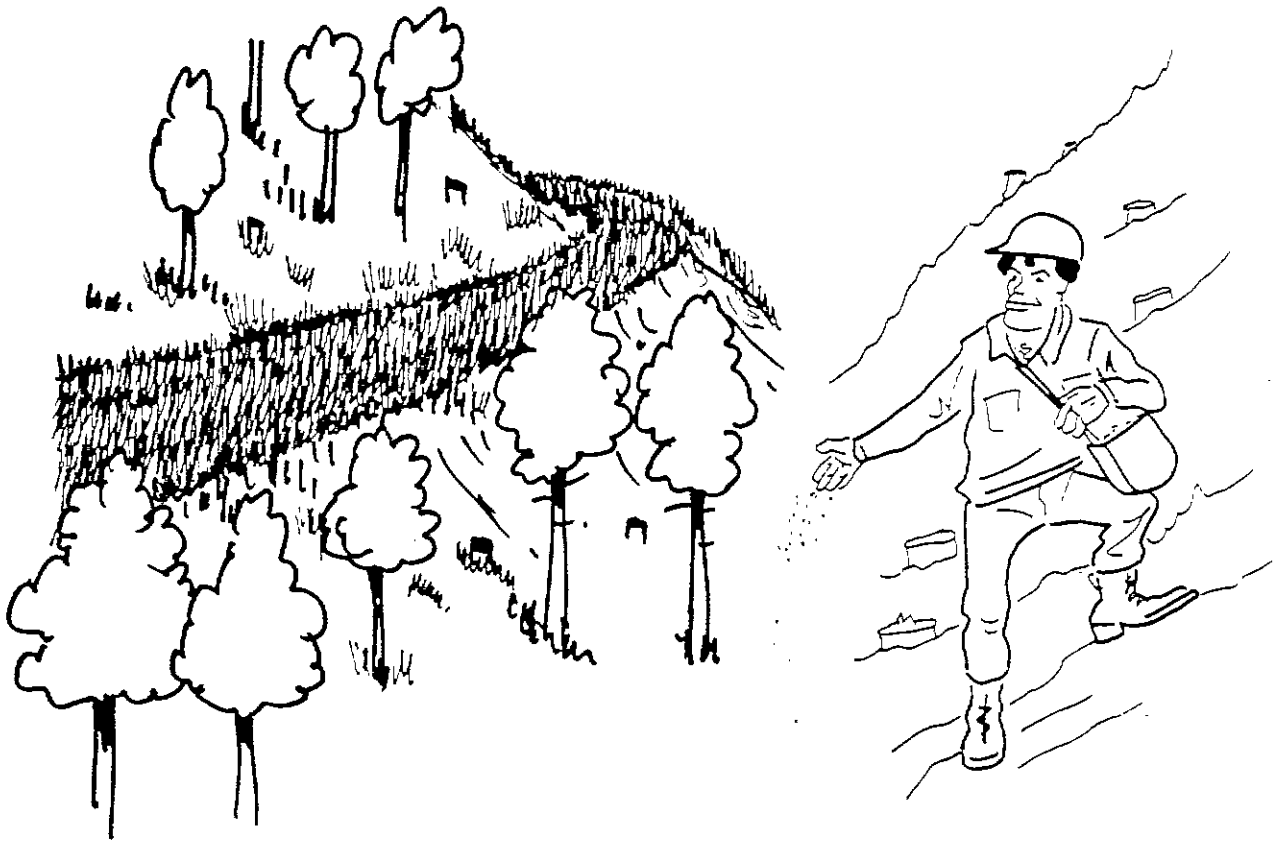


"ME AND MY JOB ARE RETIRED."

Retiring Logging Roads. Logging roads should be retired as soon as they are not needed for removing timber. Do not wait until the whole job is completed.

* Smooth and grade landings and main haul road for drainage, utility and appearance.
* Clean ditches and culverts which are permanent.
* Pull out temporary culverts and bridges and regrade cross-ditch. All natural drainages should flow across, **not down,** the road.
* Plant a cover crop on all exposed soil using lime, fertilizer, mulch and seed such as Kentucky 31 fescue (grass) as needed. As a minimum, seeding should be done on steep roads and banks, **especially near streams.**
* Gate road or use a deep trench to eliminate vehicle access.
* Plan for future maintenance—the cleaning or repairing of water control structures.
* Special steps for skid roads are:

  Install water bars or water-breaks at recommended intervals to provide for proper drainage. Be sure water bar spans the entire road and that the outlet end is open. Removing raised shoulders and outsloping may be used on gentle slopes instead of water bars. Rocks, brush, and logging debris can often be used as water retardants on skid trails.



ASSISTANCE AVAILABLE

ASSISTANCE AVAILABLE

Technical assistance is available from the Forestry Division Service Foresters (listed below) of the W.Va. Department of Agriculture (WVDA) and from consulting foresters on request. Industry foresters will assist when you contract to log with them. These foresters will help you plan your operation to keep mud out of the streams.

DISTRICT I

District Forester
1304 Goose Run Road
Fairmont, WV 26554
Phone: 366-5880

SERVICE FORESTERS

1304 Goose Run Road
Fairmont, WV 26554
Phone: 366-5880

P.O. Box 122
Kingwood, WV 26537
Phone: 329-0184

P.O. Box 447
New Martinsville, WV 26155
Phone: 455-2771

Rt. 2, Box 321-D
Philippi, WV 26416
Phone: 457-4555

Rt. 3, Box 201-C
Clarksburg, WV 26301
Phone: 623-3006

201 Scott Avenue
Morgantown, WV 26505
Phone: 285-3140

303 Methodist Building
Wheeling, WV 26003
Phone: 232-8120

DISTRICT II

District Forester
1 Depot Street
Romney, WV 26757
Phone: 822-4512

SERVICE FORESTERS

1 Depot Street
Romney, WV 26757
Phone: 822-4512

P.O. Box 66
Inwood, WV 25428
Phone: 229-5828

P.O. Box 578
Petersburg, WV 26847
Phone: 257-4334

P.O. Box 55
Franklin, WV 26807
Phone: 358-2316

253 Carskadon Lane
Keyser, WV 26726
Phone: 788-0311

Rt. 1, Box 302
Moorefield, WV 26836
Phone: 538-2397

DISTRICT III

District Forester
P.O. Box 38
French Creek, WV 26218
Phone: 924-6266

SERVICE FORESTERS

P.O. Box 572
Weston, WV 26452
Phone: 627-2200

P.O. Box 67
Elkins, WV 26241
Phone: 636-1767

801 State Street
Gassaway, WV 26624
Phone: 364-5040

P.O. Box 187
Summersville, WV 26651
Phone: 872-5069

P.O. Box 372
Webster Springs, WV 26288
Phone: 847-2935

P.O. Box 38
French Creek, WV 26218
Phone: 924-6266

Rt. 1, Box 142
Dunmore, WV 24934
Phone: 799-6151

DISTRICT IV

District Forester
General Delivery
MacArthur, WV 25873
Phone: 256-6775

SERVICE FORESTERS

477 Ragland Road
Beckley, WV 25801
Phone: 256-6770

P.O. Box 635
Fayetteville, WV 25840
Phone: 574-2106

717 N. Jefferson Street
Lewisburg, WV 24901
Phone: 647-7425

ASSISTANCE AVAILABLE (Cont'd.)

114 Gott Road
Princeton, WV 24740
Phone: 487-1406

P.O. Box 635
Fayetteville, WV 25840
Phone: 574-2106

P.O. Box 48
Pineville, WV 24874
Phone: 732-7487

P.O. Box 125
Panther, WV 24872
Phone: 938-2392

DISTRICT V

District Forester
P.O. Box 189
Milton, WV 25541
Phone: 743-6186

SERVICE FORESTERS

P.O. Box 189
Milton, WV 25541
Phone: 743-6186

State Capitol
Charleston, WV 25305
Phone: 348-2283

General Delivery
Lakin, WV 25250
Phone: 675-1820

8116 Dingess Avenue
Hamlin, WV 25523
Phone: 824-5858

DISTRICT VI

District Forester
2309 Gihon Road
Parkersburg, WV 26101
Phone: 420-4515

SERVICE FORESTERS

2309 Gihon Road
Parkersburg, WV 2610
Phone: 420-4515

P.O. Box 556
Ripley, WV 25271
Phone: 372-3253

P.O. Box 183
Harrisville, WV 2636
Phone: 643-2520

P.O. Box 47
Middlebourne, WV 26
Phone: 758-2512

P.O. Box 52
Spencer, WV 25276
Phone: 927-2920

P.O. Box 62
West Union, WV 2643
Phone: 873-2531

GLOSSARY OF TERMS

Best Management Practices

Wood Culvert (Open top)—A three-sided wooden trough with cross braces, usually made from 2x8 rough sawn timber and installed at a 30-degree angle downgrade and flush with the road surface to intercept and divert small sources of water from road surfaces.

Diversion Ditch—Any ditch or trench dug to divert water from an area where it is not wanted.

Broad-based Drainage Dip—An earthen water control structure constructed in roadbeds in such a way that vehicles can traverse them. It also intercepts and diverts water from road surfaces.

Filterstrip—A band of minimally disturbed forest floor between a road and a stream which traps sediment and other debris that may be suspended in the water draining from a road surface.

Grade Break—A change in road grade, abrupt or gradual, which collects and diverts water from road surfaces.

Insloped Road—A road slightly sloped (1-3%) in toward the cut bank.

Haul Road—A road constructed to a standard upon which loaded trucks can negotiate safely with reasonable speed.

Landing—A place where trees are bucked and logs are accumulated, sorted, and perhaps scaled prior to loading and hauling to market.

Outsloped Road—A road surface that is slightly canted 1-3 percent to the fill side to permit surface water to drain off the road.

Skid Road—A road for use by wheeled skidders or tractors to move logs from the cutting area to a landing.

Slash Cover—The debris left after logging.

Water Bar—A water control structure constructed across a road, usually from earth, to intercept and divert water from road surfaces.

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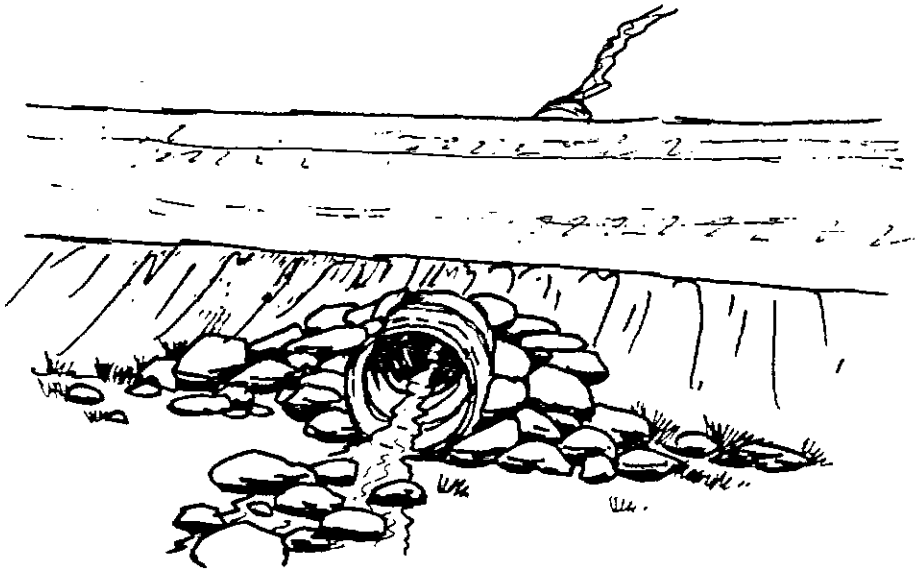


SIGHT ACROSS THIS TOP EDGE TO PERSON OR OBJECT AT YOUR EYE LEVEL

Fold here over edge of plywood or board

GRADE METER

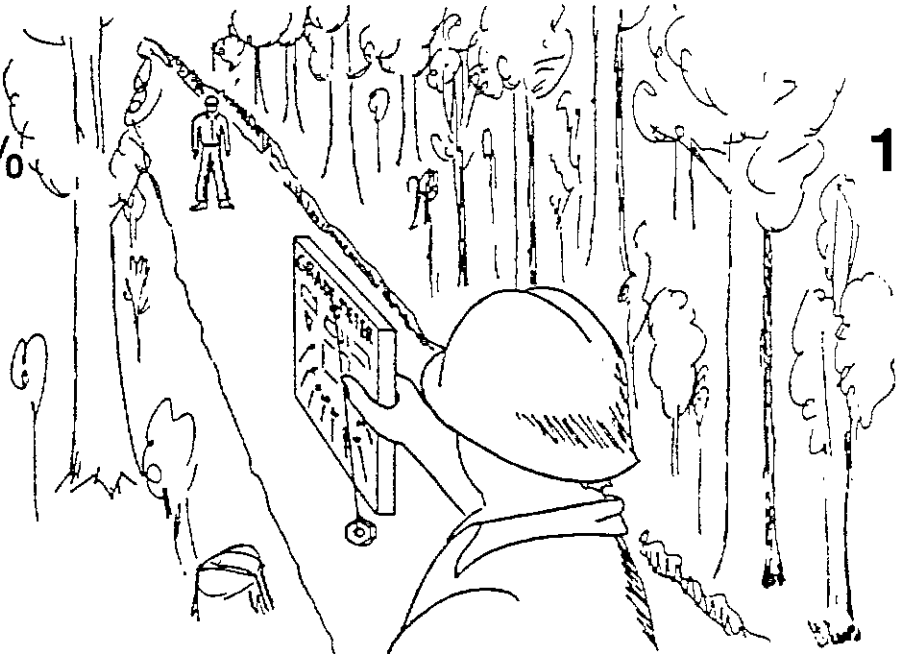
Put tack or nail here and attach string with nut or bolt on end.

DIRECTIONS FOR MAKING THIS GRADE METER

1. Remove this page from the manual.
2. Fold over at dotted line.
3. Cut plywood or board to size of paper below fold.
4. Put glue over entire back side of paper and attach paper to board.
5. Spray with clear varnish or other waterproofing.
6. Put tack or nail at top center point and attach 15" string with nut or bolt on other end. Make sure string swings around nail.

CLEAN STREAMS & BETTER LOGGING

1. Plan your road system: keep road grades low.
2. Stay away from streams
3. Use care when you must cross streams.
4. Keep water drained off roads and landings.
5. Retire roads as soon as they are not needed.



100% (45°)
90%
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70%
60% (31°)
50% (27°)

100% (45°)
90%
80% (39°)
70%
60% (31°)
50% (27°)

DIRECTIONS FOR USING THIS METER

1. Sight across top edge to person or object at your eye level. Keep the meter vertical so string hangs.
2. When the edge is lined up, hold string against front and read scale of meter for grade (slope) of road or hill.
3. This meter gives a rough measure of grade. For more exact measurement use an Abney level or Suunto clinometer.

LEVEL

40% (22°) 30% (17°) 20% (11°) 10% (6°) 0% (0°) 10% (6°) 20% (11°) 30% (17°) 40% (22°)

SKID ROAD GRADES

HAUL ROAD GRADES

WEST VIRGINIA SILVICULTURAL WATER QUALITY MANAGEMENT PLAN

A part of the West Virginia Nonpoint Source Water Pollution Control Program

BY

THE WEST VIRGINIA DIVISION OF FORESTRY

and the

WEST VIRGINIA WATER RESOURCES SECTION

Division of Forestry Technical Report 89-6

Robert D. Whipkey, Assistant Administrative Forester, Forest Management
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ACKNOWLEDGEMENT

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Introduction

When Congress passed the Federal Water Pollution Control Act Amendments of 1972, West Virginia was already engaged in an effort to reduce any impact that might be caused by timber harvesting operations. In fact, a booklet titled "West Virginia Forest Practice Standards for Timber Harvesting" (2) was prepared in 1971 and published in March 1972. It was distributed a full year before EPA's "Process, Procedures, and Methods to Control Pollution Resulting from Silvicultural Activities" (1) was prepared. This publication represented an effort by the West Virginia forestry community to promote good forest management in all areas of silviculture.

This small pocket-sized reference included Best Management Practices (BMPs) for timber harvesting and culminated several years of study and editing by 25 forest scientists and/or professionally trained people with an interest in forestry. For the most part, this pioneering research was conducted at the Fernow Experimental Forest in Tucker County in northern West Virginia.

It was here, under the leadership of award-winning project leader George Trimble, that a large percentage of the pioneering studies of the effects of timber harvesting on water quality were conducted. The titles of the reports are themselves descriptive of the research. For example, one of the earliest was titled "How far from a stream should a logging road be located" (3).

The Fernow Forest work generally substantiated and extended research dating from 1934 on the Coweeta Watersheds in western North Carolina (5) where the annual rainfall is approximately 80 inches. Average annual precipitation on the Fernow Forest is 60 inches.

The Coweeta study that created a lot of interest and essentially triggered the Fernow Research involved harvesting (clear cutting) a watershed without building roads. The regrowth was slashed back each year for more than a decade. Yet, in spite of this, there was no evident erosion. Then a road system was established and measurable erosion almost immediately ensued.

Kochenderfer (14) in 1977 reported that roads were usually spaced 100 to 150 feet apart and along with log landings, usually exposed about 10 percent of the soil surface. This figure in West Virginia in 1988 more nearly approximates 6 to 8 %; however, where strict compliance in using BMPs is adhered to, for example on state forests, the percentage involving roads and landings has been as low as 4%.

This and other studies of harvested watersheds has also shown the only sediment sources on forest land to be the roads, landings and stream channels. In fact, even when roads were constructed within 50 feet of streams, graveled and closely-spaced, broad-based dips protected the road from erosion. In such cases, there was no significant observable movement of soil to the stream. Douglas (16) showed that normal forest erosion is less than 300 pounds per acre per year and results mainly from normal geologic erosion of stream channels and banks.

In 1951, stream flow measurements were begun on five small watersheds on the Fernow Forest (4). These measurements were continued for six years to "calibrate" the watersheds. In 1957 to 1959, the uneven-aged, fifty year old forests on four of five watersheds were harvested, each by a different method. The fifth watershed was kept as a control.

One result of these studies was to show that poorly planned timber harvesting operations play havoc with water quality, but that planning can prevent most of the turbidity that often comes from logging.

Through the 1960's especially, a great amount of evidence was accumulated which documented the control of sediment loss from forest logging road systems as a result of careful road layout and construction; observation of road grade standards; installation of drainage structures, use of broad-based dips with gravel water bars and maintenance of buffer strips. It was, for example, shown that roads built

to the suggested standards held the sediment loss to essentially that normally expected from undisturbed forested watersheds. More spectacular, are studies showing that even phenomenal rainstorms and flash flooding do not destroy well constructed road systems (8) and that well located and constructed roads diminish the amount of eroded soil materials entering streams (38). In other words, the Fernow research showed that timber harvesting with well-planned road systems makes no significant change in water quality. An ongoing study at the Fernow Forest which is presently monitoring the effectiveness of BMPs substantiates past research. A 96 acre tract of timber was harvested in 1987 removing 1/2 million bd. ft. of timber using a 14 inch diameter limit cut which was a fairly common practice in West Virginia at that time. BMP standards were used in planning and implementing the timber removal. Jim Kochenderfer, USFS, reports that, to date, water monitoring reveals no change in water quality since the harvest operation. This indicates, according to Kochenderfer, that BMPs prevent stream sedimentation when used. Past Fernow research also reveals that the severity of cutting from most harvesting has no effect on water quality (6.p.23). Another very important finding was that water quality, that is stream temperature, pH, nonstorm turbidity and concentration of dissolved solids Ca, Mg, NA, K, Fe, Cw, Zn, Mn, and Nh 4+-N, is not affected by most harvesting practice used in West Virginia (10).

These and other studies, either published or preliminarily reported and later published were discussed at numerous workshops held on the Fernow. As one consequence, a committee composed of representatives of the West Virginia Extension Service; Timber and Watershed Laboratory, USDA Forest Service; Soil Conservation Service, West Virginia Division of Forestry and several wood using industries was formed to develop a series of effective, but easily understandable, BMPs that could be used to prevent erosion in timber harvesting operations across the State. The above mentioned booklet (2) was the basis for this development. Other bulletins were also based on the Fernow research (28), (29).

Through a cooperative agreement, the Division of Forestry became the lead agency for West Virginia's silvicultural nonpoint program. A 208 Silvicultural Technical Action Committee was then organized to assess West Virginia's problems and needs. It prepared the "Silviculture... Water Quality Management Plan" so as to comply with the federal law (12). BMPs, as used today, were developed and incorporated into this plan. This plan has since guided erosion control activities on forest land which covers more than three-fourths of the state's surface. The Silviculture Erosion Control Plan of 1979 (12) was established as a voluntary program based upon specific BMPs which: set a schedule for implementing, monitoring, and evaluating the program; initiated the development of an educational program; established provisions for a technical assistance program and implemented a specific reporting system.

This voluntary compliance approach requires the cooperation of several agencies and groups. In general, cooperation has been successful throughout the last 10 years. A voluntary compliance committee composed of members of the State Division of Forestry, Water Resources Section, West Virginia Forestry Association, West Virginia University Extension Service, U.S. Forest Service, Soil Conservation Districts, State Water Resources Board, U.S. Soil Conservation Service, U.S. Agricultural Stabilization and Conservation Service and other groups closely associated with the timbering industry and concerned with water quality improvement was established in 1979 to guide the overall program. The chairman is the State Forester.

This approach has worked well. Two evaluations of actual BMP usage (20, 21) have been prepared. The latest (21) indicates that compliance with BMP use is about 71 percent. This corresponds favorably to most of the regulatory programs presently existing in the state. These evaluations are used as one method to measure the overall success of the Silviculture Water Quality Management Program in West Virginia.

In August of 1987, the Assistant Administrator for Water with EPA provided a guidance document which is now Chapter 2 of the Water Quality Standards Handbook. This guidance states that, "For proposed management actions, BMPs designed and implemented in accordance with a state approved process will normally constitute compliance with the Clean Water Act." It also states that, "Once BMPs have been approved by the state, the BMPs become the primary mechanism for meeting water quality

standards."

As detailed in this Introduction, the cooperative efforts of the Water Resources Section, the State Division of Forestry and the members of the West Virginia Forestry Association, among others, has kept West Virginia among the leaders in erosion control under Silviculture 208. But, there is a problem that has not been efficiently addressed, that of erosion from land burned over by forest fires. This has been an especially difficult problem in 10 southwestern counties, where during one 11 day period in the fall of 1987 over 400,000 acres were severely charred (22). Observations reveal that erosion may exceed 200 tons per acre per year on some of this land. Data collected from one 1,200 acre tract has shown erosion averaging more than 23 tons per acre for the first year.

Multi-agency coordination and cooperation is the only way to promptly solve erosion problems from fire. One way to control such fires is to investigate the causes, prosecute when possible and to mount an intensive educational program. The latter has been started by the West Virginia Division of Forestry, but the former will take nearly $100,000 per year for three years to rent Conservation Officers to work in fire investigation.

It is believed that a continuation of the current voluntary program with renewed emphasis on education, the reporting of timber harvesting activities by logging contractors and the securing of a grant to implement the fire investigative and educational work will keep West Virginia among the leaders in silviculture nonpoint pollution control activities.

POTENTIAL FOR POLLUTION FROM FORESTRY ACTIVITIES OTHER THAN TIMBER HARVESTING

From The Use Of Pesticides, Chemical Fertilizers, Fire Retardants, And Clearcutting

Pesticide use in the practice of silviculture in West Virginia is extremely limited. The only major ongoing pesticide use program involves the control of gypsy moth presently in the northeastern portion of the State. This program uses insecticides registered by the EPA and these are applied in strict compliance with label guidelines. An environmental assessment of this project is published annually.

Groundwater impacts from the above items are considered minimal because of their limited use. The Department Natural Resources, Water Resources Section, does not have the resources to evaluate potential groundwater impacts from pesticides and, therefore, assumes the U.S. EPA review of registered products is sufficient to protect groundwater.

Chemical fertilizers are not currently used in silviculture in West Virginia.

The use of fire retardants in the suppression of forest fires is uncommon in West Virginia. Forest fire suppression in West Virginia usually involves hand tools and, in limited situations, bull dozers.

Potential water quality impacts of clearcutting, as practiced in West Virginia, have been demonstrated to be limited to increases in stream temperature and this effect can be mitigated by retention of stream side shade. Most clearcutting as a silvicultural practice in West Virginia is applied on national forest system lands for the purpose of regenerating hardwood timber stands. Standards and guidelines of the national forest land and resource management plans provide for retention of shade strips along perennial streams. Most commercial harvests on private lands involve diameter-limit cuts and other partial cuts such as selection marking which result in the maintenance of shade.

From Wood Waste

Wood waste storage areas have been shown to be a potential source of groundwater and surface water pollution. In an effort to prevent pollution from these sites, the Water Resources Section, in cooperation with the Division of Forestry, has developed Best Management Practices (BMPs) for the storage of untreated wood by-products. The details the strategy for doing this are included in this plan.

Therefore, this plan only addresses potential erosion as a result of poor logging practices, erosion caused by severe and reoccurring forest fires along with possible pollution from wood by-products. All other effects on water quality are minimal or are already addressed by EPA environmental guidelines and existing regulatory programs.

If the current situation concerning any of the above possible impacts should change, this plan will be amended accordingly.

IMPLEMENTATION PROGRAMS

Harvesting

General

West Virginia has been among the leaders in devising controls for nonpoint erosion from silvicultural operations. The state was fortunate to have one of the major forest research centers for timber harvesting and water quality located at Parsons in Tucker County where site-specific solutions were developed. Several agencies, including the West Virginia Division of Forestry, West Virginia University Extension Service, USDA Forest Service, USDA Soil Conservation Service, along with the West Virginia Chapter, Society American Foresters, in cooperation with the forest industry, made a commitment in early 1971 (2) to develop practical, environmentally sound forestry standards in West Virginia. The forest practices standards that resulted included measures which protected water quality and ultimately resulted in considerable progress in meeting water quality objectives. This plan has been designed to further that work.

Water systems are very complex and the site-specific and source-specific solutions in the BMPs are flexible enough that sediment is not allowed undue entry into the system.

West Virginia is also fortunate in that silviculture has never been listed as a major problem (37) with Agriculture, mining, construction and urban areas being listed as being of much greater importance by water pollution control administrators.

There is, however, a great problem with erosion caused by forest fires. Forest fires are the number one forest management problem in southern West Virginia because they contribute extremely heavy loads of sediment to streams. Therefore, this problem is given special consideration in a separate section of this plan.

Also, recent concern for potential ground water and stream pollution from wood by-product storage facilities, namely sawdust and bark piles is also addressed in this plan.

West Virginia's plan is nonregulatory, but it was structured in a way that would, to a considerable degree, assure compliance through: education; technical assistance; and enforcement. Current water quality regulations (Appendix 1) & (1a) provide a mechanism to protect water quality degradation through the enforcement authority of the Water Resources Section of the Division of Natural Resources. The turbidity standard (Appendix 1a) was also devised to support enforcement authority along with providing an incentive for compliance. This standard was added in 1981. The coupling of this authority with the voluntary mechanisms described herein, provides for an effective nonregulatory program.

The West Virginia Silviculture 208 Water Quality Program was designed to improve and to safeguard water quality. Enforcement responsibility for the program is with the Division of Natural Resources, Water Resources Section, but the West Virginia Division of Forestry personnel have all been trained in water sampling procedures.

The implementation of Best Management Practices (BMPs) (see standards and specifications for water control structures[1] has been of prime importance in determining program success as has the authority to enforce current laws pertaining to violations of water quality due to noncompliance. Although legal action is not the primary tool for implementing the program, it is understood that such action is a viable alternative mechanism that can be used when and if compliance is not achieved voluntarily.

The West Virginia Division of Forestry has been delegated the authority for protecting and managing

[1]Guidelines for Controlling Soil Erosion and Water Pollution on Logging Operations in West Virginia.

forest lands in the State. Therefore, a memorandum of agreement (Appendix 2) between the Division of Forestry and Water Resources Section has been developed to provide a two-pronged (cooperative) authority designed to prevent water pollution from forest management activities.

Program Coordination

In 1979, the 208 Silvicultural Technical Action Committee, chaired by the State Forester, organized a Forest Water Quality Voluntary Compliance Committee. This committee now meets every three months (quarterly) to evaluate the ongoing program. This includes: monitoring the effectiveness of BMP usage (Appendix 3); evaluating presumed and actual violations of water quality via the prescribed complaint-investigation procedure (Appendix 4); development of educational programs and planning for their delivery; reporting, comparatively, on the registration (Appendix 5) of timber harvest operations; and coordination of, and whenever appropriate, providing for technical assistance to the industry, and the development of new pollution control procedures and improved timber harvesting techniques.

The Voluntary Compliance Committee (Appendix 6) is composed of personnel from the West Virginia Division of Forestry; West Virginia Division of Natural Resources, Water Resources Section; West Virginia Forestry Association; West Virginia University Extension Service; USDA Forest Service; West Virginia Soil Conservation Districts; State Water Resources Board; U.S. Soil Conservation Service; six forest industry representatives, as well as private woodland owners (tree farmers), groups concerned with water quality improvement and members of the State's professional consulting foresters association.

This committee has the responsibility of defining and guiding the overall program under the authorities of the Division of Forestry and the Water Resources Section. These agencies insure that the basic tenets of the program are followed. The State Forester is Chairman of this committee, but the Water Resources Section has concurrent convening authority.

These working relationships between governmental authorities, the forest industry, state agencies and concerned environmental and professional groups will continue to be nurtured and strengthened through effective educational processes directed by this voluntary compliance committee.

The State Division of Forestry has and will continue to cooperate with the Division of Natural Resources, Water Resources Section, USDA Agricultural Stabilization Conservation Service, West Virginia University Extension Service, the Forest Service Research Section at the Fernow Experimental Forest and the West Virginia Department of Agriculture, Plant Pest Control Division, regarding harvesting, forest management, forest protection including pesticide use and regulation and most other silvicultural related activities.

Industry Cooperation

Although the WV Division of Forestry and Water Resources Section maintain primary responsibility for the implementation of the Silvicultural Water Quality Program, relationships already established within the forest community have been a key to the implementation mechanism. The West Virginia Forestry Association, a statewide association that services the forestry community, presently serves as a very effective self-policing body for its membership through its executive committee and its full-time executive director. This statewide association includes members from the forest industry, forest land holders including tree farmers, the forestry profession, and the general business community.

Through an agreement with the WV Division of Forestry, the West Virginia Forestry Association cooperatively responds to water quality complaints resulting from problem operations, and works cooperatively with its membership and nonmember operators to resolve any problems. The association cooperatively sponsors professional workshops and educational meetings to train the industry in proper forestry practices. It has also developed a very popular "Logger of the Year" recognition program (Appendix 7) which has resulted in a statewide promotion of loggers who register their operations, effectively use BMPs, and perform in an exemplary fashion.

By exerting peer pressure, backed by the ever-present threat of existing water quality laws, the West Virginia Forestry Association is able to effectively self-regulate its member organizations and establish working relations with nonmembers. Due to the excellent relationship the association has established with the forest industry, the organization has been a viable and vital part of this effective voluntary program.

These working relationships between governmental authorities and the industry continue to be nurtured and strengthened through effective educational processes.

As a Part of Timber Harvesting Activities:

The working document delineating specific Best Management Practices (BMPs) has been sufficiently detailed to enable operators to make effective judgments as to the appropriateness of practices to their specific situations. Technical advice, however, must be provided in special circumstances and in areas with critical problem potential. This assistance has been available primarily through the West Virginia Division of Forestry, with the Division of Natural Resources, Water Resources Section personnel helping to insure that water quality is protected.

In 1980, a voluntary registration program was initiated to help determine the extent of timber harvesting operations in the state and to provide a means of locating and educating a greater number of operators in the use of BMPs for proper harvesting techniques.

In 1983, the registration form was revised to provide a tabular checkoff of BMPs to be utilized on the particular logging operation. This change expanded the purpose of registration to: (1) indicate intent of proper BMP application, (2) provide a training tool for loggers regarding logging compliance and water quality enforcement standards, (3) provide a simplified tool for loggers to properly plan their logging activities and (4) provide that a logger who is registered and attempting to use BMPs, but who is still creating a water pollution problem would not be cited the first time. Instead, the logger would be provided hands-on technical training in the proper application of BMPs and permitted to correct the indicated problems. The latter provision was added as an incentive for advanced registration as well as to increase training possibilities. (Appendix 5)

The logger registration process is not yet 100% effective, but the percentage is steadily rising. Hindrances have come from: (1) changes in the public disclosure law during inception of registration, (2) widespread misunderstandings concerning its use, (3) legal interpretations of its use, (4) intermittent lack of commitment by some agencies and forest industries to its use, and (5) major changes in the registration process in 1983. Registration is a very important part of the Forest Water Quality Program as evidenced by the fact that less than 1% of the logging complaint investigations for muddy water have occurred on registered operations.

The West Virginia Division of Forestry and Water Resources Section are working diligently to intensify registration activities. This will be continued by:

1. Requiring that all service foresters of the Forestry Division request registration on logging operations they, through the technical assistance program (CFM), have initiated and helped administer.

2. Cooperating with the forest industry (procurement) to require their contract loggers to register their individual operations.

3. Cooperating with the forest industry log buyers to actively promote registration by supplying forms to all log producers from whom they may purchase logs.

4. Including registration as a major component of the landowner training workshops "Selling Your Own Timber" and inserting the registration requirement into sample contracts used

for this purpose.

5. Through cooperation with forest utilization foresters to supply registration forms, along with directions for their use, to all loggers presently operating in West Virginia.

6. Development of special packets for out-of-state based loggers which will effectively explain West Virginia's voluntary compliance program including water quality laws and the turbidity standard and through periodic educational news releases about the program to all agencies with field personnel, i.e. – Conservation Officers.

Education

The educational process involves the promotion of logging operation registration; distribution of Best Management Practices manuals, BMP Technical Guides; and coordinating training sessions for loggers, forest landowners, foresters and related agency personnel. By 1982, several special educational materials had been developed including "Guidelines for Controlling Soil Erosion and Water Pollution on West Virginia Logging Operations," Clean Streams Handbook for Loggers," "Keeping Mud out of the Creeks" brochure; "Why You Should Register Your Log Job" brochure; and "Planning Your Logging Operation" slide-tape series. Formal logger training workshops were developed and initiated by the West Virginia Division of Forestry, with help from the West Virginia Forestry Association, Division of Natural Resources, Water Resources Section, West Virginia University Extension Service, and in some cases the Soil Conservation Districts. To date, more than 65 workshops have been held with over 350 loggers and 400 landowners receiving formal certified training (Appendix 8). These activities will be continued and expanded.

The Forest Water Quality Voluntary Compliance Committee (VCC), for example, has already reactivated its educational subcommittee and charged it with the tasks of updating old literature and the development of a new educational program pointed towards the more than 200,000 private nonindustrial forest landowners in West Virginia. A new slide-tape program "Selling Your Own Timber" has been developed, a new video "Building Forest Roads" has been distributed by the West Virginia University Extension Service, and several additional brochures and leaflets have been developed. The new titles include "Timber Sale Contract Outline," "What a Landowner Should Know and Do When Selling Timber," "Landowners and Forest Roads," and a "Clean Streams Handbook for Landowners." A formal "Lesson Plan" for foresters to use in landowner training workshops has also been completed and is being used.

The training of agency personnel throughout the state, so as to be able to coordinate a cooperative statewide effort in the implementation of these landowner training workshop, has also been completed. Presently, twenty-five landowner workshops have been held with approximately 400 landowners in attendance.

Both logger training and landowner training workshops will be conducted concurrently during the next four years throughout the State.

Evaluation

A number of methods have been devised to evaluate the overall effectiveness of the Silviculture Water Quality Program. These are:

1. Registration of logging operations with the West Virginia Division of Forestry.

2. Quarterly tracking of complaint investigations as a basis for accountability.

3. Logger training workshop attendance increase.

4. Results of intensive BMP compliance surveys. (Two have been conducted to date)

5. Continuous monitoring of research on BMP development and incorporation into practical application.

Studies have shown that the average logging operation lasts about 4.8 months. Therefore, it has been questioned that water quality may not be affected during the active logging operation if it is very dry, but could possibly cause later impacts. Research, however, on the Fernow Forest has shown and continues to show that when BMPs are used on logging operations, overall water quality is not altered (see Introduction). Observations on seven state forests, where numerous logging operations have been conducted under strict BMP compliance standards, have also shown this to be true.

Also, the 1981 and 1987 BMP compliance surveys of active logging operations have shown that the current program is largely effective. A third logger compliance evaluation is scheduled for 1990 and every two years thereafter.

Activities and Milestones

Due to the proven effectiveness of the ongoing Forest Water Quality Voluntary Compliance Program, the existing program format will be continued, but certain aspects of the ongoing program will be intensified in light of experience gained during the initial program. This will include the following (as identified in previous sections):

1. Increase the emphasis on log job registrations to achieve an 80% advance registration rate, by 1992, of logging operations predicted to last more than two weeks. This will result in increased achievements, due to increased emphasis and to the amelioration of past obstacles.

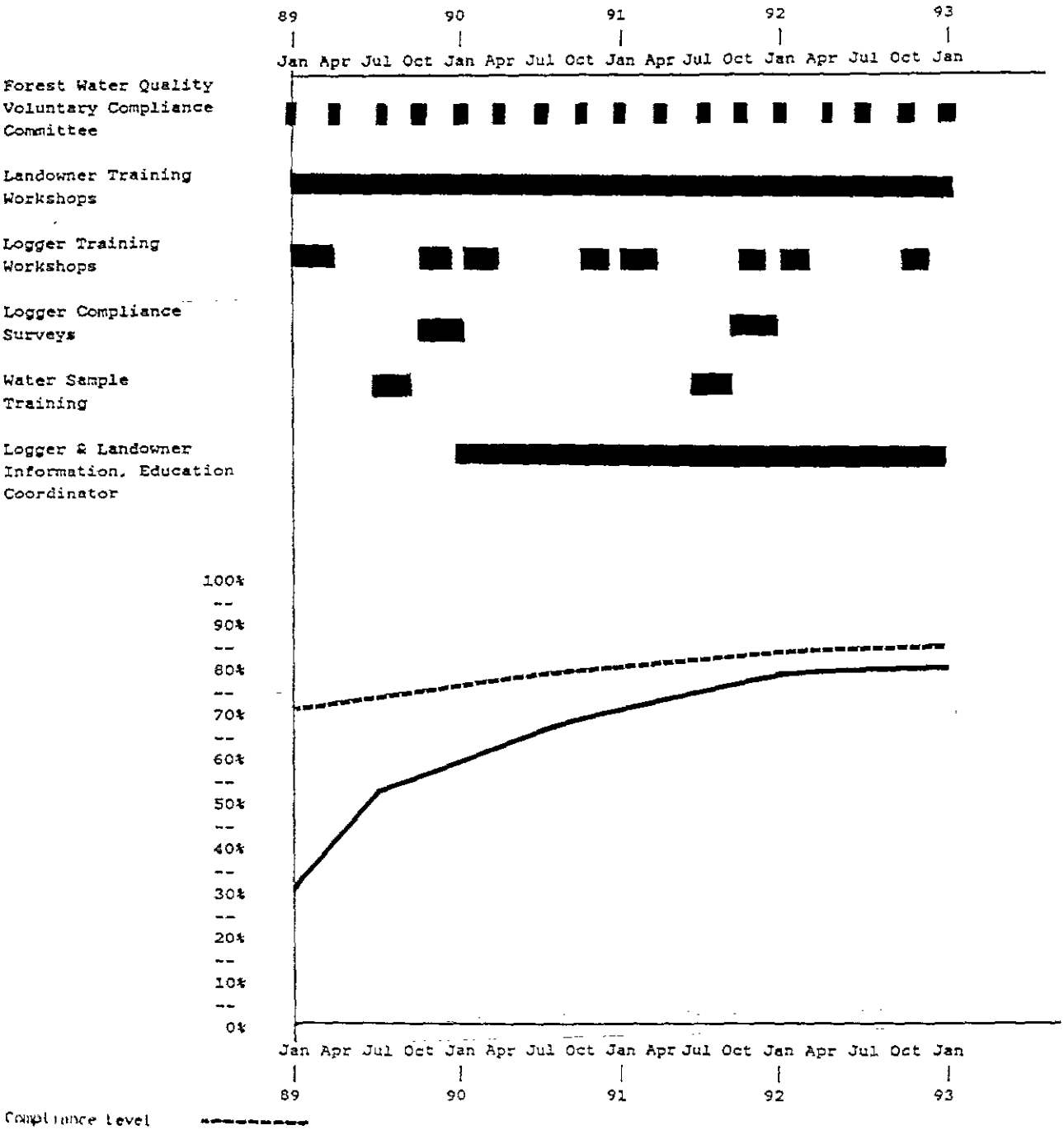
2. Maintain existing logger training workshops while intensifying landowner training workshops. The initial objective will be to conduct one workshop in each Division of Natural Resources district, and to follow through with the ultimate goal being to hold at least one workshop in each county of the state by 1992. It is anticipated that the degree of timber harvesting will be affected by market conditions which, in turn, will affect the number of workshops needed to expose every logger to the system.

3. Conduct a third logger compliance survey (in 1990) so as to monitor the use of BMP effectiveness, the level of logger understanding of BMPs, the percentage of timber harvesting job registration, and to develop guidance for the ongoing educational programs.

4. Provide updated additional training for Forestry Division personnel in inspection procedures, techniques of water sampling and evidence collection for turbidity (sediment) and other pollutants that might arise from logging.

5. The overall coordinated efforts of the Forestry Division, the Water Resources Division, and the Silvicultural Water Quality Voluntary Compliance Committee, will be intensified so as to obtain a higher percentage of logger compliance in the use of BMPs at or greater than 85%, by 1992, of harvesting operations scheduled to last two weeks or more.

HARVESTING ACTIVITIES



HARVESTING MILESTONES

Identification of BMP's

The actual quantities of soil and other pollutants beyond that of the normal geological process that are discharged to streams are determined by the manner in which the forests are managed and by the efforts that are made to control and minimize pollution. It is widely accepted by research foresters and others familiar with forest conditions that the amount of sedimentation resulting from forest harvest and management activities is small in relation to overall sedimentation from other sources. However, the amount or potential amount is significant enough that Best Management Practices (BMPs) have been developed and utilized to lessen such sedimentation and pollution of waters in West Virginia. The use of these practices becomes doubly important where sensitive areas such as cold water streams, trout streams and public water supplies are involved.

It has been determined by survey that some type of forest harvesting activity occurs on estimated 130,000 acres annually in West Virginia. This is just over 1% of the State's commercial forest land. Soil erosion and sedimentation are a major form of nonpoint source pollution that can be minimized by careful planning and execution of forest operations. In many cases, the application of common sense and simple treatment measures is all that is necessary.

The key to siltation control from forest lands is in educating the small forest landowners and the forest industry. Proper road location, use of filterstrips, proper location of log landings and concentration yards and stabilization of logging roads must be encouraged.

In the mid 1980's, a series of log road workshops was scheduled on an area basis involving agency, industry and consulting foresters. Brochures, slide-tape programs and handbooks pertaining to BMPs have been developed and disseminated on a large-scale basis. The educational phase has been directed not only to those involved in the forest industry, but also to the public in general in order to create awareness and involvement. Training and equipment have been required for those whose duties are to evaluate the usefulness of specific BMPs through the monitoring of streams, surveys, etc.

Forest lands are the best source of high quality water on a per acre basis in comparison to the output from other land uses. Water from the undisturbed or properly managed forest is high in yield, of good quality and low in sediments.

The established silvicultural Best Management Practices are the best available and practicable forest management practices to assist in achieving the goal of improving and maintaining water quality in West Virginia.

GUIDELINES FOR TRUCK HAUL ROADS

Definition

A road system, temporary or permanent, installed for transportation of wood products from the harvest site by truck. A single-lane road system installed by grading with a bulldozer or other mechanical equipment which may incur a series of minor cuts and fills.

Purpose

To provide for an efficient transportation system to effectively protect the forest land and water quality when removing forest products from their harvest site, developing the forest for recreation, forest fire access or other needed forest management activities.

Conditions Where Practice Applies

When an area to be cut and volume per acre makes it necessary and economically feasible for an operator to install such a road system.

Specifications

1. Final center line grade of road should be 10% or less 1/. Steeper gradients not to exceed 15% are permissible for distances up to 200 feet 2/. By breaking or changing grade frequently, less erosion problems will be encountered than on long, straight continuous gradients.

2. Free flowing watercourses should be bridged as close to a right angle to the stream as possible and should be sized so as not to impede stream flow in keeping with good drainage practices. (See pipe culvert specifications.)

1/ On soils with severe erosion hazard, grade should be 8% or less, but grades not over 12% for 150 feet are acceptable.

2/ Water diversion by cross drainage interception of surface water on road unslope form the top of these steep slopes is often needed to keep excess water off the steeper slopes.

3. Road gradients approaching water crossing should be broken and surface water dispersed so it will not reach the watercourse. Roads should be located (with the exception of stream crossings) a minimum of 25 feet or more from any free flowing watercourse. Distance is measured to the edge of soil disturbance, in case of fills, to the toe of the fill slope. (See guidelines and specifications for filter strips.)

4. Roads may be outslopes for cross drainage. On side hills where a curb, fender or berm is necessary to protect the fill slope, the road should be insloped with cross drainage installed from the inside toe of slope to the outside or downhill side. (See culvert, box culvert or broad-based dip specifications.)

5. Where roads are insloped as described in 4 above, cross drain interception of surface water should be required 25 feet upgrade of any short, steep stretches of road where gradients exceed 10%.

6. Level ridgetops where drainage is difficult to establish and wet floodplain soils should be avoided for road location if possible.

7. Truck roads that intersect main highways must have gravel or other aggregate for about

200 feet to keep mud off the highway.

Truck Haul Road Maintenance

1. During construction, adequate drainage of the road surface by temporary cross drains, "thank you ma'ams" or waterbars on a day–to–day basis is desired in the event of storm flow prior to road completion and installation of a permanent drainage system. This applies to those operations that would discharge sediment into waters of the State if not protected.

2. During the harvest operation period, roads and their attendant drainage systems should be maintained to perform to standard.

3. Operations that will cause adverse erosion and sediment problems should not be carried on in times of extreme weather conditions.

Post–Harvest Operations

If roads are to be used after logging, culverts and bridges should be left intact. If not used, drainage structures should be removed and road surfaces restored to a natural drainage by outsloping smoothly at +3%, leaving existing dips and establishing waterbars. Roads, ditches and landings that present an erosion problem should be seeded. Stream banks will be least disturbed if bridge abutments are left intact when bridge is removed. "Drainage structures (culverts) should be left in place on all perennial streams."

GUIDELINES FOR SKID ROAD AND TRAILS

Definition

An unsurfaced single-lane trail or narrow road, usually steeper and narrower than a truck haul road, used for skidding harvested products.

Purpose

To skid logs, tree lengths or other roundwood products from the stump to a common landing or concentration area.

Conditions Where Practice Applies

This practice is used where harvesting products requires centralizing for sawing or for loading on trucks or trailers and where topography and size of operation make skidding the primary and most economical means of collecting trees, logs or other roundwood products.

Standard

Locate landings fires and lay out road approach with low grade. Major skid trails should have planned locations to minimize damage to the residual stand, reduce erosion and sedimentation and provide the most economical method for skidding products.

1. Gradients should not be steeper than 15% with exception of short, steep segments not exceeding 20%. (Grades up to 40% are acceptable if no mineral soil is exposed.)

2. Cross drainage ("thank you ma'am," broad-based dips and turnouts) for dispersing surface water should be provided according to the gradient involved and the following spacing formula:

$$\frac{\text{Cross Drainage Spacing (in feet)}}{} = \frac{1{,}000}{\%\ \text{grade}}$$

3. Major skid trails should be located away from watercourses according to the filter strip formula.

4. Any skid trail necessitating the crossing of a live stream will require a bridge or culvert of acceptable design. Logs should not be skidded through flowing streams.

5. Approaches to water crossing should be as near to right angles to the stream direction as possible.

6. Upon completion of skidding, areas subject to erosion should be stabilized quickly. The first need is off-drainage of skid roads and exposed skid trails by establishing waterbars at these minimum grade intervals: 2%–250 feet; 5%–135 feet; 10%–80 feet; 15%–60 feet; 20%–45 feet. Waterbars should be installed at a near 30 degree angle downslope, with ends open to prevent water accumulation behind them. A permanent vegetative cover should be established upon exposed roads, trails and landings. Scattered logging slash may supplement waterbars and seedlings.

GUIDELINES FOR LANDINGS AND CONCENTRATION YARDS

Definition

An area where logs are assembled. This includes landings at the end of side and haul roads as well as concentration yards near mills and railroads.

Standard

This practice almost always results in the disturbance of the surface. Care should be taken to locate areas properly to minimize the chance of erosion and sedimentation.

The following points should be considered in the location and the use of landings and concentration yards:

1. Adequate filter strips should be left between landings and stream. (see filter strip chart.)

2. Landings and yards should have a slight slope to allow for drainage.

3. Provide for adequate drainage on approach road so that road drainage does not enter landing area and cause "mudholes."

4. Provide diversion ditch around uphill side of landings where seepage and lateral flow of water is a problem.

5. When servicing equipment on site, drain old oil, etc., into containers and properly dispose of in accordance with proper solid waste disposal. All empty containers should be removed and disposed of properly.

6. Revegetate landings and yards immediately following completion of operations. (See Table 4.)

Table 4

GUIDE TO SEEDING ROAD AND DISTURBED AREAS 1/

1. Road cut and fill slopes subject to erosion. These areas should be seeded as soon after construction as weather will permit. 2/ Seed and fertilize may be broadcast by hand, cyclone seeder or applied with a hydroseeder. Mulching is recommended.

2. Roads, landings, concentration yards being taken out of use. Water control should be provided for by the use of waterbars, outsloping of roads, or diversion ditches prior to seeding. Broadcast seed and fertilizer or use mechanical seeder. Mulching is recommended on exposes areas such as landings and concentration yards.

3. Prepare seedbed by scarifying surface two to three inches using equipment such as disc harrow or ripper teeth on a dozer blade. Broadcast or drill seed (useful on old or compacted areas.)

4. Broadcast seed should be covered by dragging blade, chain, brush or other method.

5. Mulching at a rate of 1 1/2–2 tons straw or hay per acre is recommended on exposed areas.

1/ See Table 5 for suggested seeding mixtures and rates.

2/ Soil moisture and growing conditions for successful seedings are usually most favorable in spring (March to June) and fall (late August to November). However, with proper care, successful seeding can be done anytime during the growing season.

Table 5

SUGGESTED SEEDING MIXTURES AND RATES BY LAND RESOURCE AREA (LRA)

#1 Tall Fescue	60	All LRA's
#2 Tall Fescue	25	All LRA's
White Dutch Clover*	2	
#3 Tall Fescue	25	125, 126, 128, 147
Sericea Lespedeza*	30	
#4 Tall Fescue	30	126, 128, 147
Crown Vetch*	10	Best suited on lime-influenced soils.
#5 Tall Fescue	25	127
Red top	2	Best suited to
Bird's-foot Trefoil*	8	elevations over 2,000 feet.
#6 Creeping Red Fescue	25	127
		Suited to shady areas.
Redtop	2	
Bird's-foot Trefoil*	8	
#7 Tall Oat Grass, unhulled	25	147
Sericea Lespedeza*	25	Suited to droughty
Redtop	2	soils and erratic or low rainfall.

*Inoculate

Fertilizer recommendation: 500 lbs. 10-10-10/acre. Game food mixtures can be substituted for Lespedeza or white dutch clover.

For temporary seeding, 30 lbs/acre of domestic ryegrass may be used.

GUIDELINES FOR PESTICIDE USE AND APPLICATION

Only pesticides (herbicides, insecticides, rodenticides, etc.) currently registered and labeled by the U.S. Department of Agriculture or the Environmental Protection Agency (EPA) for the specific use proposed will be used an they will be applied in accordance with label directions or directions received from EPA or Council on Environmental Quality.

Application of pesticides may be done only by persons certified by the State of West Virginia.

Exhibit 1

SUGGESTED STANDARD AND SPECIFICATIONS FOR WATERBARS

Definition

A combined shallow trench and pole reinforcement constructed across a road or trail.

Purpose

To intercept and divert side ditch and surface runoff prior to or following completion of use of a road or trail to minimize erosion and provide conditions suitable for natural or artificial revegetation.

Conditions where Practice Applies

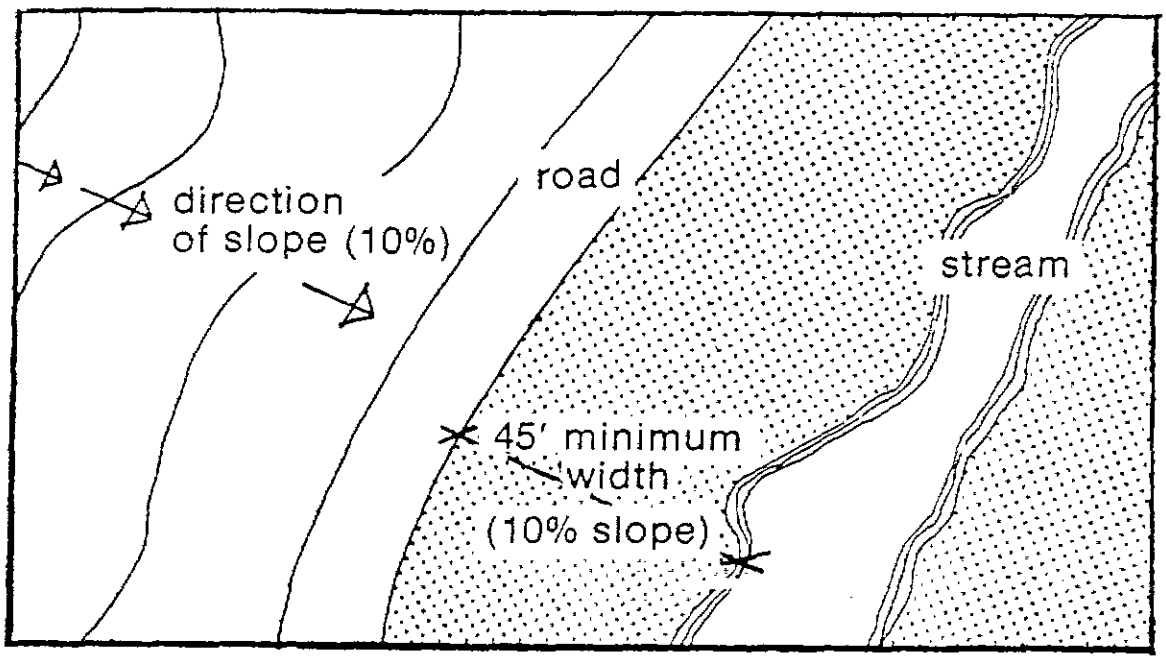
On any sloping road or trail where surface water runoff may cause erosion of the exposed trail.

Specifications

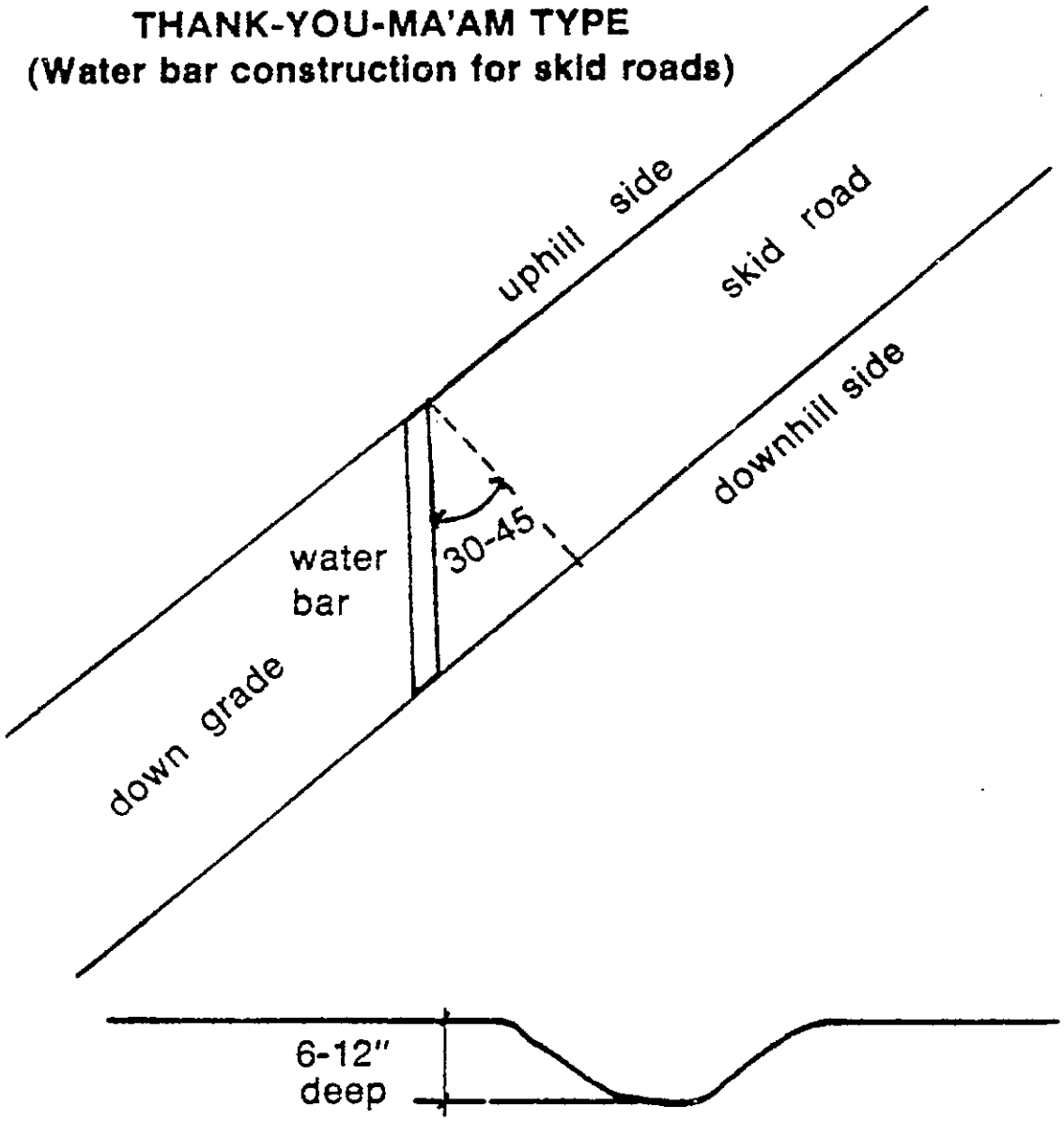
1. Proper spacing between waterbars can be determined from the table.
2. Installation should be at an angle of 30 degrees downslope or more to turn surface water off the road or trail.
3. A shallow trench should be dug 3-4 inches below the surface of the road or trail and extend beyond both sides.
4. A five to eight inch pole should be placed in the trench, pegged and filled with soil on the downslope side.
5. The uphill end of the bar should extend beyond the side ditch line of the road to fully intercept any ditch flows.
6. The outflow end of the bar should be fully open and extended far enough beyond the edge of the road or trail to safely disperse runoff water onto disturbed forest floor.

SUGGESTED SPACING TO USE BETWEEN WATERBARS

% Grade of Road	Distance Between Waterbars
2	250
5	135
10	80
15	60
20	45
30	35



THANK-YOU-MA'AM TYPE
(Water bar construction for skid roads)



SUGGESTED STANDARD AND SPECIFICATIONS FOR OPEN-TOP BOX CULVERT

Definition

A wooden culvert placed across truck haul roads to convey road surface runoff and side ditch flows across road surface to downslope side.

Purpose

To collect and direct road surface storm runoff and upslope side ditch flows across road without eroding drainage system or road surfaces.

Conditions Where Practice Applies

This is a drainage structure for ongoing operations and is not permanent. It can be used for cross drainage on truck haul roads on smaller operations as a substitute for pipe culverts, however, it silts in readily and requires frequent maintenance. This practice should not be used for handling intermittent or live streams or skid trail cross drainage.

Design Criteria

1. Box culvert is to be installed flush with road surface and skewed at an angle not less than 30 degrees downgrade.

2. Invert end will be at grade with side ditch and extend into toe of upslope cast.

3. Outslope will extend beyond the road surface with adequate rip-rap or other material to dissipate water velocity to assure no erosion of cast fill.

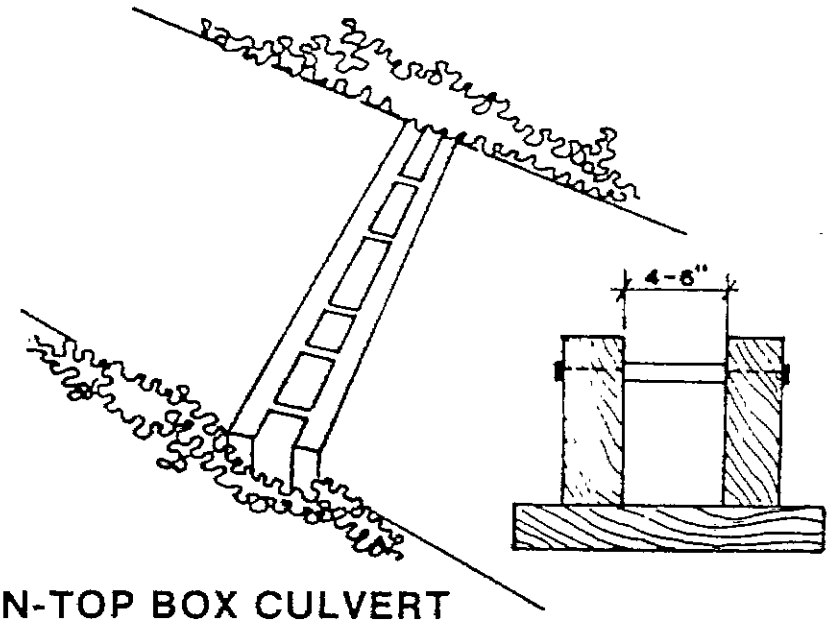
4. Spacing will be determined by the following formula:

$$\text{Spacing} = \frac{400'}{\text{slope}} + 100'$$ (Note: refer to spacing table)

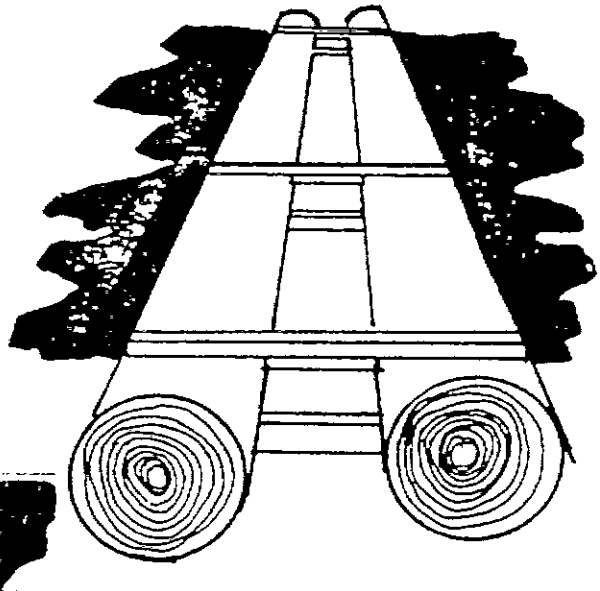
5. Clean-out maintenance must be done to remove sediment, gravel and logging debris to allow normal function of structure at all times.

SPACING TABLE FOR OPEN-TOP BOX CULVERT

Road Grade (percent)	Spacing between culverts (feet)
2	300
4	200
6	165
8	150
10	140
12	130
14	130
16	125



OPEN-TOP BOX CULVERT



OPEN-TOP POLE CULVERT

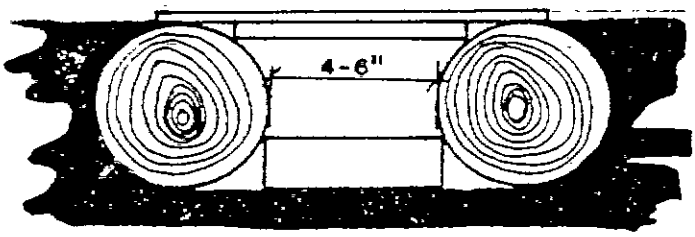


Exhibit 3

SUGGESTED STANDARD AND SPECIFICATIONS FOR PIPE CULVERT

Definition

Corrugated metal pipe or other suitable material is placed under truck haul or major skid roads to transmit side ditch storm runoff, seeps and small intermittent or live watercourse flows.

Purpose

To collect and transmit water flows from side ditches or seeps and intermittent or live streams under haul and skid roads safely without eroding drainage systems or road surface.

Conditions Where Practice Applies

Its use is for any size operation where cross drainage of storm water or diversion of small intermittent or live watercourses is needed for truck haul or major skid roads. In such cases, it is a necessary drainage structure for temporary operations, but can be permanent.

Design Criteria

Streams:

1. Pipe length should be long enough so both ends extend beyond side slope toes.
2. Fill material should be one foot or more over the pipe and more than 1/2 the pipe diameter between multiple pipe installations.

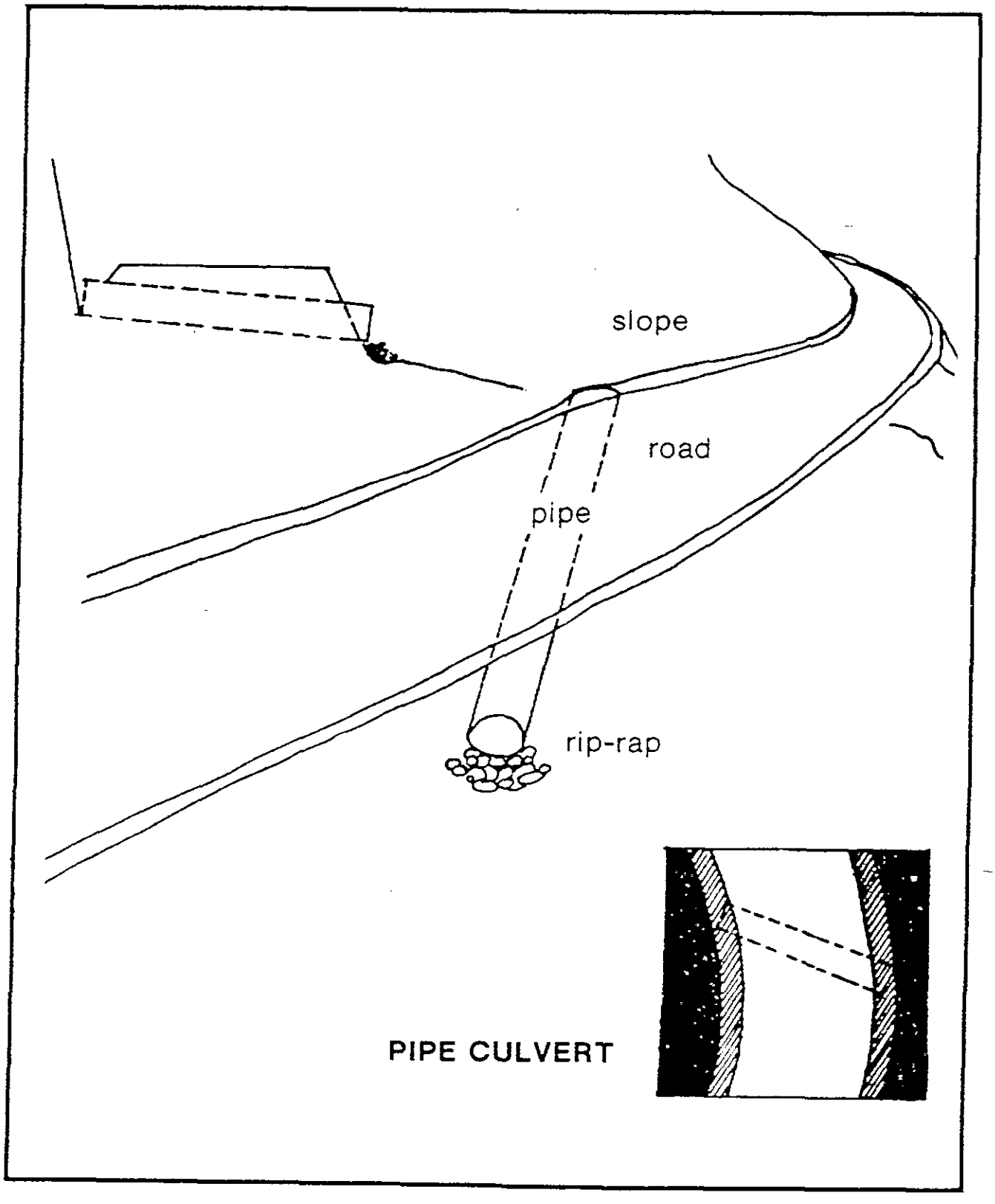
Cross Drainage:

1. Pipe length should be long enough so both ends extend beyond side slope toes.
2. Pipe and stream gradients should be the same, with pipe alignment the same as stream course or thread.
3. For use on disposing of collected surface water drainage, the culvert gradients should match that of the contributing ditch.
4. Installation should be skewed 30–45 degrees downgrade.
5. Erosion protection should be provided for outflows of culverts to minimize erosion downslope or downstream of the outfall. It may also be needed on the upstream end of culverts on flowing streams. This protection can be in the form of rip–rap or plastic filter cloth and rip–rap, large stone, etc.

DRAINAGE TABLE

DIAMETER OF PIPE NEEDED

Acres Drained	LIGHT SOILD			MEDIUM SOILS			HEAVY SOILS		
	Flat	Moderate	Steep	Flat	Moderate	Steep	Flat	Moderate	Steep
2	15	15	15	15	15	15	15	18	18
4	15	15	15	15	15	18	21	21	21
6	15	15	15	15	18	21	21	27	27
8	15	15	15	15	18	21	24	27	30
10	15	15	15	18	21	24	27	30	36
20	15	15	15	21	24	30	30	36	42
30	15	15	15	21	27	36	36	42	48
40	15	15	15	24	30	36	42	48	54
50	15	15	18	27	36	42	42	48	
60	15	15	18	27	36	42	42	54	
70	15	18	18	27	36	42	48	54	
80	15	18	21	30	36	42	42	54	
90	15	18	21	30	36	48	48		
100	15	18	21	30	36	48	48		
150	18	21	24	36	42	48	48		
200	21	21	27	36	42	54	54		
250	21	21	27	36	48				
300	21	27	30	42	54				
350	24	27	30	42	54				
400	24	27	36	48					



PIPE CULVERT

Exhibit 4

SUGGESTED STANDARD AND SPECIFICATIONS FOR BROAD-BASED DRAINAGE DIP

Definition

A dip and reverse slope in a road surface with an outslope in the dip for natural cross drainage.

Purpose

To provide cross drainage on inslope truck roads to prevent buildup of excessive surface runoff and subsequent erosion.

Conditions Where Practice Applies

Broad-based dips can be used on truck haul and heavily used skid roads having a gradient of 10% or less. They are not to be used for cross draining intermittent or live streams. This practice may be substituted for other surface water cross drain practices (pipe or box culvert).

Design Criteria

1. Installation takes place following basic roadbed construction.

2. A 20 foot, 3% reverse grade is constructed into the existing roadbed by cutting from upgrade of the dip location and using cut mat material for the reverse grade.

3. Spacing of broad-based dips will be determined by the following formula:

$$\text{Spacing (in feet)} = \frac{400'}{\text{Slope \%}} + 100$$

(Note: Refer to spacing table.)

4. Cross drain outslope will be 2-3% maximum.

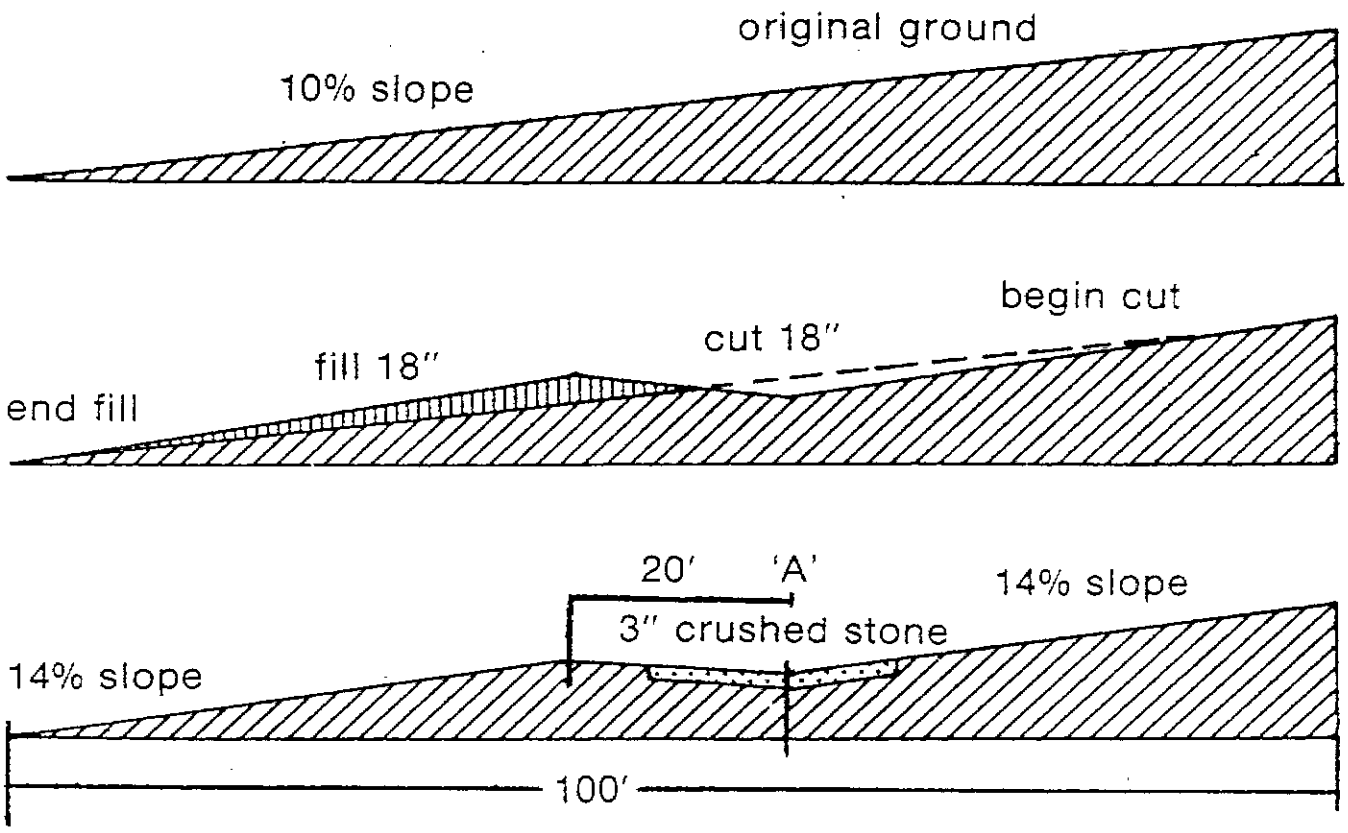
5. An energy dissipator and, in some cases, a level spreader should be installed at the outfall of the dip to dissipate water velocity, assuring no erosion of cast fill.

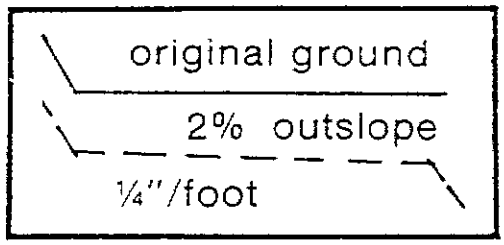
6. The dip and reverse grade section may require bedding with three-inch crushed stone in some soils to avoid rutting of the road surface.

SPACING TABLE FOR BROAD-BASED DIPS

Road Grade (percent)	Spacing between Dips (feet)
2	300
3	235
4	200
5	180
6	165
7	155
8	150
9	145
10	140

BROAD-BASED DRAINAGE DIP





Cross section 'A'

GUIDELINES FOR FILTER STRIP AND SHADE STRIP ZONES

Definitions

Filter Strip – A protective strip of undisturbed forest soil between areas disturbed to mineral soil and a watercourse.

Shade Strip – A no-cut or light-cut area that preserves adequate shading of streams.

Purpose

Filter Strip – Provides a relatively undisturbed zone to trap and filter out suspended sediments before these particulate reach the stream.

Shade Strip – Maintain satisfactory stream water temperatures.

Conditions Where Practice Applies

Filet strip areas should be maintained between all streams, watercourses, truck haul roads, major skid trails and/or other areas where soil has been exposed and surface runoff will carry sediment loads. Filter strips should begin at and continue downstream from the point where the stream drains an area for approximately 100 acres or more. Use of filter strips for stream draining smaller areas is beneficial and is encouraged. Filter strips should be required around lakes or ponds an acre or larger in size, perennial flowing natural springs and all springs and reservoirs serving a domestic water supply.

Shade strip areas should be maintained along all permanent streams.

Design and Management Criteria

1. The minimum filter strip width or distance between road or trail (exposed mineral soil) and a watercourse should be 25 feet (50 feet in municipal watersheds or other sensitive areas).

2. Where sloping land is encountered between road or trail and a watercourse, use the filter strip conversion table to determine filter strip width.

3. The filter strip should be protected to prevent exposure of mineral soil and subsequent erosion. Equipment operation in this area should be limited. If mineral soil is exposed, it should be stabilized by seeding and/or mulching as soon a growing conditions permit.

4. Truck and skid roads should not be permitted within the filter strip except when entering and leaving stream crossings.

5. No log yarding areas should be permitted within the filter strip.

6. Energy absorbers should be installed at culvert outlets or discharge points into or within the filter strip.

7. Drainage structure such as ditches, culverts, waterbars and broad-based dips should be used to truck and skid roads within the filter strip to intercept and properly discharge runoff.

8. To minimize erosion sources, cut and fill slopes within the filter strip should be held to minimum heights in accordance with safety and other design criteria.

9. Shade strip areas should be maintained along permanent watercourses or streams. This

will involved no-cut buffers or light selection cut areas so as to maintain adequate stream shade.

FILTER STRIP CONVERSION TABLE

for

DETERMINING WIDTH OF FILTER STRIPS BETWEEN EXPOSED MINERAL SOIL AREAS AND WATERCOURSES

Average Percent Slope Between Land and Watercourse	Filter Strip Width Feet (Width) Common Logging Areas	Municipal Watersheds Trout Streams and Other Sensitive Areas
0 (level)	25	50
10	45	90
20	65	130
30	85	170
40	105	210
50	125	250
60	145	290
70	165	330

FOREST FIRES

General

Experience has shown that the potential nonpoint source pollution from logging is nowhere near as bad as the sedimentation created by forest fires, especially in the 10 county "hot" spot of Southern West Virginia (see map 1 of Appendix). Forest fire erosion data, which was recently collected from a single 1,210 acre forest fire that burned in the fall of 1987, reveals soil erosion problems were created that, if expanded to include all of the fire burned acreage recorded during the fall of 1987, would take the logging industry many years to equal.

The 1987 fall fire season was one of the worst on record with over 400,000 acres of forest land being burned in West Virginia. (This is more than triple the number of annually harvested acres.) Ninety-seven percent of the acreage that burned during this period did so in 10 southern counties with over 50% of the entire surface area of one county (Mingo) being burned over by forest fires (see graph 1 & 2 of Appendix). Eighty-nine percent of this acreage burned during an 11-day period when severe burning conditions resulted in "high intensity" fires that actually consumed the entire duff layer of the forest floor -- burning to the mineral soil. More than 90% of these fires were caused by arsonists.

Until recently, the more obvious destructive results of forest fire, i.e timber productivity loss, wildlife habitat destruction, reduction of aesthetic appeal of the woodlands and, the overall increased susceptibility of damaged trees to insects and disease, etc. were the only considerations; probably because the control of fires has been accepted as being imperfect. Some officials, for various reasons, particularly in federal agencies have continued to accept that certain fires can be beneficial to the forest. Therefore, forestry personnel were asked to be very thorough in their evaluation of forest fires as a cause of erosion.

As a result, Forestry Division personnel working on an unrelated watershed Forest Management Plan began collecting statistical information on erosion caused by fire. Although water quality degradation has always been accepted as one of the destructive effects of forest fires, the extent of that destruction was quite apparent in this instance. It was also apparent that the major soil erosion and sediment causing problem within the entire watershed was probably the forest fires.

Soil scientists from the USDA Forest Service were asked to collect soil erosion data using the Universal Soil Loss Equations for forest land. This request was made so as to remove any bias. The results of the study revealed that as much as 34.8 tons of soil per acre for the first year were eroding from the burned forest land as a result of just that fire in a previously unburned area. As much as 40% of the mineral soil was exposed due to destruction of the forest humus or duff. It was discovered that the average overall soil erosion for burned areas on a 42% slope (average for Southern West Virginia) and having only 30% mineral soil exposed was 23 tons/acre/for the first year. According to the USDA Forest Service, approximately 10 percent of all erosion results in stream sedimentation. Therefore, we can expect that a minimum of 400,000 tons of actual stream sedimentation occurred during the six month period immediately following the 1987 fall wildfire season. Ninety-five percent of this sedimentation will have occurred in watersheds in 10 Southern West Virginia counties where extensive burns occur each year. The USDA Soil Conservation Service tolerable soil loss, which is defined as that which sustains soil productivity economically and indefinitely, is from one to five tons per acre. With this as a guide, this land is ruined for decades and the streams are well on their way to a similar fate.

Additional observations made by Division of Forestry personnel, taken after the initial data collection by the Forest Service, revealed that, in many areas, the entire "A" horizon (an area of decomposed and leached organic material just above mineral soil) of the forest floor was destroyed. The erosion on these areas is expected to exceed 200 tons per acre this year. Erosion control plots are being established on selected repeat and severe burn areas to, in fact, monitor overall erosion rates. Monitoring thus far shows that these figures can be expanded significantly when reburned areas are considered. The significance of repeat burning is in the accumulative effect of reducing humus along with overall tree stocking in both the understory and overstory trees. When forest canopy is reduced, future humus accumulation is also

reduced. Sartz and Huttinger, for instance, showed that humus under well stocked (70-100% canopy cover) stands was about .5 inches deeper than in fair stocked stands (40-70% canopy cover) (33).

Duff or forest humus stores and transmits moisture and shields the soil against the soil-eroding forces of rainfall. This humus layer actually forms an obstruction to surface runoff, increasing the frictional resistance to overland water flow.

According to research conducted by Loudermilk in the 1930's (31) surface runoff from a burned forest floor in clay loam soils can be 16-1/2 times greater than in unburned areas and infiltration capacity is reduced 40% when this humus layer is removed (32). These rates are totally applicable where intense ground fires destroy the forest floor and thus are applicable in a high percentage of West Virginia fires.

The initial findings thus far substantiate Mobley and Kerr's earlier work (34) which showed that forest fires can impair the ability of watersheds to absorb rainfall and hold back runoff when it consumes all of the ground litter. They say, "When bare soil is exposed on slopes, the additional surface runoff will carry suspended soil particles and other material into adjacent streams with a corresponding reduction of water quality." They also say, "Wildfire is responsible for a vast amount of flood damage and siltation of reservoirs. After a fire has exposed the soil, wood ashes and silt washed into streams can kill large numbers of fish and ruin a good fishing stream." (34)

Consequently, both the West Virginia Division of Forestry and the Division of Natural Resources Water Resources Section personnel are convinced that one of the most destructive forces causing nonpoint source pollution to major watersheds in Southern West Virginia is forest fire and the tendency for forest fires to occur repeatedly in certain areas. These 10 counties approximate one-third of the total acreage in the State.

Causes

Over 75% of the fires that occurred during the fall of 1987, and as high as 90% during an 11-day period of severe burning conditions, were due to arsonists. Carelessness in burning debris was the second major cause of forest fire. Arson and debris burning have traditionally been the cause of two-thirds of the forest fires in West Virginia and more than 90% of the acreage burned (35).

Shortly after the 1987 fall fire season ended, the West Virginia Division of Forestry's Forest Protection Advisory Committee met. This committee developed a tactical plan (36) to solve the forest fire problem, especially in Southern West Virginia by concentrating on solutions for arson.

Activities and Milestones

1. These provisions have been implemented.

   A. Increased number of trained fire crews - Pocahontas Land Co/WV Division of Forestry joint effort in Wyoming, McDowell and Mingo.

   B. Increased wages paid for registered fire crew members and revamped entire fire warden system.

   C. Changed the misdemeanor penalty for arson found in Chapter 61 of the State Code so that arson cases involving forest fires will be prosecuted similar to those prosecuted under the Forestry statute (Chapter 19).

   D. Requested Division of Natural Resources to give forest fire law enforcement, fire investigation and the apprehension of arsonists a top priority during fire seasons.

(Implemented February 1988 and increased prosecutions and investigations already resulting)

E. Printed National Wildfire Coordinators Group "Wildfire Cause Determination Handbook" and distributed to all Forestry personnel and Conservation Officers.

F. Increased public awareness of the $1,000 West Virginia Forestry Association reward for information leading to an arrest and conviction for woods arson. New posters describing the recently increased arson reward have been produced and distributed.

G. Increased fire prevention announcements in newspapers, radio and television. All personnel are increasing prevention contacts.

H. Urged companies to extinguish or safety strip around underground mine fires on their properties.

I. Distributed 12,000 brochures "Protect Your Forest Home From Wildfire."

J. Prepared fire plans for woodland home subdivisions.

K. Developed specific criteria to trigger initiation of ban on open burning during dry periods and times of high fire occurrence.

L. Developed specific criteria to trigger woods closure during periods of extreme dryness and fire occurrence.

M. Participated in the Mid Atlantic and the Northeastern Interstate Forest Fire Protection Compacts Training Programs.

2. These provisions are under consideration or in the process of being implemented.

A. Add seven full-time Division of Forestry personnel and twenty patrolmen.

B. Add three conservation officers for investigation and enforcement in "hot" counties.

C. Purchase portable radios and blowers to replenish fire caches depleted in past fire seasons.

D. Replace outdated mobile radios with programmable radios.

E. Conduct fire investigation training for law enforcement, fire control and forest industry personnel.

F. Seek legislation to give officers the authority to declare any property constituting a forest fire menace a public nuisance and to order its abatement.

G. Develop annual 4-color process fire prevention posters featuring a West Virginia celebrity and Smokey with an arson prevention theme. (Two posters featuring Astronaut Jon McBride and West Virginia University 1988 football team have already been completed). Black and White posters will be distributed to all fourth grade students in the State.

H. Establish awards for Conservation Officers with significant arrests for forest fire

violations.

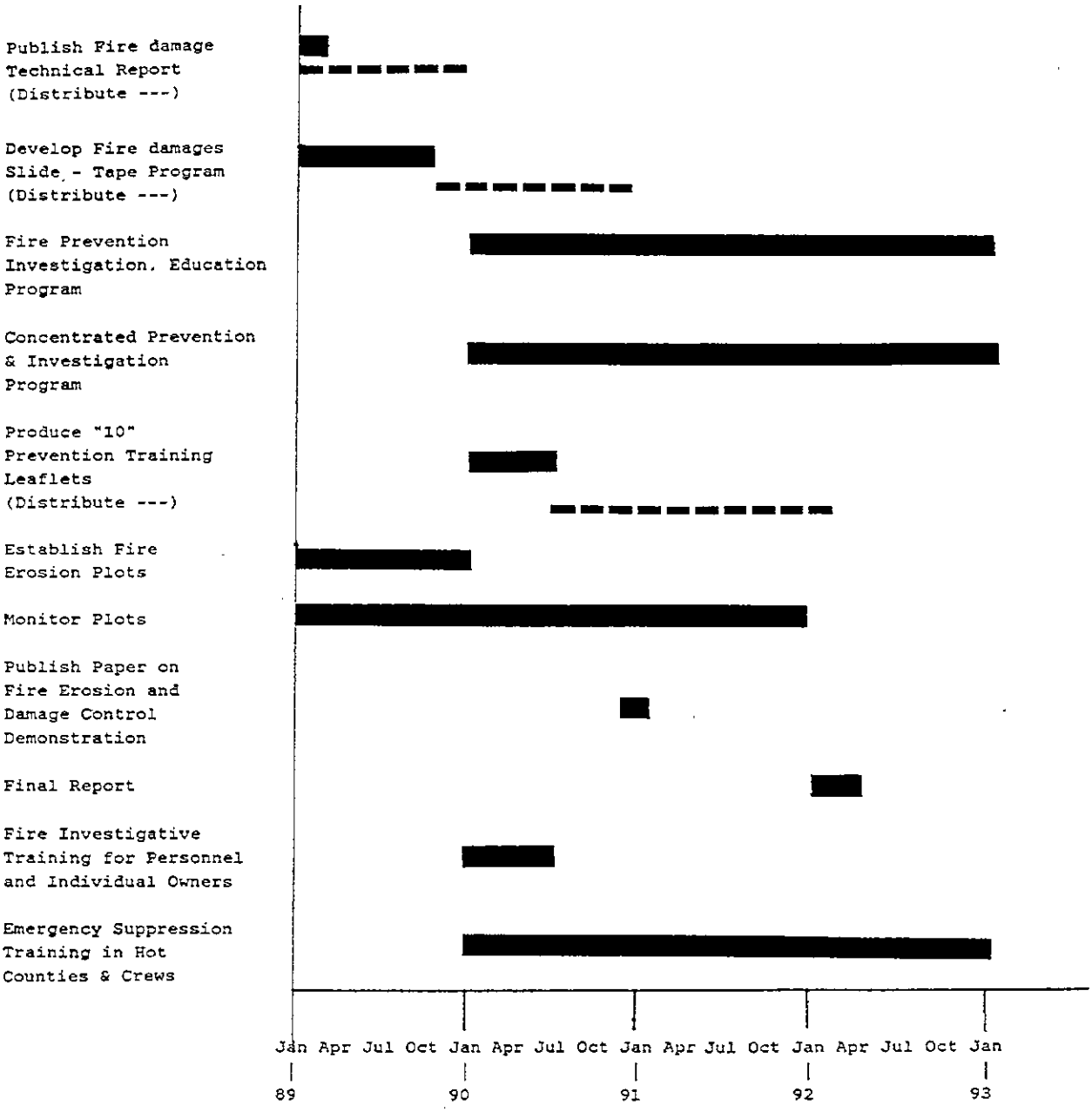
l. Request raising the penalty for arson to a $1,000 – $5,000 fine and increasing the jail term to 5 – 10 years.

The Division of Natural Resources Water Resources Section will develop grant requests for funds to be provided to the West Virginia Division of Forestry. (Refer to fiscal note) These funds will be used to supplement state legislative funding.

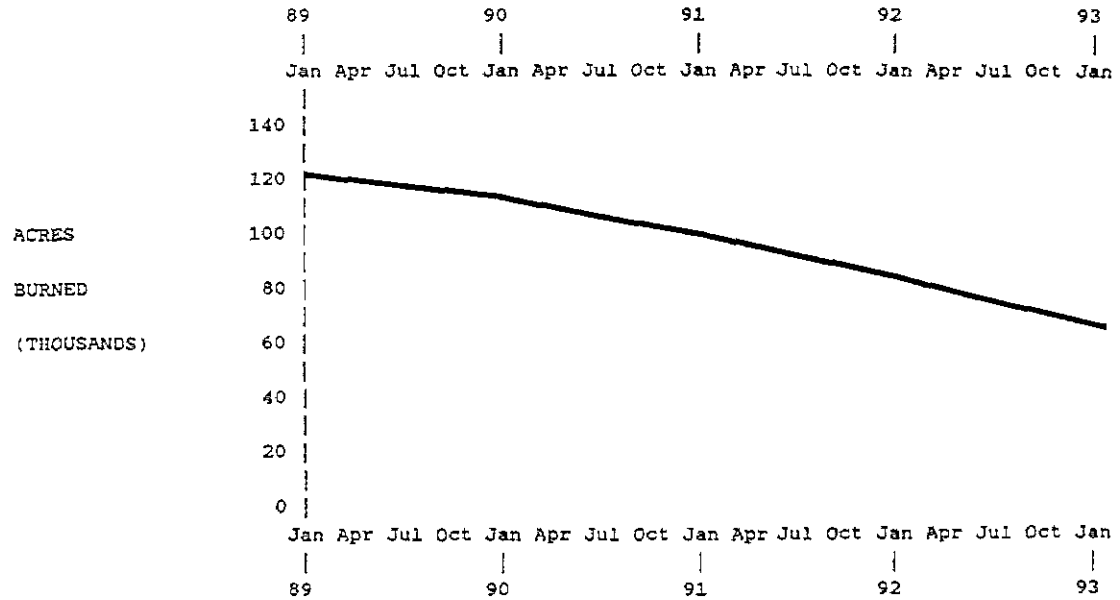
As listed in the appendix, (Appendix 10) 24 watersheds within the 10 "hot" counties have been identified as those most significantly impacted by severe repeat burns according to the West Virginia Division of Forestry forest fire records. Within these watersheds, 26 streams are listed as priority problem areas that will be targeted initially for overall fire reduction activities.

The major program milestone will be to effectively stop arson related fires within three years from implementation of the above tactical plan. Once this milestone has been achieved, water quality degradation by forest fire to the listed watersheds will have been reduced by at least 75%.

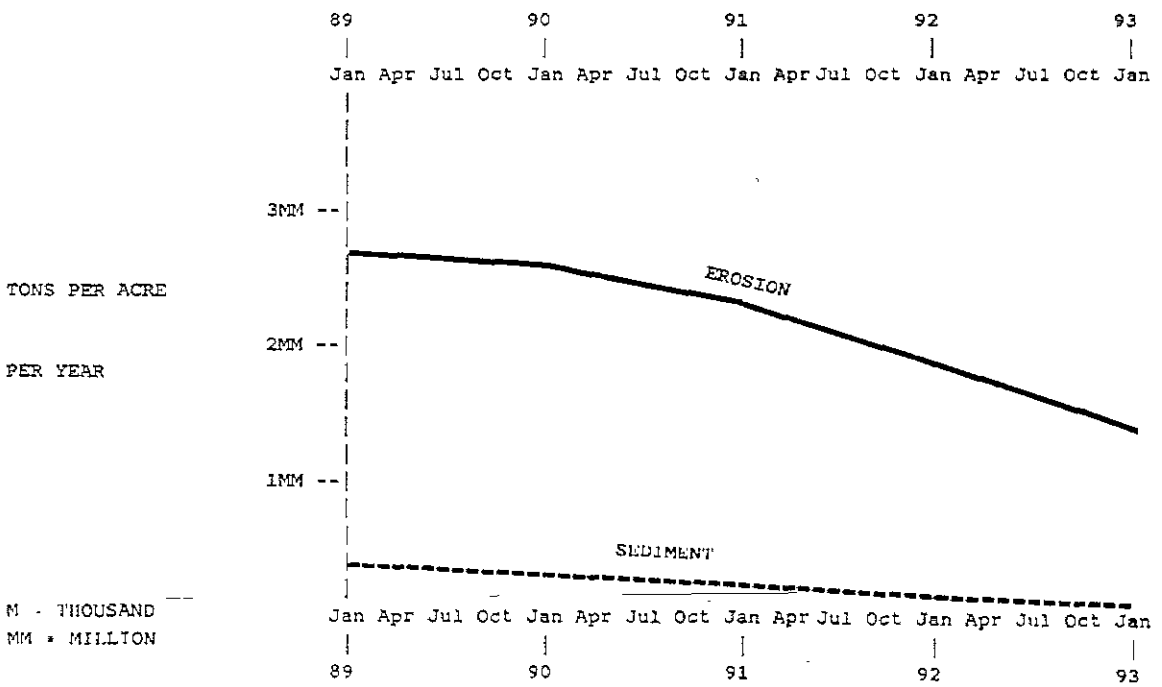
FOREST FIRE EROSION ACTIVITIES



FOREST FIRE MILESTONES



ACCUMULATIVE AREA SAVED = 124,000 ACRES



TOTAL ACCUMULATIVE REDUCTION EROSION TONS ——— = 2.8 MM

TOTAL ACCUMULATIVE REDUCTION SEDIMENT TONS - - - - - = 283 M

SAWMILL BY-PRODUCTS

BMPs for Untreated Sawdust and Bark

1. Small Volume Storage and Disposal Practices for Portable Sawmill Operations.

Portable sawmill is defined as any mill that produces less than 1 million board feet per year or no more than 2,500 cubic yards of by-product per year.

These BMPs are intended as guides for untreated wood by-product storage and disposal sites created after June 1, 1988, or for preexisting sites that may be approved for such usage by personnel of the Water Resources Section of the Division of Natural Resources and the West Virginia Division of Forestry.

A. Type of Material.

a. These BMPs are to be used only for wood by-products from sawmilling or other wood manufacturing operations that use untreated wood.

b. Waste, including household trash, old or used equipment parts, etc., is to be excluded from the pile.

B. Location of Storage/Disposal Sites.

a. Sites shall not be located in a wetlands area, or any other area where the wood dust or bark is likely to come in direct contact with water. Any area that contains plants that are generally considered to be wetland species shall be considered a wetland.

b. Sites shall not be located on known springs.

c. Sites shall not be located in karst areas, such as, but not limited to, the areas underlain by limestone which approaches the surface, sink holes, or solution channels.

d. Sites shall not be located within 50 feet of a stream bank or within 200 feet of a domestic water well.

e. Security measures shall be in place to assure no unauthorized access to the storage/disposal site.

C. Diversion of surface water away from or around storage/disposal sites.

a. Diversion ditches or dikes shall be used to divert water away from the storage/disposal site.

b. If the site is located near a stream, diversion structures shall be capable of diverting a once-in-ten-years 24 hour frequency storm.

c. Provisions for a temporary cover shall be made for the storage/disposal site when the facility is not operating.

D. Sites.

a. Sites that are no longer in use and which are scheduled for abandonment shall

be covered with a minimum of two feet of soil and seeded. The top of the pile shall have a slope of at least one percent with the side slopes being at least 3:1.

2. Large Volumes Short Term (Less than 1 year) Storage Practices for Permanent Sawmill Operations.

A permanent sawmill is defined as one cutting more than 1 million board feet annually or generating more than 2,500 cubic yards of by-products.

These BMPs are intended as guides for untreated wood by-product storage sites created after June 1, 1988 or for preexisting sites that may be approved for such usage by personnel of the Division of Natural Resources Water Resources Section and the West Virginia Division of Forestry.

A. Type of Material.

a. These BMPs are to be used only for by-products from sawmilling or other wood manufacturing operations that use untreated wood.

b. Waste, including household trash, old or used equipment parts, etc., is to be excluded form the pile.

B. Location of Storage Sites.

a. Shall not be located in a wetlands area, or any other area where the wood or bark is likely to come in direct contact with water. Any area that contains plants that are generally considered to be wetland species shall be considered a wetland.

b. Shall not be located on known springs.

c. Shall not be located in karst areas, such as, but not limited to, the areas underlain by limestone which approaches the surface, sink holes, or solution channels.

d. Shall not be located with 50 feet of a stream bank or within 200 feet of a domestic water well.

e. Security measures shall be in place to assure no unauthorized access to the storage site.

C. Diversion of Surface Water Away from or Around Storage Sites.

a. Diversion ditches or dikes shall be used to divert water away from wood by-product storage piles.

b. If the site is located near a stream, diversion structures shall be capable of diverting a once-in-ten-years 24 hour frequency storm.

c. Provisions for a temporary cover shall be made for the storage site when the facility is not operating.

D. Removal of Stored By-products.

a. These sites are not permanent storage sites. All by-products must be removed and the site reclaimed no longer than one (1) year after the end of sawing operations.

b. No more than one (1) years production of by-product may be stored at any given time.

3. Large Volume, Long Term (Greater than 1 year) Storage Practices for Permanent Sawmill Operations.

A permanent sawmill is defined as one cutting more than one (1) million board feet annually at a site or generating more than 2,500 cubic yards of by-products generated.

These BMPs are intended as guides for untreated wood by-product storage sites created after June 1, 1988, or for preexiting sites that may be approved for such usage by personnel of the Division of Natural Resources Water Resources Section and the West Virginia Division of Forestry.

A. Type of Material.

a. These BMPs are to be used only for wood by-products from sawmilling or other wood manufacturing operations that use untreated wood.

b. Waste, including household trash, old or used equipment parts, etc., is to be excluded from the pile.

B. Location of Storage Sites.

a. Shall not be located in a wetlands area, or any other area where the wood or bark is likely to come in direct contact with water. Any area that contains plants that are generally considered to be wetland species shall be considered a wetland.

b. Shall not be located on known springs.

c. Shall not be located in karst areas, such as, but not limited to, the areas underlain by limestone which approaches the surface, sink holes, or solution channels.

d. Shall not be located within 50 feet of a stream bank or within 200 feet of a domestic water well.

e. Security measures shall be in place to assure no unauthorized access to the storage site.

C. Diversion of Surface Water Away from or Around Storage Sites.

a. Diversion ditches or dikes shall be used to divert water away from wood by-product storage piles.

b. If the site is located near a stream, diversion structures shall be capable of diverting a once-in-ten-years 24 hour frequency storm.

c. Liners shall be placed between the wood by-product and the ground water or bed rock and covers shall be required for all long term storage sites.

D. Leachate.

a. Leachate generated from these sites is to be collected and handled in an environmentally sound manner.

b. Leachate disposal on site will require a National Pollutant Discharge Elimination

System (NPDES) permit.

E. Removal of Stored By–Products.

a. These sites are not permanent storage sites. All by–products must be removed and the site reclaimed one (1) year after the end of sawing operations.

b. No more than three (3) years of total production of sawmill by–products may be stored at any one time.

Activities and Milestones

BMPs have just recently been developed regarding sawmill by-product storage. Implementation milestones as well as activities and guidelines are being drafted. Interagency cooperative agreements are being initiated as well as agency training and implementation guidelines. These materials will be appended to this plan upon completion.

Wood By-Product Storage Program

Wood by-product storage areas have been predicted to cause ground and surface water pollution. In an effort to prevent possible pollution from these materials, the Division of Natural Resources Water Resources Section, in cooperation with the West Virginia Division of Forestry, has developed Best Management Practices (BMPs) for the storage of untreated sawdust and bark.

The submission of a site application form acknowledging the use of BMPs in wood by-product storage areas is required.

These BMPs do not apply to existing storage areas if water quality related problems were suspected nor do they apply to permanent disposal sites which are required to have permits under Chapter 20, Articles 5A-5 and 5F-5 of the West Virginia Code.

The West Virginia Division of Forestry will notify the industry of needs and provide technical assistance and some measure of control through a site application form in much the same manner as the current registration process for harvesting.

Involvement of the Water Resources Section, as the regulatory agent, will be minimal unless lack of compliance can be shown to cause water quality problems.

Three different approaches (disposal, short term and long term storage) are presented for "sawmill by-product" management. Disposal practices are meant to be used where "small volumes" are generated and it is unlikely that a market will exist for the material because of volume, distance to market, inaccessibility of site, etc. These are defined as the volumes that are generally associated with "portable" mill operations. The Water Resources Section believes that "small volumes" of sawmill by-products in isolated areas are unlikely to present a serious threat to ground and surface waters if handled in accordance with the "BMPs for small volume generators." These operations may temporarily store or permanently dispose of the materials on site, using the appropriate BMPs.

Large volume generators are predicted to have the potential to cause problems because of the increased volume of material stored on a particular site. For this reason, no BMP provisions are made for on-site disposal of large volumes of sawmill by-products. Such operations will require a permit from the Industrial Waste Unit of the Water Resources Section of the Division of Natural Resources. Short term storage and long term storage, however, can be addressed with BMPs. The major difference between the two will be the requirement for a liner and a cover of some sort for the long term, large volume storage. Any leachate must be adequately handled. This type of operation may require an National Pollutant Discharge Elimination system (NPDES) permit, but this determination will be made on a case by case basis.

SOURCES OF STATE, FEDERAL AND OTHER ASSISTANCE AND FUNDING

The following is a summary of programs relating to nonpoint source responsibilities in that they address nonpoint source pollution through activities such as assessment, demonstration, education, financial assistance, monitoring, research, regulation and/or assistance.

State Programs

West Virginia Division of Forestry – the West Virginia Division of Forestry administers several state and federally funded programs that relate to the Water Quality Program. They are: Rural Forestry Assistance; Flood Prevention (PL–534); Cooperative Watershed Programs (PL–566); Urban Forestry Program; Forestry Incentive Program; Agricultural Conservation Program, including a special (SP43) woodland roads practice, Focus Funding Grants Program, and Rural Community Fire Protection. This agency serves as the lead agency in administering the Forest Water Quality Program.

The approximate annual West Virginia Division of Forestry expenditure for the West Virginia Forest Water Quality Program exceeds $125,000.

A new cost–share practice administered through the USDA Agricultural Stabilization Conservation Service has proven extremely beneficial to the harvesting and forest roads portion of the Water Quality Program. This practice referred to as the forest roads practice (SP43) resulted in the expenditure of $58,000 for preplanned forest access and harvest roads this past year. Plans are to expand funding for this practice to $190,000 by 1990 and it should continue at this level for each of the succeeding program years.

West Virginia Department of Agriculture – Relative to pesticide use, the West Virginia Pesticide Use and Application Program regulates the sale and use of pesticides including forestry uses. The program operates under the authority of the Pesticide Act of 1961 and the Pesticide Use and Application Act of 1975. The program is administered by the West Virginia Department of Agriculture under a cooperative agreement with the US EPA. A comprehensive plan for applicator certification and inspection enforcement exists. The certification program is administered in cooperation with the West Virginia University Extension Service.

Flood Prevention and Small Watershed Program – The Flood Prevention and Small Watershed Programs operate under the authority of Public Law 83–566 and 534. The objective of the programs is to ensure the evaluation and consideration of all forests from a multiple–use standpoint to solve resource, environmental and socioeconomic problems in watersheds.

Policies are established to develop and implement watershed work plans that include those forest watershed management and forestry land treatment activities that contribute toward solving watershed problems such as erosion, flood water, and sediment, along with improving land use.

The USDA Soil Conservation Service administers the overall program with the USDA Forest Service providing planning for the forestry aspects.

Presently, two watersheds and one major flood prevention program are funded in West Virginia. Federal funds total $76,000 with West Virginia matching the funds at a 20% rate. The active watersheds are Howards Creek and Upper Mud River. The Flood Prevention Program is on the Potomac and is funded at $43,000 annually.

The Cranberry Whitestick Watershed was recently completed and will receive a field review in the near future. Funding has ended for this watershed.

Watershed proposals exist for the North River and the North Fork of the Hughes River and data is presently being collected for planning purposes on Reedy Creek and the Upper Little Kanawha.

Budgeting proposals of $35,000 have been submitted for the Lower Mud River for the 1990 fiscal year and three years thereafter.

West Virginia Division of Natural Resources (WVDNR) – Responsibility of the West Virginia Division of Natural Resources entails the wise use of our renewable natural resources, including game and fish, along with enforcement of conservation laws and informing and educating the public about the goals. It also includes natural resources related planning and research and water pollution control and abatement. The Water Resources Section is the head enforcement agency addressing overall water quality needs. These include the Permits, Solid Waste and Hazardous Waste/Ground Water, Monitoring and Planning, Construction Grants and Fields Operations.

West Virginia Forestry Association – This association comprises a membership of over 500 individuals, forest landowners, businesses, forest industries, companies and state and federal agency people generally representing the forestry community. This association encourages and promotes better forest land management, improved fire protection and suppression, true conservation, and utilization of West Virginia's woodland resources. Additionally, it has developed an educational program that arouses public support and awareness of a unified conservation program including the multiple use of forests, development of natural resources, application of sound land management, the development of our increasing wildlife and recreational values; and encourages the wise and economical use of the overall or total resource.

It has provided funding that relates to the Forest Water Quality Program for educational materials, workshops, and training. Through cooperative agreements, it also assists the Division of Forestry and Water Resources Section in conducting the Forest Water Quality Program.

State Tree Farm Program – The American Tree Farm System is conducted on the state level by state Tree Farm committees. It is a program of the American Forest Foundation, administered by the American Forest Council in Washington, D.C. Funding for the program comes from private donations and contributions from the forest products industry.

The current West Virginia Tree Farm program has over 750 members who manage over 1.7 million acres of West Virginia woodlands. The Tree Farm Committee provides funds for education materials and workshops. It has more recently provided funds through a productivity grant from the American Forest Council to support Forestry education. The state Tree Farm program is sponsored by the West Virginia Forestry Association.

West Virginia Cooperative Extension Service (WVCES) – The West Virginia Cooperative Extension Service (WVCES) facilitates the implementation of recommended agricultural and forestry practices that are derived from West Virginia University and other institutional research centers. This technology transfer is achieved through education and demonstration programs conducted at the local level. A variety of subjects related to nonpoint source pollution are offered including forest water quality educational activities along with pesticide applicator training and pesticide impact assessment conducted to monitor and evaluate the use of pesticides in West Virginia.

The extension forester and county agents provide leadership in establishing forestry demonstrations for the information and guidance of farmers, 4-H clubs, communities and other organizations. The Cooperative Extension Service is very helpful and instrumental in getting forestry projects underway. It also conducts tours of properties where soil, forest and game conservation measures are well established and which serve as excellent demonstrations. The Division of Forestry encourages and assists the extension forester and county agents in these activities.

West Virginia University – The West Virginia University is involved in research and teaching activities which pertain to nonpoint source pollution. The College of Agriculture and Forestry supports research and teaching related to nonpoint source pollution in several of its departments. The Division of Forestry has many research projects in progress relating to potential soil erosion from silviculture. The West Virginia University, Division of Forestry conducts research under the auspices of the West Virginia

Agricultural and Forestry Experiment Station at WVU. The Division also has a Cooperative Fish & Wildlife Research Unit that services WVDNR and other agencies in research projects including water quality.

Soil Conservation Districts (SCD) – West Virginia SCDs operate at the multi–county level, with the exception of the Capitol SCD of Kanawha County. Working through the Forestry Division, they assist with Forestry programs designed to reduce soil erosion and to control sediment. Conservation education and information activities also are a part of the SCD's. SCD personnel work through the Forestry Division with landowners in developing conservation plans tailored to the individual's forest needs. A supplemental memorandum of understanding between the Soil Conservation Districts and the Division of Forestry stipulates that the Division of Forestry can provide each district with technical services to fulfill its objectives and programs.

Planning and Development Councils – Regional Planning and Development Councils operate at a multi–county level, which are cooperative associations of counties and cities. The council of elected officials, through its professional staff, identifies and helps solve problems in the area through planning, coordination and seek funding sources for community projects.

Federal Programs

Agricultural Stabilization and Conservation Service (ASCS) – The ASCS provides cost–share assistance to agricultural and forest producers to install conservation practices through the Agricultural Conservation Program and the Forestry Incentive Program. The ASCS county committees, consisting of three elected farmers, set project priorities, review assistance applications and determine eligibility of individual land conservation practices for federal cost–sharing funds. ACP and FIP funds are allocated to all counties on an annual basis. Additional funds are available to counties with special projects such as the ongoing SP43 forest roads practice.

Several provisions of the Food Security Act of 1985 supports nonpoint source programs and regulations in which ASCS has a major administrative role. The principal program which can affect nonpoint source pollution under the Act is the Conservation Reserve Program, which provides assistance to farmers in retiring highly erodible cropland from production. As ASCS administers CRP, farmers agree to take their highly erodible fields out of crop production for ten years in order to participate in the program. In return, they receive annual rental payments from the federal government.

Farmers Home Administration (FmHA) – The FmHA administers several financial aid programs which can assist forest landowners and communities in implementing nonpoint source pollution abatement projects in rural areas and towns. FmHA provides financial assistance to individuals for housing and farm–forestry assistance. Funds can be utilized for pollution abatement practices and farm–forestry conservation implementation.

Soil Conservation Service (SCS) – The mission of the SCS includes soil and water conservation, natural resource surveys and community resource protection and development. SCS staff located in each of West Virginia's counties provide technical assistance to individuals, organizations and communities. Resource Conservation and Development (RC&D) Programs are administered by SCS in several multiple county areas in West Virginia. The purpose of these RC&D's is to enhance the quality of the environment and improve the economy of the area through the conservation and development of the area resources. The SCS conducts a River Basin program. The SCS also conducts the Rural Abandoned Mined Land Program which provides assistance for reclaiming land disturbed by past coal mining. All Forestry related activities are coordinated through interagency cooperative agreements with the West Virginia Division of Forestry. Farm plans prepared by the technicians of the Soil Conservation Service for cooperators are regarded as basic and essential for the State Division of Forestry's Forest Management Program. Many of the plans designate steep, eroded areas to be planted, areas that will restock naturally with trees when protected against grazing, and areas where cover and food will be provided for wildlife. Many farmers desirous of managing areas suitable for forestry and game management are referred by the Soil Conservation Service to the Division of Forestry and whenever called upon, a service forester assists the

SCS work unit leader to develop the forestry phase of the farm plan.

United States Department of Agriculture Forest Service – The state and private forestry unit assists the West Virginia Division of Forestry by partially financing and enhancing its ability to provide forestry service to the public.

The Division of Forestry cooperates with the United States Forest Service under the provisions of the Cooperative Forest Management Act in its program aimed at aiding landowners with their forestry problems and wood operators with solutions to their wood utilization problems, and under the provisions of the Clark–McNary Act in the distribution of forest planting stock.

U.S. Forest Service policies concerning the cooperative woodland management program and the cooperative production and distribution of forest tree planting stock are set forth fully in the Forest Service's "Cooperative Forest Management Manual." The administrative procedures for the Cooperative Forest Management Act of 1950 are also covered by another U.S. Forest Service manual issued on January 1, 1951. The Division of Forestry is in complete accord with these policies and procedures and administers said programs in strict conformity with the mentioned statements.

PROPOSED BUDGETS

The West Virginia Division of Forestry looks upon the silviculture (NPS) Water Quality Program as part of its regular duty as financed from the State of West Virginia general fund. In this regard, the Division plans to discharge its responsibilities in a thoroughly professional and totally accountable way as its mandated contribution towards insuring that forestry and a quality environment, the twin bases of West Virginia's future economy, are assured for future generations. The West Virginia forest industry has committed to the plan as a part of doing business in the state and cooperating fully through the West Virginia Forestry Association.

In certain particulars, however, a much better job could be assured if the following funds were to be made available either directly to the West Virginia Division of Forestry or as pass-through grants to the Division from the Water Resources Section of the Divisio of Natural Resources. These will equal no more than about 25 percent of program costs.

U.S. Fiscal Year 1989-90

1. Publication of Quadrennial Silviculture Water Quality Plan 1989-1993. 500 copies @$4.00/copy = $2,000

2. 10 training leaflets. (2,000 copies each) @.10/copy = $2,000

3. Video camera and associated equipment and supplies for training loggers and landowners in the proper use of BMPs = $3,000

4. Coordinator for Information-Education activities with civic clubs, churches and youth organizations. 1 person = $18,000

5. Training/retraining of all Forestry field personnel in water sampling techniques:
   Forestry - 60 days @$100/day = $6,000
   Water - 5 days @$100/day = $500

6. Publication of technical paper on 1987 fall forest fire season 5,000 copies @$1.00/copy = $5,000

7. Rental of three conservation officers to work fire prevention and investigation in 10 county, 3-year demonstration to stop fires and consequently erosion: Salaries $25,000
   Expenses $ 7,000
   $32,000 x 3 = $96,000

8. Final preparation of slide-tape show on fire damages = $6,000

Total 1989-90 Fiscal Year Request = $138,500

U.S. Fiscal Year 1990-1991

1. Publication of biennial assessment of BMP implementation effectiveness (compliance report) 500 copies @$3.00/copy = $1,500

2. Continuation of 10 county, 3-year forest fire prevention and investigation program to stop fires and consequently erosion = $96,000

3. Information-Education coordinator = $18,000

4. Training supplies for workshops = $2,500

Total 1990-1991 Fiscal Year Request = $118,000

U.S. Fiscal Year 1991–1992

1. Publication costs for 2,000 copies each of 10 training leaflets. @$.12/copy = $2,400

2. Video camera supplies = $500

3. Information–Education coordinator = $18,000

4. Continuation of 10 county, 3–year forest fire prevention and investigation program = $96,000

5. Training supplies for workshops = $600

Total 1991–1992 Fiscal Year Request = $117,500

U.S. Fiscal Year 1992–1993

1. Publication of technical paper on 10–county forest fire and erosion control demonstration. 1,000 copies @$5.00/copy = $5,000

2. Publication of quadrennial silviculture water quality plan for 1992–1996. 500 copies @$5.00/copy = $2,500

3. Publication of biennial assessment of the effectiveness of BMP implementation (compliance report). 500 copies @$3.00/copy – $1,500

4. Information–Education coordinator = $18,000

5. Training/retraining forestry personnel in water sampling techniques.

Forestry – 40 days @$110/day = $4,400
Water (instructor) 4 days @$110/day = $440

Total 1992–1993 Fiscal Year Request = $31,880

Total Request by West Virginia Division of Forestry for Grants 1989–1993 = $405,880

Sources of Funding

West Virginia Division of Forestry – general revenue as provided by legislative action.

West Virginia Department of Agriculture – general and special revenue as provided by legislative action.

West Virginia Forestry Association – provided by the Board of Directors.
State Tree Farm Committee – provided through special productivity grants through the American Forest Council.

USDA Agricultural Stabilization Conservation Service – funding requests for special woodland roads practice (SP43). Projected needs at $190,000/year over the next four years.

USDA Soil Conservation Service – funds primarily through public law 83–566 and 83–534 for watershed and flood control planning and technical assistance. Also resource conservation and development funds through the six RC&D areas for planning and technical assistance.

USDA Forest Service – funds provided through rural forestry assistance, utilization and marketing, urban forestry, focus funding and rural community fire protection.

West Virginia University Extension Service – provide funding for educational materials and promotion of the various related programs.

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APPENDICES

Law

Specific reference to the powers and duties of the Chief of the Water Resources Section of the Division of Natural Resources and of the Water Resources Board may be found in the State Water Pollution Control Act, Chapter 20, Article 5A of the West Virginia Code. Section 3 of this Article gives the CHief "general supervision over the administration and enforcement of the provisions of this article, and all rules, regulations, permits and orders issued pursuant tot he provisions of this article." both Sections 3 and 3a give the Water Resources Board the power and duty to "promulgate rules and regulations setting standards of water quality." Civil and criminal penalties may be found in Chapter 20, Article 5A, Sections 17 and 19.

Regulations

Of the rules and regulations promulgated by the Water Resources Board, the most important to the operation of the nonpoint source program has been as follows:

Emergency
Water Resources Board
Legislative Rules, Ch20-5 & Ch20-5A
Series I

Section 8 Specific Water Quality Criteria

8.29 Turbidity

No point or nonpoint source to West Virginia's waters shall contribute a net load of suspended matter such that the turbidity exceeds ten NUT's over background turbidity when background is fifty NUT's or less, or have more than a ten percent increase in turbidity (plus ten NUT minimum) when the background turbidity is more than fifty NUT's.

This limitation shall apply to all earth disturbance activities and shall be determined by measuring stream quality directly above and below the area where drainage from such activity enters the affected stream. Any earth disturbance activity continuously or intermittently carried on by the same or associated persons on the same stream or tributary segment shall be allowed a single net loading increase.

8.29.1

This rule shall not apply to those activities at which Best Management Practices in accordance with the State's adopted 208 Water Quality Management Plan are being utilized, maintained and completed on a site specific basis as determined by the appropriate 208 cooperative or an approved Federal or State Surface Mining Permit is in effect. This exemption shall not apply to trout waters.

Section 3. Conditions Not Allowable in State Waters

3.1 Certain characteristics of sewage, industrial wastes and other wastes cause pollution and are objectionable in all waters of the State. Therefore, the State Water Resources Board does hereby proclaim that the following general conditions are no to be allowed in any of the waters of the State.

3.2 No sewage, industrial wastes or other wastes present in any of the waters of the State shall cause therein or materially contribute to any of the following conditions thereof.

3.2.a Distinctly visible floating or settleable solids, suspended solids, scum, foam or oily slicks.

3.2.b Deposits or sludge banks on the bottom.

3.2.c Odors in the vicinity of the waters.

3.2.d Taste or odor that would adversely affect the designated uses of the affected waters.

3.2.e Materials in concentrations which are harmful, hazardous or toxic to man, animal or aquatic life.

3.2.f Distinctly visible color.

3.2.g Concentrations of bacteria which may impair or interfere with the designated uses of the affected waters.

3.2.h Requiring an unreasonable degree of treatment for the production of potable water by modern water treatment processes as commonly employed.

3.2.i Any other condition, including radiological exposure, which alters the chemical, physical or biological integrity of the waters of the State.

INTERAGENCY POLICY GUIDANCE DOCUMENT

Department of Natural Resources - Division of Water Resources
Department of Agriculture - Forestry Division

In the spirit of maintaining cooperative relationships and reconfirming joint guidance policies this document is hereby adopted by the two agencies noted above.

1. Registration of logging operations is accepted as a major educational mechanism with which to promote compliance with the nonpoint source Best Management Practices recommended for logging projects.

2. The registration form (copy attached) developed by joint agreement on August 1, 1984, is accepted by the Division of Water Resources as one vehicle by which compliance with the State's adopted 208 Water Quality management Plan is determined, if the pertinent practices included on the form are installed and maintained. Other vehicles used to determine compliance are the Quarterly Complaint Tracking Report and the periodic 208 Logger Performance Surveys (1982 and 1986).

3. Registration and satisfactory implementation of the pertinent practices included on the form will be indicative of a good faith effort on the part of the logger. The first investigation of a complaint, on a registered operation, therefore, shall involve identification of the problem, followed by a suggested remedial training program and suggestions on action needed to correct the problem. If, after investigation, recommendations are made by Division of Water Resources and Forestry division personnel, remedial action to correct deficiencies is not performed by the operators within a reasonable time period, enforcement action shall be pursued.

4. If, upon investigation of a water pollution complaint from a logging operation, it is determined that the operation is not registered, or if registered, it is apparent they are not in compliance with the proposed best management practices, the Division of Water Resources inspector may immediately initiate enforcement procedures providing that water pollution is occurring or if substantial evidence of adverse water quality impacts can be obtained.

5. Streams shall not be used for skid roads nor shall haul roads be constructed in streams by the operator. Such use or construction, if causing a water quality problem, shall constitute an immediate cause for enforcement action.

To insure closer cooperation between field personnel, the following complaint response procedure will be established by each respective District Office:

1. All registrations will be tabulated in the Forestry Division District Office and be available for reference regarding individual operators being registered upon request by Division of Water Resources

personnel. A copy of all registrations will also be sent to the Forestry Division office at Guthrie.

2. When complaints are received by either agency, whether at the District or Division headquarters level, the appropriate District level representative of the other organization shall be notified.

3. If at all possible a joint investigation will be made.

4. If a joint review is not possible, the results of either agency's inspection will be transmitted to the other.

5. All reports of logging complaints, registrations, enforcement action, investigations and follow-up investigations will be transmitted to the Headquarters Office of the Forestry Division at Guthrie for incorporation into the "Complaint Tracking System."

6. Forestry Division personnel who have received water quality training from the Division of Water Resources are authorized to collect evidence and water samples from logging operations if a Division of Water Resources inspector is not available and if water pollution is occurring. Such evidence and samples shall be used by the Division of Water Resources inspector as support for, but not in place of, evidence of a water quality violation.

7. Both parties shall participate in the educational programs, especially logging road workshops, and shall promote such education endeavors with all possible owners of forest lands as well as the Forest Industry in general.

Both agencies, by signature, agree to the guidance as herein described.

William H. Gillespie
Director
Forestry Division

May 12, 1987
Date

D.W. Robinson
Chief
Division of Water Resources

May 18, 1987
Date

Appendix 2a

POLICY REVISION OF DECEMBER 20, 1989

A new complaint/investigation policy has been agreed upon between the Water Resources section of the Division of Natural Resources and the Division of Forestry which more exactly follows the original intent of the registration policy guidance document. Major procedures are as follows:

1. The district forester will provide to the district Water Resources supervisor or district secretary by 2:00 p.m. every Friday a list of new registrations received during the week. The list will include the name of logger and/or logging company and location of logging site (stream, nearest post office, highway, etc. as described on the registration form.

2. Upon receiving a logging complaint, the Water Resources inspector or district supervisor will check this list kept in the district office to determine if the site is registered.

Registered - If the site is registered, the Water Resources inspector or district Water Resources supervisor will contact the appropriate forester and provide the complaint information.

3. The Division of Forestry forester will initiate the investigation to determine its validity and/or provide the necessary corrective advice and guidance.

4. The Division of Forestry forester will establish a reasonable length of time for implementation of the corrective actions and document such on the complaint/investigation form.

5. The Division of Forestry forester will initiate a follow-up visit on or near the established deadline to determine if corrective actions have been completed.

6. If corrective actions have not been completed satisfactorily, the appropriate Water Resources inspector or district supervisor is to be contacted.

7. The Water Resources inspector and Division of Forestry forester will attempt to coordinate, if possible, a site visit for possible legal action.

Nonregistered

8. If the Water Resources inspector, upon checking with his district supervisor, finds the site in question is not registered, the inspector will attempt to contact the appropriate Division of Forestry forester to schedule a joint inspection. During the inspection, the Water Resources inspector will initiate, at his/her discretion, enforcement action if judged appropriate.

General

9. The Division of Forestry forester and/or Water Resources inspector will provide the logger with a supply of registration forms and water quality information recommending that he (the logger) initiate registration and the use of BMPs.

10. The Division of Forestry forester will continue to use the compliant/investigation forms and follow previously established reporting procedures.

11. A copy of any enforcement action will be provided to the Division of Forestry forester.

Agreement between the
WV Department of Agriculture, Division of Forestry
and the
WV Department of Natural Resources, Division of Water Resources

This agreement by and between the Department of Agriculture-Division of Forestry, (herein-after referred to as DOF) and the Department of Natural Resources-Division of Water Resources (herein-after referred to as DWR), both governmental entities of the State of West Virginia is entered into upon this 9th day of August 1985, for the purpose of establishing and/or strengthening cooperative involvement in matters relating to each agency's area of responsibility, particularly in regard to maintaining and improving the water quality of West Virginia's streams and rivers.

Recognizing the value of the natural resources of the State of West Virginia and the positive effects that the utilization of these resources have on the social and economic well-being of the state's citizens and further recognizing the need for effective management and protection of the state's natural resources and in particular its timber and water resources, the parties do hereby agree that cooperative and coordinative efforts will be employed to maximize the use and protection of the environment in all instances in which each agency actions affection, or have the potential to affects, the integrity of the state's fish and wildlife populations and other habitats relating to water resources, and the integrity of the state's public, recreational, and historic resources.

WHEREAS, the Environmental Protection Agency, created by the Congress of the United States of America, has been charged under Public Law 92-500, as amended (Clean Water Act) with the responsibility of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters; and

WHEREAS, pursuant to Public Law 92-500, as amended (Clean Water Act), the said Environmental Protection Agency, (hereinafter referred to as EPA) has directed to the DWR, to carry on a continuing planning process to define, assess and manage pollution entering the state's waters from "nonpoint sources" and to maintain Best Management Practice Manuals, (hereinafter referred to as BMPs) to control or halt such pollution; and

WHEREAS, the DWR is designated as the water pollution control agency for this state for all purposes of federal and state legislation and is authorized to take all action necessary or appropriate to secure to this state the benefits of said legislation; and

WHEREAS, the Water Resource Board, a public corporation, has promulgated rules and regulations setting standards of water quality applicable to the waters of this state; and

WHEREAS, the DOF in coordination with the DWR has prepared and the EPA has approved a "Silviculture Water Quality Management Plan," to control or eliminate pollutants arising from forestry practices from the waters of the state; and

WHEREAS, the DOF is the agency responsible for the protection of nonfederal, privately-owned land from damage by wildfire, destructive grazing, insects and disease, and promotion of the state's timber resources and pursuant to its normal activities, has been involved in promoting the Silviculture Water Quality Management Program within the forest industry for some time; and

WHEREAS, it is in the interest of both agencies to effectively coordinate their respective activities as they pertain to water pollution control.

Now, therefore, based upon the above considerations and in order to maintain effective coordination between the parties involved in the implementation of the program, the following authorities and responsibilities are hereby agreed to by the agencies:

THE DOF AGREES TO:

1. Provide the services of DOF personnel in taking stream samples, collecting evidence, and making observations for the purpose of checking logging operations for stream pollution.
2. Participate in efforts, including testifying at court hearings, directed against logging operations failing to comply with laws and regulations governing the protection of the state's waters.
3. Advise, as soon as possible, DWR district supervisors of sampling and investigative activities.
4. Work cooperatively with inspectors of the DWR in areas where authorities and responsibilities overlap.
5. Provide and keep current a listing of DOF personnel.
6. Maintain close coordination with DWR when unforeseen emergencies threaten or have the potential to threaten the quality of the state's waters.
7. Provide technical assistance to landowners and operators upon request for the purpose of planning logging operations for sediment control.
8. Promote and solicit the use of the registration process within the timber industry for the purpose of providing technical assistance to the operators and documentation of compliance by the industry with the program.

THE DWR AGREES TO:

1. Provide training of DOF personnel in inspection procedures, techniques of water sampling and evidence collection for turbidity (sediment), debris, waste, oil and other pollutants arising from logging operations.
2. Provide to the DOF and keep current a listing of DWR personnel.
3. Provide the list of Trout Waters from Section 7.71 (Chapter 1, Series I West Virginia Administrative Regulations (State Water Resources Board).
4. Assist DOF personnel, as required, in inspecting logging areas to detect violations of state laws and regulations and providing technical assistance to persons performing logging operations as related to water quality.
5. Provide funds or needed materials, if and when available, to help defray the cost of DOF participation.
6. Initiate enforcement action, including the signing of warrants, based upon evidence collected by DOF personnel who have received the aforementioned training by DWR.
7. Analyze water samples.

BOTH DOF AND DWR AGREE TO:

1. To work cooperatively to carry out concurrent duties while improving and/or maintaining the quality of the environment.
2. To work cooperatively to implement the Silviculture 208 Water Quality Management Plan.

This agreement will remain in effect until amended or terminated by either party upon thirty (30) days notice in writing to the other party of his intention to terminate upon a date indicated.

Director, DNR

Date 7/31/85

Commissioner, DOA

Date 8/9/85

D. W. Robinson, Chief
Division of Water Resources

Date 7/31/85

William H. Gillespie, Director
Division of Forestry

Date 8/9/85

REVISED
MEMORANDUM OF UNDERSTANDING
WEST VIRGINIA NONPOINT SOURCE POLLUTION CONTROL PROGRAM
FORESTRY ACTIVITIES
between
WEST VIRGINIA DIVISION OF NATURAL RESOURCES
and the
WEST VIRGINIA DIVISION OF FORESTRY

Whereas, the West Virginia Division of Natural Resources has been designated by the Governor as the State lead agency for water quality management and protection and:

Whereas, the West Virginia Division of Forestry is designated by State law as the agency responsible for the management and protection of the state's timber resources:

Therefore, to prevent duplication of effort the following responsibilities are established as they relate to nonpoint pollution control and related water quality improvement.

The West Virginia Division of Forestry will:

1. Be the State designated management agency for the nonpoint pollution control program for the forestry category, including those subcategories for which a need has been demonstrated, and maintain that management role in the individual program development and implementation efforts.

2. Develop budget needs for planning and implementation of the forestry program for funding.

3. Implement a reporting system which will be compatible with the needs of the Division of Forestry in terms of their involvement in the program as well as to the federal requirements with which the Division of Natural Resources must comply.

4. Through its statutory authorities and responsibilities promote compliance with water quality concerns for the protection and improvement of the water resources of the State from the impact of forestry activities.

The West Virginia Division of Natural Resources will:

1. Provide guidance and coordination to insure that the overall nonpoint source management program requirements are being achieved by the designated management agency.

2. Provide enforcement support, water quality monitoring and training to forestry personnel where applicable.

The Division of Natural Resources and the Division of Forestry will:

1. Work cooperatively to prepare best management practices for the forestry program, including those subcategories for which a need has been demonstrated.

2. Meet the U.S. Environmental Protection Agency, the U.S. Forest Service and any other federal or state agency which may have involvement to discuss program needs, directions and project accomplishments.

3. Investigate funding alternatives, both federal and state, which may be used to implement the forestry program.

This agreement is valid until such time as either party sees fit to revise, amend or otherwise modify, provided such revision, amendment or modification is mutually agreeable to both parties.

This agreement may be terminated by either party provided the withdrawing party gives at least 180 days notice, in writing, to the other party of its intention to terminate.

William H. Gillespie — 10/11/89

Administrator
West Virginia Division of Forestry

Date

J. Edward Hamrick Jr. — 11/6/89

Administrator
West Virginia Division of
Natural Resources

Date

INTRODUCTION

This report is the second in a series of evaluations to measure the level of adoption of silviculture "Best Management Practices" by individuals and companies engaged in timber harvesting in West Virginia. The first evaluation was conducted in 1981 and the second in 1986.

The practices evaluated included the use of waterbars, culverts, proper road layout, and good road construction methods on the logging operation. The evaluation was conducted as one segment of the "WEST VIRGINIA SILVICULTURE WATER QUALITY MANAGEMENT PLAN" developed as a result of the Federal Clean Water Act.

This evaluation was proposed by the Voluntary Compliance Committee at its regular quarterly meeting in July of 1985. The Voluntary Compliance Committee is the guiding organization of West Virginia's silvicultural water quality plan and is composed of members from the timber industry, West Virginia University, and the Forestry Division. Special assistance in developing the evaluation procedure and statistical accuracy of the evaluation was provided by William Kidd and Dr. David Yandle of West Virginia University and Edward Murriner, Robert Whipkey and Jeffrey Mills of the Forestry Division.

The goals of this evaluation were to document changes in the level of adoption of "Best Management Practices" (BMPs) since the 1981 evaluation and to determine BMPs which should be stressed in future educational or technical service activities.

The method used to determine the present status of BMP adoption was based on drawing a random sample from a list of all known loggers operating in West Virginia, stratifying the sample into three geographic regions and two production size classes. This resulted in a sample of 106 loggers from the 350 known loggers operating in the state. A checklist and procedures for checking the use of prescribed BMPs was developed to enable foresters to conduct the evaluation in a precise manner. Forestry Division foresters were trained for the check during three training meetings held in August of 1986 to insure uniform checking procedures would be used throughout the state. The check took place between August and November 1986. After the check was completed, the data was compiled and analyzed using Forestry Division microcomputers and a spreadsheet software package.

DIFFERENCES BETWEEN THE 1981 AND 1986 CHECKLISTS

Background

In 1985, it became apparent that a second "in the field" evaluation of overall 208 Water Quality Logger Performance was needed. The Voluntary Compliance Committee members felt they had one of two options concerning another evaluation.

1. Use the 1981 evaluation form and follow the same procedure or;

2. Design a new evaluation that would overcome apparent measurement and interpretation problems resulting from the 1981 checklist.

An analysis of the 1981 checklist revealed the following problems and complaints from foresters using it who did not feel comfortable with the questioning format and design.

1. The questions did not adequately measure BMP use and/or logger intent.

2. The questions needed to be more analytical in design using fully described formulas and descriptions of exact measurement techniques.

3. Many foresters felt any checklist based strictly on measurements of BMP use against a standard would be inadequate because it eliminated judgmental factors concerning need. Rather than listing general comments, foresters felt they should be able to numerically rate each BMP question according to practical need, not just a standard.

The Voluntary Compliance Committee decided, based mainly on the above information, that a new checklist should be devised. Although a chance to compare progress or the lack thereof would possibly be lost by using a new checklist, much more would be gained if a more accurate measurement of BMP compliance were obtained.

Checklist Changes

The first major changes involved altering the questions to allow a better reflection of compliance to the BMP standards as applied by the logger.

Example: Question 1 involved measurements on truck haul roads. In the 1981 checklist all haul roads used by the logger were measured for compliance. However, the 1986 checklist eliminated measurements on any haul roads not built by or totally under the control of the logger. The checklist committee felt any BMP measurements taken on such roads could be misleading concerning logger intent for using or not using BMPs.

Question 2 of the checklist dealt with the use of culverts or bridges across live streams. The checklist committee interpreted the BMP standards to say that culverts are required anytime indicated or existing running water channels across a road. Therefore, the question and directions for answering this question were changed to reflect this need. The 1981 checklist did not consider the need for culverts or bridges unless water was present at the time of the check.

Question 3 dealt with the proximity of haul roads to streams. In the 1981 checklist, foresters were confused as to minimum distances between streams and haul roads when the stream was above the filterstrip area (area draining less than 100 acres) and when the stream was within the filterstrip area. These questions were separated and definite parameters were established for dealing with both cases.

Question 5 dealt with the use of stone at road entrances. The BMP standards state that haul roads must have gravel or other aggregate for about 200 feet when such haul road enters a paved, or macadam type highway. The 1981 checklist measured this BMP on the basis of how clean the highway was at the time of the check. Therefore, this question was changed to better reflect compliance with the BMP standard.

The second major change involved the use of formulas to calculate percentage (%) compliance. In the 1986 checklist, each question was followed by a written formula to be used by the forester to make his calculations. Again, formulas were devised to better reflect compliance to the BMP standards.

Example: Question 3 on the 1981 checklist stated that compliance for the (25' minimum distance from road to stream BMP) could be determined by measuring linear distance of road meeting BMP standards. However, the checklist committee determined a more realistic approach would be to measure the amount of stream violated by the 25' limitation in relation to the total amount of stream involved. A formula was devised indicating the specific measurements for this calculation.

The third major change on the checklist involved the addition of a comments area after each question. Using this format, the forester could note his comments for each BMP being checked. In this section, the forester was to use his professional judgement to numerically rate the BMP installations or the need for installations.

The checklist committees' intent was to allow for professional judgement and to later compare the judgement rating with the BMP standards rating.

The fourth change involved the checklist supplement which was also used in the 1981 survey. One addition to the 1986 checklist supplement was made for the purpose of evaluating effectiveness of the 208 Logger Educational Program. The second addition was made to evaluate the effectiveness of BMP installations and the adequacy of our BMP standards to do the job of keeping mud from the stream. The last question on the checklist supplement was added to determine the % of loggers currently registered.

In addition to these changes, three new questions were added to the 1986 checklist and two questions used in 1981 were broken into parts to more specifically rate a particular BMP standard.

Because comments express opinions and indicate aspects of BMPs which could not be quantified or were not given consideration in the checklist questions, they are a very important part of this evaluation and report. Room was provided on the checklist form itself and the supplemental sheet for the checking forester to comment on individual BMPs and the total harvesting operation. These comments are included in the comments section beginning on Page 14 and are arranged in the order of the BMPs as listed on the checklist. Some comments dealing with the appropriateness of a particular BMP as it is now written in the Silvicultural Water Quality Plan are not listed in the appendix, but will be presented to the Voluntary compliance committee who will use them to determine if the BMP should be changed.

The last portion of this report exhibits the forms used to accomplish the checking of BMPs by the foresters.

EVALUATION RESULTS

The evaluation of 16 best management practices from both the 1986 and 1981 studies is listed in Table #1. Blank spaces under either year for a particular question indicates the question was changed significantly or eliminated. In most cases, due to the addition of numerical formulas for measurement purposes in the 1986 evaluation straight comparisons between the 1986 and 1981 percentages of use are impossible. (Refer to difference between 1981 and 1986 checklists). The questions evaluated by the division foresters are based on 16 BMPs derived from the West Virginia 208 Silviculture BMP Manual "Guidelines for Controlling Soil Erosion and Water Pollution on Logging Operations in West Virginia." This evaluation deals with the use of BMPs as they are presently written and is not necessarily an indication of water quality. It is not intended as a grading of loggers compliance with 208. It is an indication of the use of designated BMPs during the periods when the checking was done. No attempt has been made to relate cost of individual BMP installation to their adoption. The BMP designators used below and in other tables correspond to questions on the checklists used on logging sites.

TABLE 1

EVALUATION RESULTS

BMP Designator	BMP Description	Percentage of use by Loggers Statewide		
		Measured 1986	Forester's Judgement 1986	Measured 1981
TR1	Haul Road Grade	79	82	86
TR2	Haul Road Stream Crossing	66	75.6	47
TR3	Haul Road Distance from Stream	93	92.5	93
TR4	Haul Road Cross Drainage	49	56.7	49
TR5	Haul Road Entrance Stone	58	76.7	84
TR6	Haul Road Maintenance	-	78.3	58
TR6-A	Haul Road Culverts Clear	85	90.6	-
TR6-B	Haul Road Ditches Clear	77	80.4	-
TR6-C	Haul Road Berms Removed	63	66.4	-
TR6-D	Haul Road Surface Smoothed	83	80.3	-
TR6-E	Haul Road Dips Open	90	85.9	-
SR1	Skid Road Grade	75	79.1	69
SR2	Skid Road Cross Drainage	49	54	38
SR3	Skid Road Distance From Stream	85	85	92

TABLE 1 (continued)

SR4	Retired Skid Roads Waterbarred	52	57	38
SR5	Skid Roads Seeded or Slash Covered	29	43.4	36
SR6-A	Skid Roads Smoothed	73	72.6	-
SR6-B	Skid Road Berms Removed	57	60	-
SR6-C	Skid Roads Outsloped	55	57.8	-
F1	Filterstrip Width	85	79.2	71
F2	Filterstrip Protection	-	-	76
L1	Landing Not In Filterstrip	76	78.3	-
L2	Landing Distance From Stream	79	79.6	86
L3	Landing Drained	82	76	75
L4	Landing Diversion of Water	74	75.1	56
L5-A	Retired Landing Smoothed	85	81.3	-
L5-B	Retired Landing Drained	93	78.5	-
L5-C	Retired Landing Seeded	39	46.8	-

Based on the evaluation results and considerable interpretation by the checklist committee who devised the numerical formulas for the 1986 checklist, BMPs which have shown a substantial increase in usage by loggers are:

1. Installing bridges or culverts where the haul road crossed a stream.

2. Maintaining the haul road.

3. Installing waterbars on retired skid roads.

4. Diverting water from the landing.

BMPs which have the lowest usage by loggers are:

1. Seeding to grass or dispersing slash on retired skid roads.

2. Active skid road cross drainage.

3. Haul road cross drainage.

NARRATIVE SUMMARY

The 1986 checklist permitted inspecting foresters to assign a percent rating to each BMP according to their judgment of what they saw. The purpose of this judgment rating was to permit a comparison between the numerically derived (formula) rating and the foresters feeling for what was observed and what was felt to be logger intent. In most cases, the judgement rating compared very favorably with the formula rating. It should be noted that in 17 of the 26 BMP description categories the forester's judgement rating was higher than the numerical (formula) rating.

Several of the comments by the inspecting foresters as well as quotes from the loggers indicated the widespread belief that seeding of skid roads is not necessary. Although, in many cases it is true that the skid roads do not need seeded to grass in order to prevent erosion or protect water quality, seeding roads, especially critical areas, highly visible haul roads and all landings is a good public relations action for the logger. This is the one BMP which scored the lowest in usage on both evaluations and is one which should be stressed in future educational efforts.

Another area which needs to be stressed in future educational programs is the use of cross drainage on skid roads while they are still active. This can often be done without installing waterbars, but instead by using grade changes and natural grade breaks to allow the water to drain from the skid roads and into the leaf litter on the forest floor which will remove the sediment from the water before it reaches the streambed.

The spreading of stone on the first 200 feet or so of the haul road before it enters the paved highway also needs to be stressed in our future educational programs. This is meant to eliminate mud from paved roads as much as keeping mud from the streams and will also do much to improve the public image of loggers in the state.

NARRATIVE SUMMARY OF EVALUATION RESULTS

Haul and Truck Roads

TR1 Final centerline grade is within specifications on 79% of the road length. Although this numerically signifies a decrease from 86% in 1981; in reality it is due to a more strict standard in measurement which more accurately measures BMP intent.

TR2 Streams whether live or not were crossed properly 66% of the time. Due to the much more strict measurement standard this indicates substantial improvement over the 1981 check.

TR3 This question pertains to haul road distance from streams when above the 100 acre drainage limitation. Ninety-three percent of the streams involved had an adequate filterstrip. Although both the 1981 and 1986 checks numerically rated 93%, no comparison can be made due to drastically differing measurement standards.

TR4 Adequate cross drainage in the form of culverts, dips, and/or pole waterbars were provided 49% of the time. Once again no comparison to the 1981 check can be made due to differing measurement standards.

TR5 Adequate stone was provided, where log trucks enter the highway, 58% of the time. The 1986 measurement standard was much more strict than the 1981 standard, therefore, comparison is impossible.

TR6 In the 1986 check haul road maintenance was broken into 4 parts. In the 1981 check haul road maintenance lumped ditching, culverts, berms, dips and grading together. The average for the haul road maintenance measurements was 80% in the 1986 check.

TR6-A Eighty-five percent of the haul road culverts were clear and functioning.

TR6-B Seventy-seven percent of the haul road ditches were clear and functioning.

TR6-C Sixty-three percent of the haul road berms were removed when feasible.

TR6-D Eighty-three percent of the haul road surface was smoothed adequately.

TR6-E Ninety percent of the haul road dips were open and functioning.

Skid Roads and Trails

SR1 Skid road measurements were made on all roads within 500' of landings and within 100' of streams. Measurement techniques were similar to the 1981 check. The 1986 check revealed that grade standards were met on 75% of the roads measured as compared to 69% in the 1981 check.

SR2 Cross drainage is provided on temporarily retired skid roads 49% of the time based on need. This question cannot be compared with the 1981 check because it pertained to active roads.

SR3 This question pertains to skid road distance from streams when above the 100 acre drainage limitation. Eighty-five percent of the streams involved had an adequate filterstrip. Measurement standards for this BMP differed greatly between the 1986 and 1981 surveys. Therefore, no comparison can be made.

SR4 An adequate number of waterbars on skid roads existed 52% of the time. The 1981 check showed that 38% of the skid roads measured were adequately barred.

SR5 Only 29% of the skid roads needing seed were actually seeded according to the 1986 check. Areas considered to require seed were skid roads over 10% grade and up to 100' from landings. The 1981 survey required all skid roads be seeded and 36% of the skid roads were adequate.

SR6-A Seventy-three percent of the retired skid roads were adequately smoothed.

SR6-B Fifty-seven percent of the retired skid roads had berms removed.

SR6-C Fifty-five percent of the retired skid roads were outsloped.

Filterstrips

F1 Filterstrips were in compliance with the BMP standards for areas draining 100 acres and more 85% of the time. The 1981 survey showed 71% compliance, however, once again a different measurement standard was used.

F2 This question pertaining to filterstrip protection was considered redundant, therefore, it was not used in the 1986 check.

Landings

L1 Seventy-six percent of the landings were in compliance with the BMP standards for filterstrip protection. The 1981 check did not measure this standard.

L2 Seventy-nine percent of the landings were located 25' or more from the streams. The 1986 measurement considered only landings on streams draining 99 acres or less. The 1981 check considered all landings which does not correspond with the BMP standard as written.

L3 Eight-two percent of the landings inspected had adequate drainage. The 1981 check revealed 75% of the landings were adequately drained.

L4 Seventy-four percent of the approach roads and seep areas on landings had adequate drainage. The 1981 check revealed that 55% of the landings had adequate diversions for approach roads and seeps.

L5-A Eighty-five percent of the retired landings inspected had been smoothed adequately. The 1981 survey did not measure this standard.

L5-B Ninety-three percent of the retired landings were adequately drained. The 1981 survey did not measure this standard.

L5-C Thirty-nine percent of the retired landings measured were seeded. The 1981 survey did not measure this standard.

ADDITIONAL DATA

Statewide, the following averages were found:

Average haul road distance in feet/logging operation was 2,510 linear feet. This figures relates only to roads built by and under the control of the logging contractor. Therefore, it does not include all haul roads utilized by the loggers to remove timber.

Average crew size - 4.1 men/crew
Average crew size large logger (1MMBF + prod./yr.) - 4.4 men/crew
Average crew size small logger (Less than 1MMBF prod./yr.) - 3.7 men/crew
Average total size of operation or unit - 254 acres
Average total size of operation large logger (1MMBF + prod./yr.) - 282 acres
Average total size of operation small logger (Less than 1MMBF prod./yr.) - 226 acres
Average duration of logging operation (loggers estimate) - 4.8 months
Average duration of logging operation large logger (1MMBF + prod./yr.) - 5 months
Average duration of logging operation small logger (Less than 1MMBF prod./yr.) - 4.6 months
Total number of loggers operating in West Virginia - 350 (listing as of September 1986)
Number of persons logging in West Virginia as of September 1986 - 1435 people
Average number of operations per year in West Virginia - 875 log jobs
Average operations per logger per year - 2.6 jobs/yr.
Miles of haul road/yr. built in West Virginia by loggers - 415 miles
Average annual production of loggers - 994 MBF/logger
Average annual production of large logger (1MMBF + yr.) - 1,380 MBF
Average annual production of small logger (Less than 1MMBF/yr.) - 593 MBF
Annual acreage cut in West Virginia/yr. - 222,250 acre/yr.
Loggers who received 208 BMP Training - 50%
Large loggers (1MMBF + yr.) who received 208 BMP Training - 63%
Small loggers (Less than 1MMBF/yr.) who received 208 BMP Training - 37%
Loggers aware of 208 BMPs through literature or contact with a professional forester - 90%
Loggers having working knowledge regarding BMP usage — Good 53%; limited 42%; None 5%
Loggers who understand the purpose of registration and its value as a potential waiver from citation - 71%
Logging jobs registered of those checked - 27%
Loggers having a water quality problem on the site during the check 13%
The water quality problem was due to:

a. inadequate application of BMPs 54%
b. no use of BMPs 38%
c. overwhelming weather conditions 8%

EVALUATION RESULTS BY AREAS AND LOGGERS SIZE

Haul Roads

TR1 Large and small loggers performed similarly on this standard. All three areas performed similarly.

TR2 Large loggers performed somewhat better than small loggers. Area 3 again showed the most contrast with large loggers performing considerably better than small loggers.

TR3 Both large and small loggers performed similarly. The highest degree of compliance was in Area 2 and lowest in Area 1.

TR4 Cross drainage continues to show a relatively low adoption rate. All areas were similar and both large and small operations showed low adoption.

TR5 A more strict compliance standard caused this rating to drop considerably from the 1981 check. However, the 1986 check measured compliance exactly as stated in the BMP Manual. Large loggers adopted this standard more readily than small loggers and Area 3 showed better compliance.

TR6, 6-A, 6-B, 6-C, 6-D, 6-E All aspects of haul road maintenance showed significant improvement over the 1981 check. All areas and both large and small loggers performed similarly.

Skid Roads and Trails

SR1 Compliance on skid road grades was similar for large and small loggers. Area 3 had the highest compliance and Area 2 the lowest.

SR2 Compliance for cross drainage on skid roads was relatively low. Small loggers continue to show the lowest rating. Highest compliance occurred in Area 3 and lowest in Area 2.

SR3 Staying away from streams with skid roads continues to be the best-followed skid road BMP. Area 3 scored the highest and Area 2 the lowest.

SR4 Using waterbars on skid roads has improved 14 percentage points since 1981. Large and small loggers performed similarly. Area 2 has improved the most.

SR5 Seeding and/or slash covering on skid roads continues to have the lowest rating throughout the state. Large loggers comply more readily than small loggers and Area 3 had the highest rating.

SR6-A, 6-B, 6-C — Smoothing skid roads, removing berms, and outsloping were not measured in 1981. Loggers averaged 61% compliance in 1986. Performance among large and small loggers and in all areas was similar.

Filterstrips

F1 — Maintaining adequate filterstrips showed uniform compliance throughout the state. Large loggers performed somewhat better than small loggers. Area 1 showed significant improvement.

F2 — Filterstrip protection was not specifically measured in the 1986 check. The restructuring of F1 rendered this question redundant.

Landings

L1 — Seventy-six percent of the landings were located outside the filterstrip areas. This standard was not measured in the 1981 survey. Large loggers performed better than small loggers and Area 3 showed the highest rating.

L2 — This standard measured landing distance to stream when the stream drained less than 100 acres. This was listed as L1 in the 1981 survey. Compliance was uniform over the state with both large and small loggers.

L3 — This 1986 check showed an improvement of 7 percentage points from the 1981 check for adequate landing drainage. Both large and small loggers performed similarly.

L4 — In the 1986 check of water diversion around landings, measurements were made in a totally different way from the 1981 check. Seventy-four percent of the roads and seeps were adequately treated to keep water off the landings. Compliance for this standard was poorest in area 2.

L5-A, 5-B, 5-C — Smoothing, draining, and seeding the landing was not measured in 1981. Smoothing and draining showed 85% and 93% compliance respectively. However, only 39% of the landings were seeded. Area 3 had a somewhat higher rating than the other 2 areas.

CONCLUSIONS

The 1986 checklist, which was changed to better reflect logger intent for using BMPs, and was devised to more accurately measure BMP compliance, apparently achieved these goals quite well. Foresters who used the checklist were unanimous in feeling more comfortable with using the 1986

checklist. Most foresters felt the new checklist accurately measured BMP compliance as reflected by the favorable comparisons between the numerical ratings and the foresters' judgement ratings.

Therefore, we now have a checklist format which can be used to statistically compare BMP compliance in the future with 1986 figures.

Some interesting information which can be extrapolated from the check is as follows:

1. Loggers build approximately 2500 linear feet of haul road for each 254 acres harvested.

2. Loggers build approximately 415 miles of haul road/year. Most haul roads average 24 feet in width (disturbed soil). Therefore, loggers expose approximately 1,207 acres of soil/year in West Virginia by building haul roads.

3. Approximately 50% of the loggers in West Virginia have received 208 BMP Training. Therefore, the development of formal 208 logging workshops must be continued.

4. Only 37% of small loggers (less than 1MMBF/yr.) have received 208 training. Therefore, actions concentrate on methods to involve the smaller and usually independent loggers in 208 workshops.

5. Loggers are now aware of the 208 program mainly by receiving literature or through contact with a professional forester. However, only 53% of the loggers have a good working knowledge of BMP usage. Therefore, workshops providing more hands-on, practical training and instruction in using BMPs is needed.

6. Most loggers (71%) understand the purpose for registering their logging jobs but only 27% are registering. More emphasis must be placed on the importance of registering log jobs by emphasizing its value as a first-time waiver and most importantly as a monitoring tool used to reveal 208 program success.

7. Only 13% of the loggers checked had a water quality problem at the time of the check, even though this check was conducted during one of the wettest fall seasons in recent years. Fifty-four percent of the water quality problems were due to inadequate application of BMPs which again reveals a need for more technical training in the use of BMPs.

8. Future training programs should emphasize seeding practices; especially on critical areas, highly visible haul road areas, and all landings. Emphasis should be placed on developing and maintaining cross drainage structures on both haul and skid roads.

9. Loggers should be encouraged to place gravel at haul road entrances to paved public highways to decrease and/or stop mud deposits onto the highways.

In general, future training should concentrate more on technical application of BMPs; how-to workshops, rather than dissemination of information about 208 and how it works.

COMMENTS

The following comments section illustrates BMP usage with statements as found on the checklists used by the inspecting foresters. Close examination of these comments substantiates the numerically derived measurement of BMP usage. The comments are all direct quotations.

OVERALL JOB

Logger is aware of 208 and definitely does not want to be fined for stream pollution. He plans his landings away from stream, but tends to run his skid roads too steep for short distances. He seeded his last job and plans to seed this one. He started seeding as a result of 208.

Logger should have attended the 208 workshop held in his county.

Entire road system planned and road system location marked prior to construction. Overall operation very good. Most needed improvement is cross drainage on temporarily retired skid roads.

More work on BMP usage is scheduled to be done at a later date.

The logger needs to know more about BMPs and should have attended 208 workshops. The logger needs to show more concern about doing a good job.

This operation is a clear-cut on company land. I see no siltation problem here and the company and logging crew assured me retired roads and landings will be treated. This is a new job and no roads or landings were retired at present.

STATE OF WEST VIRGINIA

FORESTRY DIVISION

WATER POLLUTION/LOGGING COMPLAINT INVESTIGATION ON LOGGING OPERATION

INITIAL INFORMATION
To be filled in when taking complaint

Name of person making complaint _____ Telephone(s) _____
Address _____
Name of company involved, if known _____
Landowner, if known _____
Location of complaint: County _____ Nearest town _____
Stream affected _____
When condition was noticed by person making complaint: Date _____ Time _____
Description of complaint condition _____

Description of location of condition or logging operation _____

Forester or other person receiving complaint _____ Date _____ Time _____

ACTION TAKEN

Notify the following as soon as possible after receiving complaint:

- ○ Division of Water Resources: Name _____ Date _____
- ○ Voluntary Compliance Committee Chairman or State Forester: _____ Date _____
- ○ West Virginia Forests, Inc., 273-8164: Name _____ Date _____
- ○ Company or logger involved, if known: Name _____ Date _____

On-site Inspection:

- ○ Inspection by: Name(s) _____ Date _____
- ○ Is there a water quality problem at this site? Yes ___ No ___
- ○ Is this problem caused by logging activity? N/A ___ Yes ___ No ___
- ○ Is the logging operation registered? N/A ___ Yes ___ No ___
- ○ Is this the first complaint on this company or logger? N/A ___ Yes ___ No ___

Description of findings at the site _____

Recommendations to correct the problem(s) _____

- ○ Follow-up inspection scheduled on: _____ Date _____ Time _____

FOLLOW-UP

Follow-up inspection made by: Name _____ Date _____ Time _____

- ○ Has problem been corrected? _____ N/A ___ Yes ___ No ___
- ○ Have water samples been taken? _____ N/A ___ Yes ___ No ___

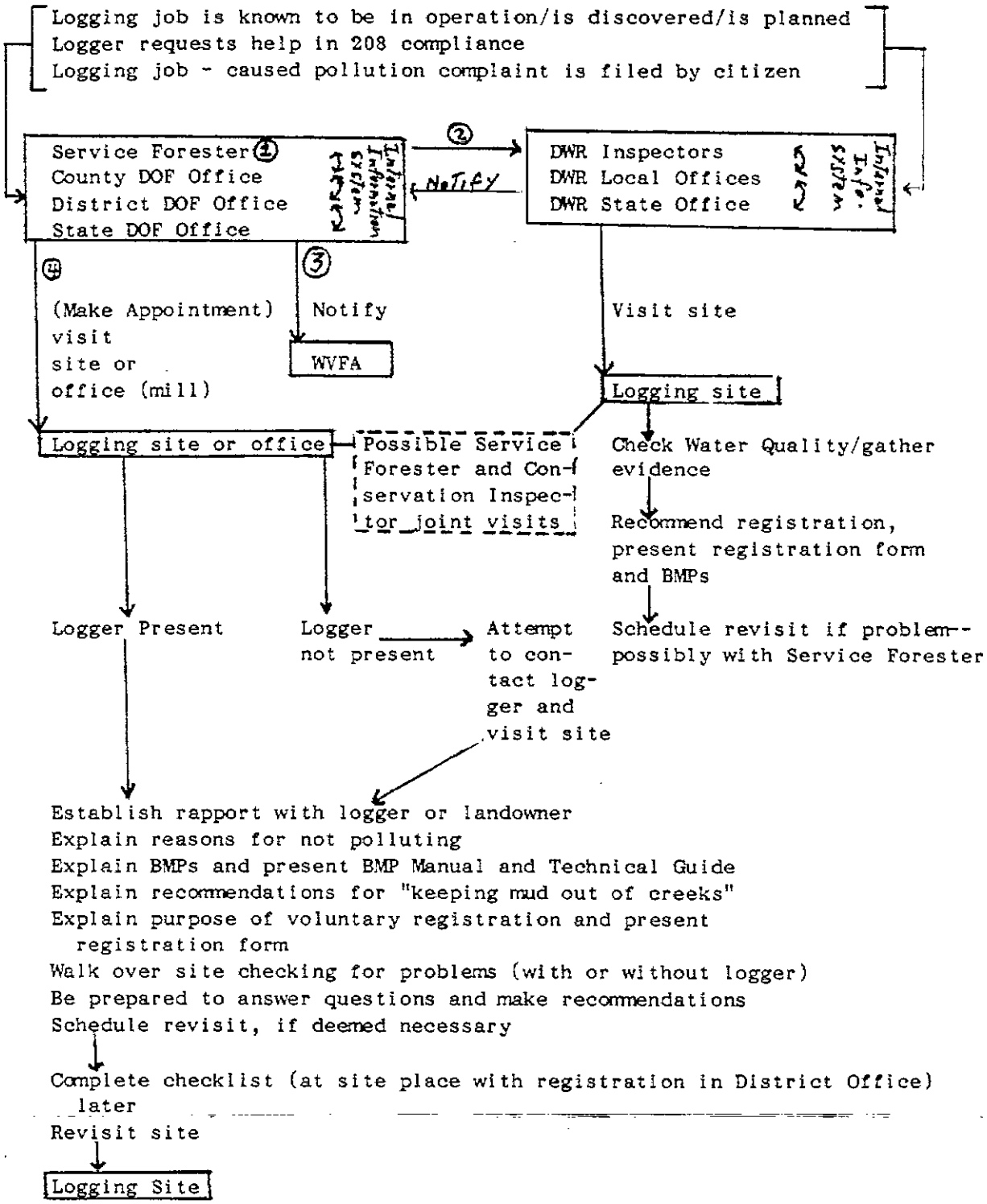
Follow-up inspection findings _____

Future action planned, if any (including legal action): _____

- ☐ Person making complaint was notified of outcome: Date _____ Time _____

Forward completed form to District Forester, District Water Resources Supervisor, and State Forest

Situations



*circled numbers suggest sequence of events for most cases

WEST VIRGINIA
DIVISION OF FORESTRY
DEPARTMENT OF COMMERCE, LABOR, ENVIRONMENTAL RESOURCES

REGISTRATION FOR LOGGING OPERATION

Name of Operator:_____

Address:_____

Phone Number:_____ Time to Contact:_____

Assistance in practice installation and planning is available from the nearest Forestry Division Service Forester.

I request the following assistance:

_____Assistance in completing this form.

_____Assistance in road layout or selection and installation of BMPs.

_____Publications on road layout and BMPs.

_____Workshop on roads and BMPs.

Name of Landowner:_____

Address:_____

Phone Number:_____

Location of Logging Operation:

County:_____ Nearest Town (P.O.)_____

Drainage (Steams and Tributaries)_____

Type of Operation: Sawlog _____ Pulpwood _____ Prop _____ Post _____
Other:_____
_____

I will use the following Best Management Practices during this operation:
(Please check as appropriate)

_____ Filter strips between haul and skid road/landings and streams (at least 25' up to 100' for steep road grade).

_____ Haul road grades (3 to 10%)

_____ Skid road grades (to 15%)

_____ Road grades exceeding above limits will receive special water control treatment.

(cont'd)
Registration for Logging Operation

_____ Diversions around landings to prevent surface runoff.

_____ Approaches to landings will be on low, gentle grade.

_____ Stream crossings will be protected by culverts or other means.

_____ Road ditches will be installed on inslope and water directed off road through culverts, cross drains or broad based dips as grade requires.

Road and Landing Retirement:

_____ Road and ditch culverts removed or cleaned as necessary.

_____ Roads and landings will be regraded, limed, fertilized, and seeded.

Seed Mixtures:_____

_____ Water bars will be installed.

_____ Harvesting debris will be disposed of in an appropriate manner (slash, tree tops etc. will not be left in streams).

Attach Section of U.S.G.S. Topographical Map on separate sheet:

Quadrangle(s):_____

Indicate Proposed Road System and Landing Locations on Topographic Map.

NOTE: Under no circumstances shall streams be used for skid roads. Such use shall constitute an immediate cause for enforcement action.

I do hereby certify that all necessary measures will be taken to protect water quality in and adjacent to this project site.

Responsible Person:_____
(print)

Signature:_____

Date:_____

Proposed Starting Date:_____

Proposed Completion Date:_____

Return Completed form to:

FOREST WATER QUALITY VOLUNTARY COMPLIANCE COMMITTEE MEMBERS

Ralph P. Glover, Jr.
Dep. Admin. Forester
Division of Forestry
State Capitol
Charleston, WV 25305

Robert D. Whipkey
Asst. Admin. Forester
Division of Forestry
State Capitol
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Water Resources
Division Natural Resources
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State Capitol
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Fairmont, WV 26554

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District Forester
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Hunt Lumber Company
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Jim Page
Forest Supervisor
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Forest
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Elkins, WV 26241-3962

Kent Austin
U.S. Forest Service
Monongahela National
Forest
200 Sycamore Street
Elkins, WV 26241-3962

Larry Barger
U.S. Forest Service
Monongahela National
Forest
Beverly Pike
Elkins, WV 26241

NOMINATION FORM Appendix 7

WEST VIRGINIA FORESTRY ASSOCIATION LOGGER AWARD

INSTRUCTIONS

1. All nominations must have two signatures.

2. The evaluation should be based on the suggested guidelines on the next page. Consideration should be given to the type of operation, equipment involved, the desired results, economic limitations of the logger and limitations by landowners specifications.

3. The minimum requirements for nomination of "Logger of the Year" are:
   a. All operations will be registered for 208.
   b. Appropriate safety gear for eye, ear, head, and foot protection will be mandatory for all employees.

4. The two nominators need only submit one written evaluation per logger nominated. Nominators may nominate more than one logger.

5. All nominations and written evaluations are due by may 1, 1988 to the Area Chairmen.

6. The Area Chairman and District Forester with WVDA, Forestry Division will select the area winners by ground visitations by June 1.

7. The State Chairman will receive the District Winner nomination and evaluation by June 5. State chairman and his committee will select a State "Logger of the Year" by ground visitation by July 10.

8. The District Winners and the State Winner will be recognized by the Association at the Annual Meeting July 16, 1988 at Canaan Valley State Park.

LOGGER'S NAME_____ AREA OF OPERATION_____

ADDRESS_____

_____ TELEPHONE NUMBER_____

We hereby nominate the above logger for the West Virginia Forestry Association, Logger Recognition Award. (Must have 2 signatures.)

_____	_____
Nominating Signature Date	Co-Nominating Signature Date
_____	_____
Address	Address
_____	_____
Occupation_____	Occupation_____
Telephone Number_____	Telephone Number_____

All nominations should be sent to:
West Virginia Forestry Association, P.O. Box 724, Ripley, WV 25271
or the Area Chairman for your Area

SUGGESTED GUIDELINES FOR NOMINATION

1. Voluntarily practices, promotes, and complies with the "State of West Virginia Silviculture...Water Quality Management Plan - Clean Water Act - Public Law 92-500 Section 208" and the "Guidelines for Controlling Soil Erosion and Pollution on Logging Operations in West Virginia."
   *a. Registers each logging job with WVDA Forestry Division.
   b. Constructs logging roads and skid trails on grades as low as possible. (Roads less than 8% to 12% and trails less than 15% to 20%)
   c. Leaves filter strips between logging roads and skid trails and the stream and drainage ways - 25 feet at 0% slope to 165 feet for 70% slope.
   d. Uses water bars, culverts, broad based dips, and small bridges to divert surface and ground water. 250 feet at 2% slope to 35 feet at 30% slope.
   e. Smooths, regrades, and out-slopes all logging roads, skid trails, and landings after each section of logging job is completed and installs water control structures before moving to the next cutting section.
   f. Reclaims all logging roads, landings, and steep skid trails by seeding grass, mulching with straw or hay, and applies fertilizer and lime to establish a permanent grass cover.

2. Harvests timber according to a predesigned logging plan.

3. Cuts and deadens all designated trees or stands and utilizes all merchantable wood within tree cut.

4. Protects residual timber stands and individual trees from felling and logging damage during thinning and harvesting operations.

5. Repairs all fences, bridges, roads, ditches, and any other property if damaged by the logging operation.

6. Practices directional tree felling techniques to prevent tree tops and slash from entering roads, ditches, streams, fields, pastures, and other rights-of-way and removes any that accidentally are misplaced or felled.

7. Promotes safety to his employees by furnishing and requiring them to wear proper safety gear. Sets proper example by wearing safety apparel and belts himself.

8. Understands and complies with the West Virginia laws and regulations pertaining to forestry. (Forest fire laws, timber trespass, and water pollution)

9. Additional remarks should be made as to loggers' voluntary practices, work "above and beyond the call of duty," activities promoting "the forestry community" in civil and community affairs, etc.

10. Nominees do not have to be members of the West Virginia Forestry Association. Logger evaluation (supporting materials such as newspaper articles, other awards, etc.) may be included.

West Virginia Division of Forestry

Certificate of Training

This is to certify that

_____

has received training in

FOREST WATER QUALITY MANAGEMENT

conducted by the West Virginia Division of Forestry.

_____ DATE

_____ STATE ADMINISTRATIVE FORESTER

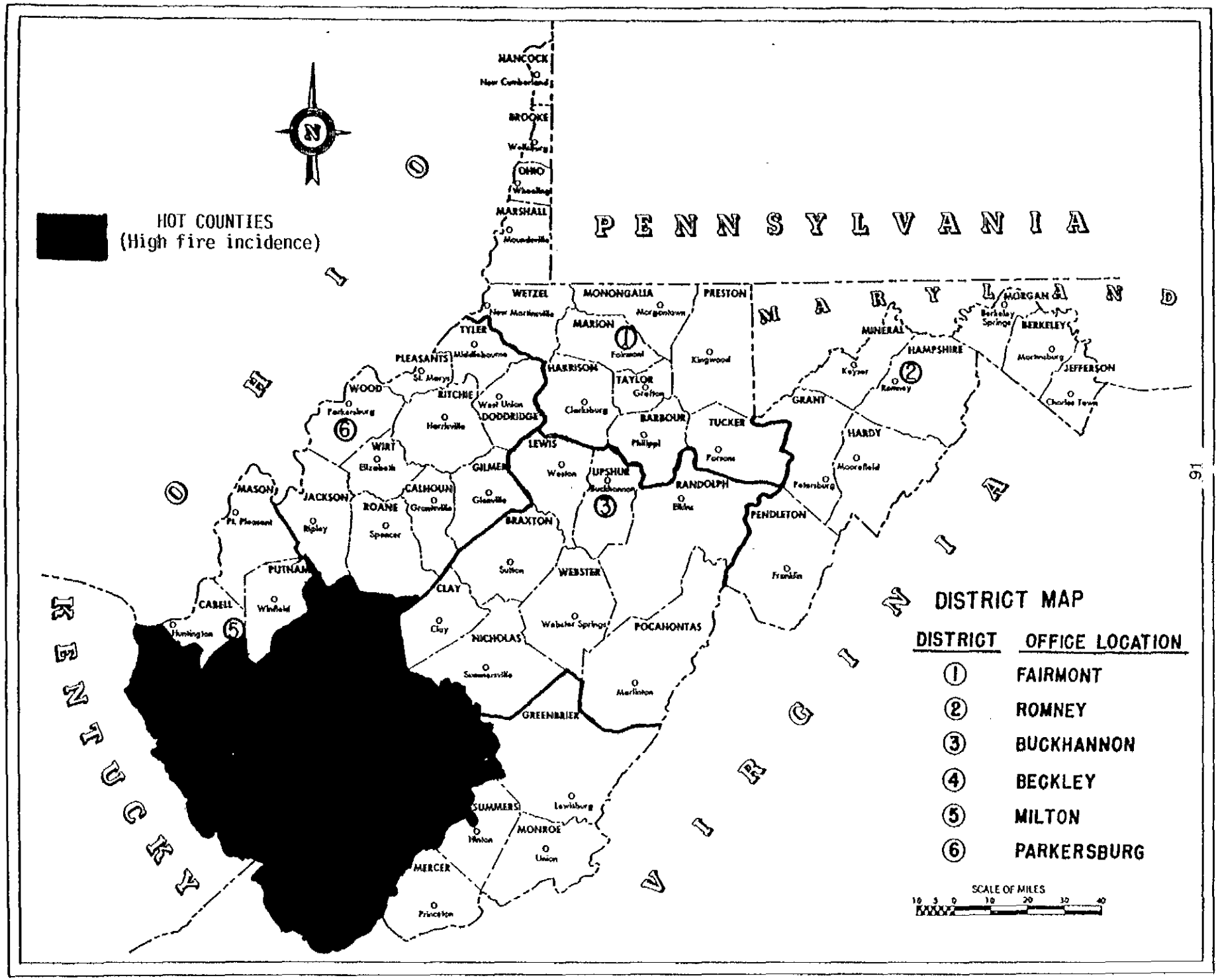
Appendix 9

High Incidence of Repeat Burns
(Data Collection)

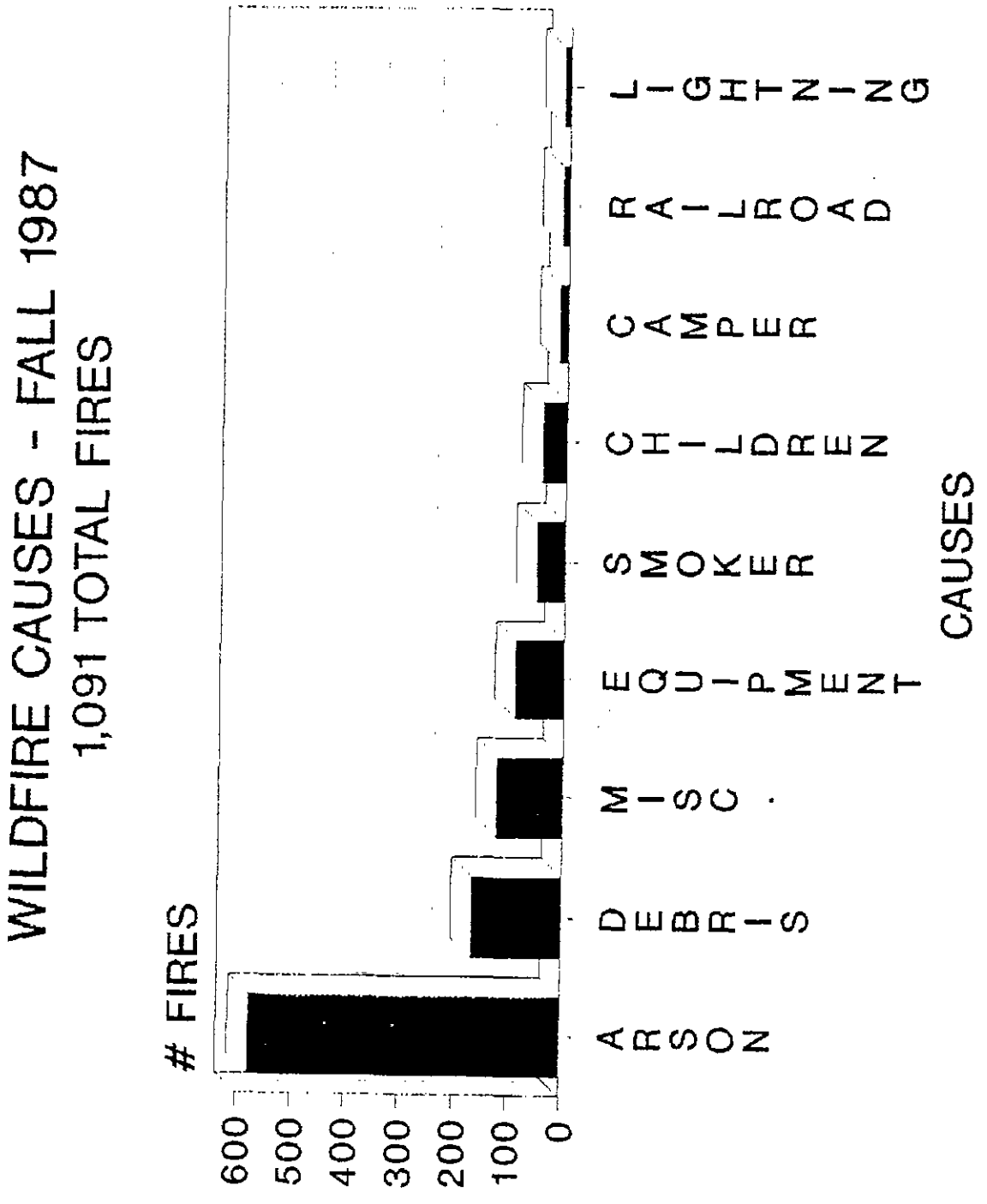
County	Watershed Number	Priority Stream
Wayne	293*	Old Fork of Jennie Creek
Mingo	296	Mitchel Branch of Mate Creek Left Fork of Marrowbone Creek
Lincoln	159	Frances Branch of Kiahs Creek
	274	Sand Creek
Logan	248	Seng Camp Creek
	277	North Fork Big Creek
Boone	247	Joes Creek, Joes Branch and Seng Creek
Kanawha	182*	Cabin Creek
Wyoming	287	Toney's Fork and Laurel Fork
	285 & 287	Clear Fork
	282	Cub Creek
McDowell	298	Johnnie Cake Branch
	299	Sandy Huff
	301*	Little Slate Creek
	297*	Bull Creek
Fayette	189	Armstrong Creek
	192	Cotton Hill
	211	Rich Creek
Raleigh	291	Tommy Creek, Clab Fork
	250 & 252*	Marsh Fork
	251*	Clear Fork and Sycamore
	191	Head Paint Creek

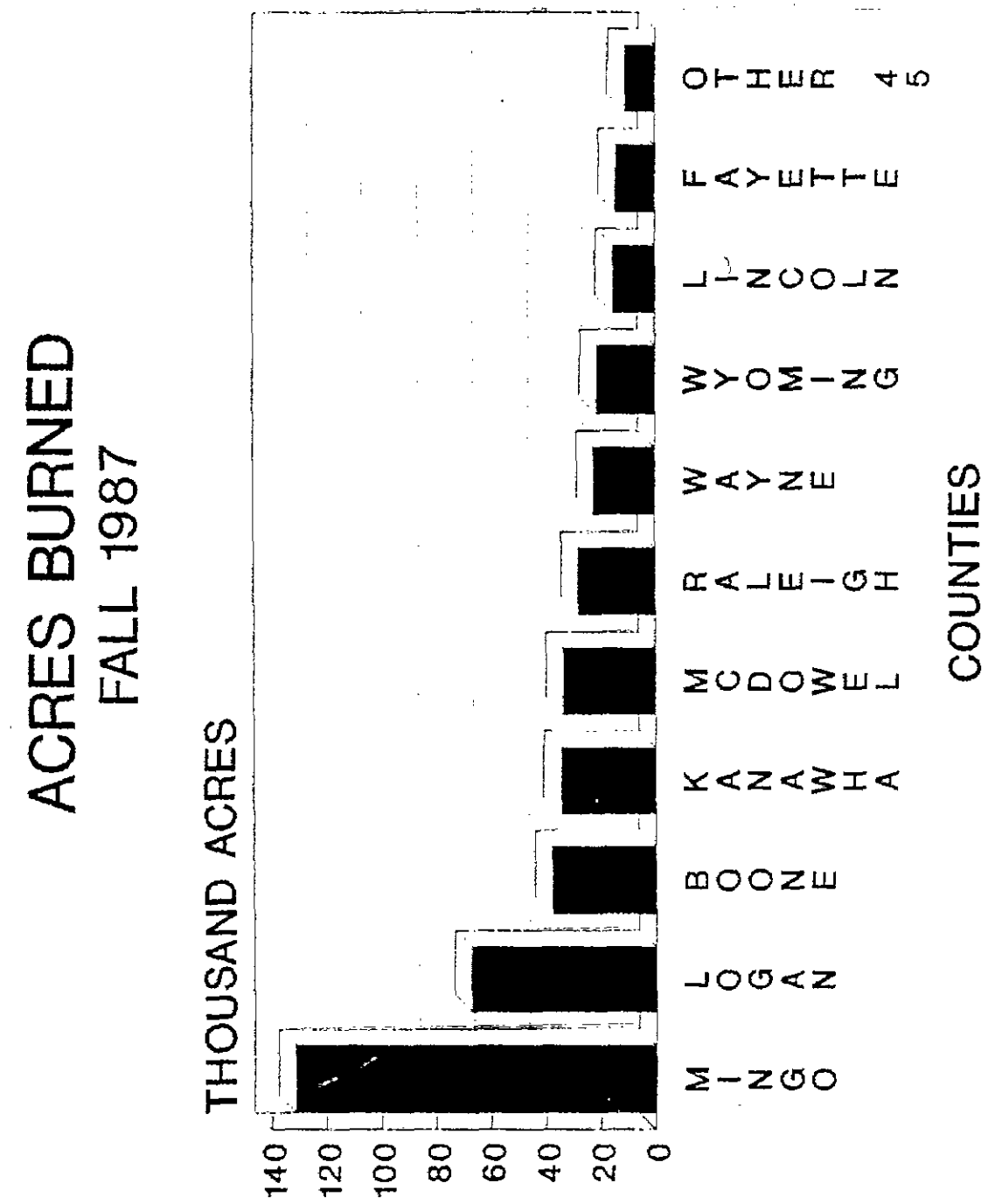
*Most severely burned.

Map 1


HOT COUNTIES
(High fire incidence)
PENNSYLVANIA
MARYLAND
OHIO
KENTUCKY
VIRGINIA
HANCOCK
BROOKE
OHIO
MARSHALL
WETZEL
MONONGALIA
PRESTON
TYLER
MARION
MORGAN
MINERAL
BERKELEY
JEFFERSON
HAMPSHIRE
PLEASANTS
HARRISON
TAYLOR
WOOD
RITCHIE
DODDRIDGE
BARBOUR
TUCKER
GRANT
HARDY
WIRT
LEWIS
UPSHUR
RANDOLPH
GILMER
MASON
JACKSON
ROANE
CALHOUN
BRAXTON
PENDLETON
PUTNAM
CABELL
CLAY
WEBSTER
POCAHONTAS
NICHOLAS
GREENBRIER
SUMMERS
MONROE
MERCER
DISTRICT MAP
DISTRICT
OFFICE LOCATION
① FAIRMONT
② ROMNEY
③ BUCKHANNON
④ BECKLEY
⑤ MILTON
⑥ PARKERSBURG
SCALE OF MILES

91


WILDFIRE CAUSES - FALL 1987
1,091 TOTAL FIRES
FIRES
600
500
400
300
200
100
0
ARSON
DEBR-S
M-SC.
EQU-PMENT
SMOKER
CH-LDREN
CAMPER
RAILROAD
LIGHTNING
CAUSES


ACRES BURNED
FALL 1987
THOUSAND ACRES
140
120
100
80
60
40
20
0
MINGO
LOGAN
BOONE
KANAWHA
MCDOWELL
RALEIGH
WAYNE
WYOMING
LINCOLN
FAYETTE
OTHER 45
COUNTIES

ASSESSMENT DATA

The West Virginia Silvicultural Water Quality Plan was discussed at the West Virginia Forest Water Quality Voluntary Compliance Committee meeting (VCC) in April of 1988. At that time, a subcommittee was formed to work with the plan. At the first meeting, held May 9, 1988, random observations indicated that the subjective data tendered in February as a preliminary draft of the silvicultural assessment had been based on dissimilar interpretations of the questions asked and so was exceedingly flawed. Accordingly, the interagency VCC subcommittee agreed that a totally new and professionally developed assessment of the intensity of timber harvesting in each subbasin of the State was needed. This resulted in an intensive field survey to locate all commercial timber harvesting operations that have been conducted in West Virginia during the last three years.

The decision to limit the survey to those operations active during the most recent three years was a technical decision based on established research as well as observations by professionals. For example, Reinhart and others (1963) observed that erosion from timber harvesting is a result of road and landing developments, and on nearly all soils, diminishes rapidly after active use is completed. This is due to the surface becoming layered with small stones (erosion pavement) and the rapid development of volunteer vegetation. However, professional observations reveal that on highly erodible soils and on extremely steep slopes, it is possible for erosion to continue, although slowly, for up to three years after active harvesting has been completed. These scenarios are extreme as the installation of recommended BMPs inhibits and essentially prevents erosion.

The subcommittee, after deliberation, also decided, in the interest of time and expense, to review only commercial timber harvesting operations because they are the only ones likely to have road and landings installations that could contribute to erosion. This decision removed roadside firewood operations, small post and prop operations, farm timbering where roads were not installed, etc. from further consideration although these were often hurriedly scanned to insure that they complied with the criteria.

METHODS

The methods used to gather the data along with the data results are listed in the following. In general, acreages harvested were ascertained for each of the 36 stream basins previously delineated (Map 2) by the Water Resources Section personnel.

West Virginia Division of Forestry employees toured each basin by vehicle or viewed it from an airplane. The only exception was acreages on the Monongahela, George Washington and Thomas Jefferson National Forests which were provided by the U.S. Forest Service. Division of Forestry personnel traveled approximately 27,000 miles and utilized one and one-half man years in data collection activities. No effort was made to collect information from any of the similar industries for which assessments are being prepared by others, i.e. - agriculture, construction, urban, etc.

SUBBASIN LOGGING INTENSITY SURVEY METHODS

During the latter part of May and the first two weeks of June 1988, an in-the-field survey was conducted across the State of West Virginia to determine the extent of commercial logging operations that have occurred the last three years. (May 1985 through June 1988)

The following methods were used to obtain this data:

1. The state was divided into 36 basins to correspond with the DNR, Water Resources Section delineation.

2. Division of Forestry personnel were assigned to the appropriate basins to conduct the survey.

3. Forest industry was contacted initially to collect logging data that might be available.

4. Land holding companies were contacted for data.

5. Consulting foresters were contacted in some areas.

6. When accurate acreage data was not available, especially for pulpwood harvests, pulpwood tonnage figures were used and converted to cords/acre and acres using dependable conversion formulas.

7. All basins were toured by vehicle and in some instances viewed from aircraft to substantiate the logging data compilation.

8. The USFS personnel were contacted on the Monongahela National Forest, George Washington National Forest, and the Thomas Jefferson National Forest. They provided detailed logging acres data by basin.

9. All data was collected by the Division of Forestry's six District Foresters. Basins which overlapped into more than one District were cross-checked for duplication and sent to the Charleston Office for compilation.

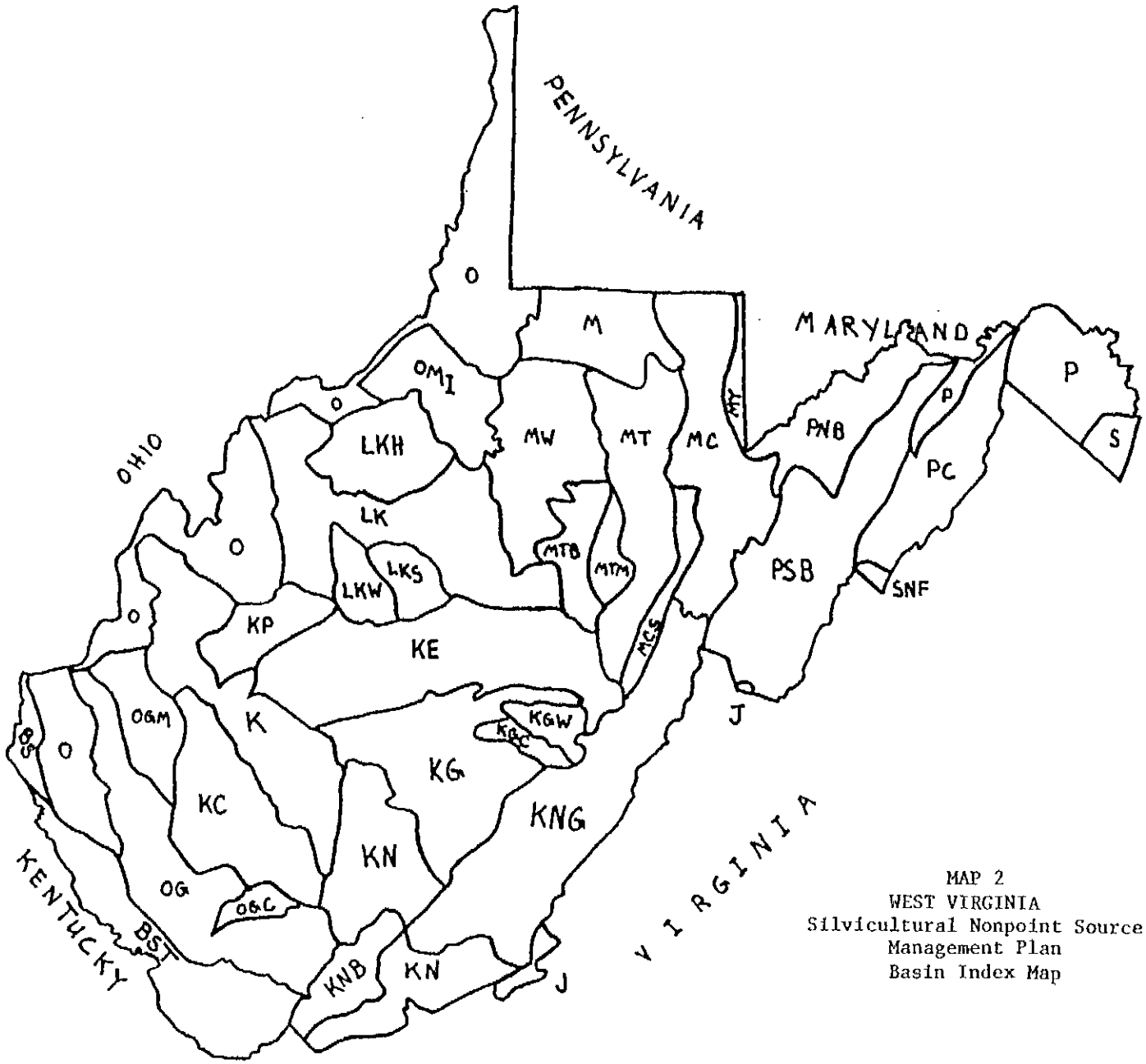
10. Division of Forestry personnel traveled approximately 27,000 miles and spent over 2,940 man-hours collecting this data.

LOGGING INTENSITY ASSESSMENT BY BASIN FOR THREE YEARS (JUNE 1985 TO JUNE 1988)

BASIN	DRAINAGE ACREAGE	TOTAL TIMBERLAND ACREAGE	% BASIN FORESTED	TOTAL ACRES HARVESTED	% TIMBERLAND (SUBBASIN) ACREAGE HARVESTED
BS	60500	39830	65.8	3935	9.9
BST	592800	532076	89.8	12451	2.3
J	48600	39420	81.1	215	.5
K	697650	498248	71.4	18335	3.7
KC	554450	459233	82.8	18063	3.9
KE	988200	837781	84.7	38506	4.6
KG	758100	610693	80.6	42666	7
KGC	62200	60676	97.5	1861	3.1
KGW	83000	78925	95.1	2000	2.5
KN	712900	423816	59.4	14460	3.4
KNB	238450	162932	68.3	697	.4
KNG	1057050	755408	71.5	20984	2.8
KP	220750	153700	69.6	5000	3.3
LK	879836	614295	69.8	21478	3.5
LKS	87700	69840	79.6	2058	2.9
LKW	158300	118299	74.7	4000	3.4
LKH	332200	234261	70.5	8420	3.6
M	365750	208556	57	3413	1.6
MC	709600	545263	78.8	19997	3.7
MCS	137200	125395	91.4	3089	3
MT	577250	379166	65.7	13656	3.6
MTB	195100	124007	63.6	7120	5.7
MTM	96000	85985	89.6	6325	7.3
MW	618192	299743	48.5	5105	1.7
MY	41500	20488	49.4	3307	16.1
O	1496468	997180	65.3	40995	4.2
OG	836650	673762	80.5	28985	4.3
OGC	2500	1878	75.1	94	5
OGM	227300	168060	73.9	3730	2.2
OMI	362000	259698	71.7	10316	4
P	477730	251683	52.7	5002	2
PC	433500	340170	78.5	6286	1.8
PNB	368960	275681	74.7	11385	4.1
PSB	878040	644387	73.4	13208	2
S	65300	12718	19.5	132	1
SNF	11900	10468	88	0	0
	15433626	11093251	71.9%	397903	3.6%

AVERAGE ACRES HARVESTED PER YEAR = 132,634 OR 1.33% OF TOTAL TIMBERLAND

AVERAGE ACRES DISTURBED (EXPOSED) SOIL PER YEAR = 10,611 ACRES
(8% AVERAGE DISTURBANCE/YEAR)



MAP 2
WEST VIRGINIA
Silvicultural Nonpoint Source
Management Plan
Basin Index Map

INTRODUCTION

Loggers can have a big effect on whether or not mud from logging operations gets into the streams. This manual has been specially prepared so you can learn the best methods of keeping mud out of streams. These methods may also make your logging more efficient and profitable.

This manual explains the general methods which you can use to reduce stream pollution from logging. The exact standards for logging are contained in the original 208 Silviculture Water Quality Management Plan of West Virginia. In addition, the State of West Virginia has adopted water turbidity standards which apply to the streams, and has developed a new Forestry Water Quality Plan (1989) which revises and updates Best Management Practices.

Methods in this manual are presented in a step-by-step fashion. The steps are planning, constructing, maintaining, and retiring the operations (this includes all roads and landings). The biggest focus is on roads because they can cause the biggest problems. Each person in the logging crew should know what is necessary in each step. Understanding and following these steps will enable you to do a better job and keep mud out of the streams.

ACKNOWLEDGEMENTS

In preparing this manual we have drawn freely from the references listed and received assistance and suggestions from state, federal and industry foresters. Original art work is by Barry Nehr, U.S. Department of Agriculture—Forest Service, and L. Whalen, courtesy of Forest Engineering Research Institute of Canada. This publication was revised by the Education Subcommittee of the West Virginia Forest Water Quality Compliance Committee.

CONTENTS

CLEAN STREAMS AND BETTER LOGGING

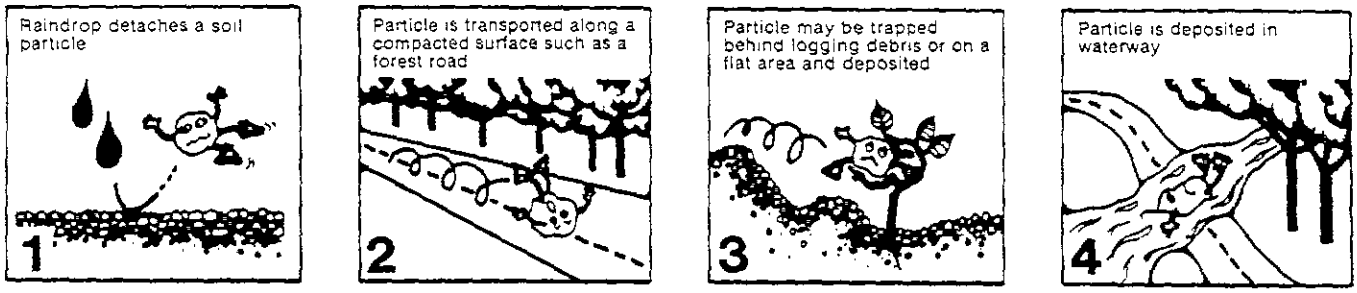
CLEAN STREAMS AND BETTER LOGGING

Mud In The Stream—What Causes It?

The biggest water pollution problem from logging operations is mud in the stream. It is caused by erosion of soil. Erosion takes place in four parts:

1. A soil particle is detached by a raindrop or flowing water.
2. The detached particle is moved with the flowing water, which is now muddy water.
3. The particle catches on logging debris, brush, leaves, or grass, or is left on a flat area.
4. If the particle does not get caught, it continues in the flowing water into the stream, causing water pollution. Mud in the stream is water pollution.

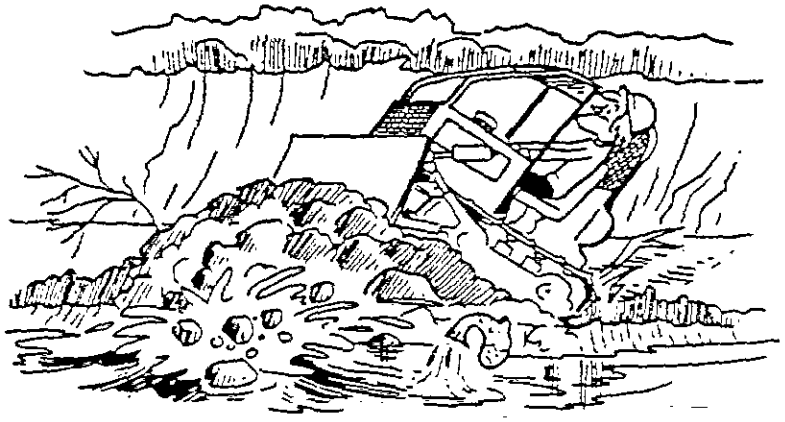
PROCESS OF EROSION



Courtesy of Florida Division of Forestry

Where Does the Mud Come From?

Haul roads and skid roads cause the biggest problem. Most mud comes from road building and roads. Mud does not usually come from leaf-covered or undisturbed parts of logging jobs.



What Damage Does Mud In The Stream Cause?

* Fills in stream and riverbeds and lakes and reservoirs, which can cause flooding or require expensive dredging.

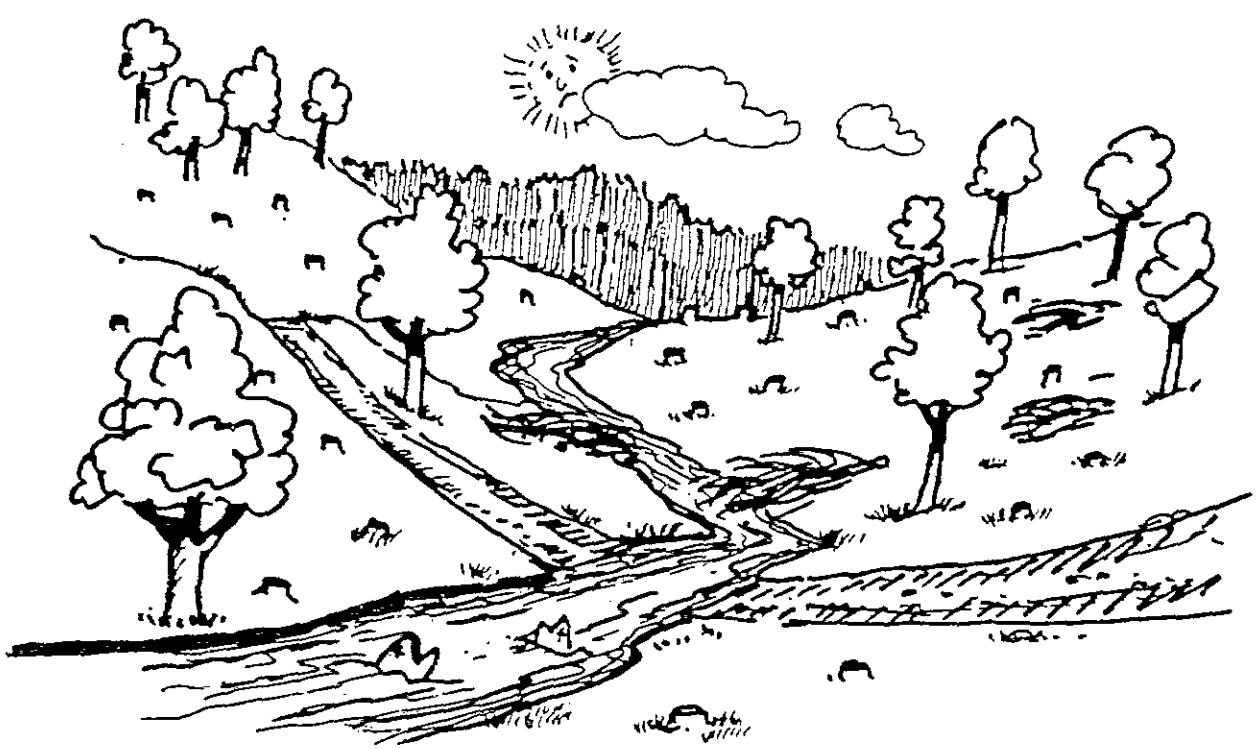
* Causes dirty drinking water supplies; it costs a lot to remove the mud.

* Kills tiny plants and animals (fish food) living on stream bottoms and makes it hard for fish to see food; fewer fish can live in the water.

* Kills larger water plants.

* Makes fishing and swimming poor.

* Looks bad.



What Happens When A Citizen Complains About Mud In the Stream?

Complaints are usually investigated jointly by a service forester and a water inspector, along with, in some cases, the West Virginia Forestry Association Executive Director, representing the timber industry. Sometimes it is determined that the logging **is not** the cause of mud in the stream. When logging **is** the cause of the mud, the logger is normally first given an opportunity to clean up the job. If corrective action is not taken by the logger, a warrant may be issued by the water inspector. Fines can be severe: willful violation of water quality standards carries a fine of $2,500 to $25,000 per day.

How Can You Avoid A Fine For Getting Mud In The Stream?

Streams, rivers, and lakes must be kept clean. This is enforced by the West Virginia Water Resources Section. Using *Best Management Practices* (BMPs) on your logging jobs will help prevent mud in the stream and avoid complaints by citizens and fines for water pollution regarding mud in the stream.

West Virginia has developed a voluntary logger registration form which allows a logger to properly plan his logging activities and, in some cases, protect him from a possible citation. If a logger is registered and attempting to use BMPs, but still creates a water pollution problem, he will not be cited the first time. Instead, the logger will be provided hands-on technical training in the proper application of BMPs and permitted to correct the problem(s).

Will Logging Be Regulated?

Loggers in West Virginia are improving their methods to keep streams clean. Control of mud from logging operations is up to you, the logger. Logging in West Virginia could become further regulated if you are not effective in keeping mud out of the streams.

You can help keep mud out of streams by insuring the use of BMPs on logging operations. BMPs are practices such as proper road and landing location and construction, and the use of culverts and water bars. A booklet explaining recommended BMPs is available from West Virginia Division of Forestry personnel. The logger can also use ingenuity and any new technology (such as road stabilization fabrics and filter mats) so that the result is clean streams.

Five BMPs You And Your Logger Can Use To Keep Mud Out Of The Stream.

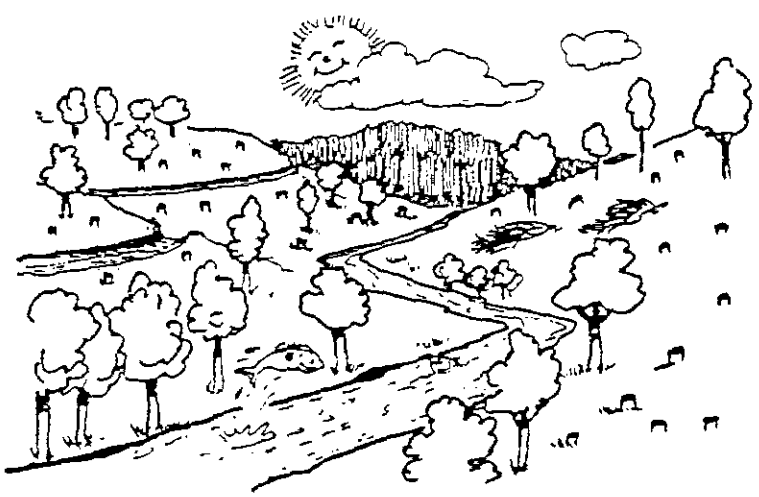
1. **Plan the job.** The landowner and logger should mutually spend time planning and laying out roads and landings to prevent potential problems. This includes fitting the roads to the lay of the land and keeping grades low. Well planned and properly located roads can be a great asset to the landowner's property. Permanent roads can greatly enhance woodland activities such as hiking and hunting. Permanent roads permit access for fire protection, firewood cutting, future timber management, and harvesting.

2. **Stay away from streams.** You should try to plan and build roads and landings at least 100 feet from streams. Equipment should be kept out of streams. A filterstrip of vegetation should be left along the stream.

3. **Great care should be used in crossing streams.** When a stream must be crossed, a culvert or bridge should be used; crossing should be at a right angle, and the approaching roads should not drain water into the stream.

4. **Water should be drained off roads and landings.** The logger should use ditches, culverts, dips, and grade breaks, and log in favorable weather when possible. These drainage structures need to be maintained during operation to keep them working. To prevent water from washing down long stretches of road or standing in landings or dips, the logger should inspect ditches, culverts, etc., periodically to make sure they are effective. If muddy water is noticed entering a stream, or if there is a possibility of this, steps need to be taken to correct the problem.

5. **Roads should be retired as soon as they are not needed.** Water bars and seed or slash-cover may be used.



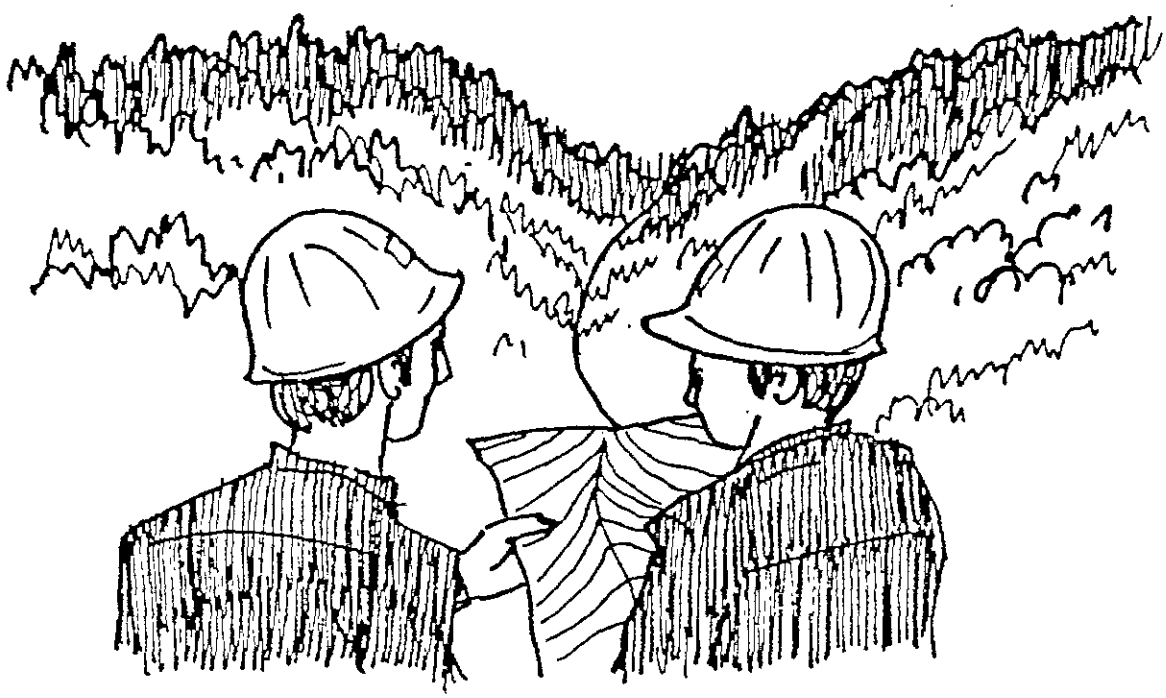
What Materials Are Needed To Keep Mud Out Of The Stream?

Your concern for clean water is shown by how prepared you are when you log. Some items which will help you keep mud out of the stream are:

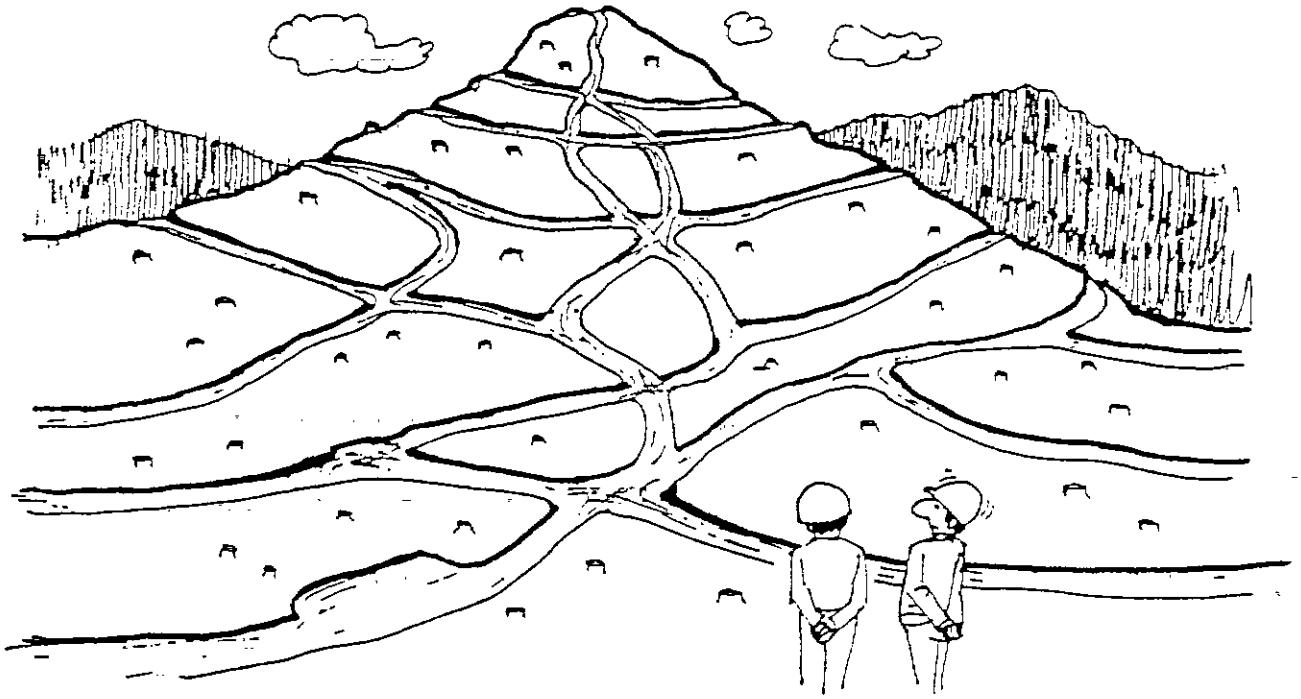
1. **Maps** for planning your logging job.
2. A **device for measuring road grade** such as an Abney level, clinometer or grade meter.
3. **Flagging tape** for marking roads and drainage structures.
4. **Culverts** for crossing streams and draining roads.
5. **Seed** for planting steep roads and banks.

Where Can You Get Help In Using BMPs and Planning Your Logging?

Contact your service forester, consulting forester or industry (company) forester. See list of foresters at end of this manual.



PLANNING LOGGING ROADS



"MAYBE WE SHOULD HAVE PLANNED OUR ROAD SYSTEM."

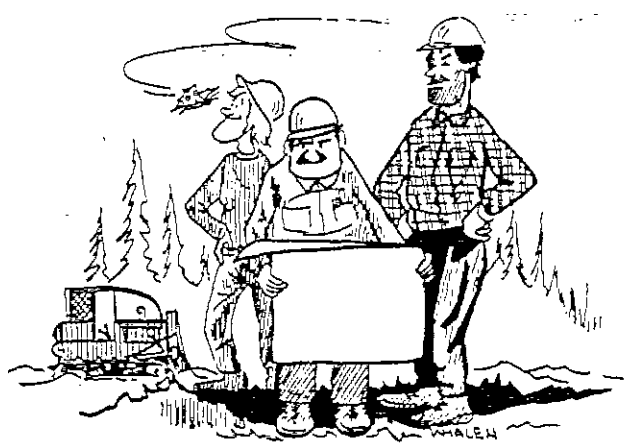
PLANNING LOGGING ROADS

Why Plan Your Road System?

With proper planning you can save time, money and effort and also prevent mud in the stream.

Advantages of Planning Your Road System:

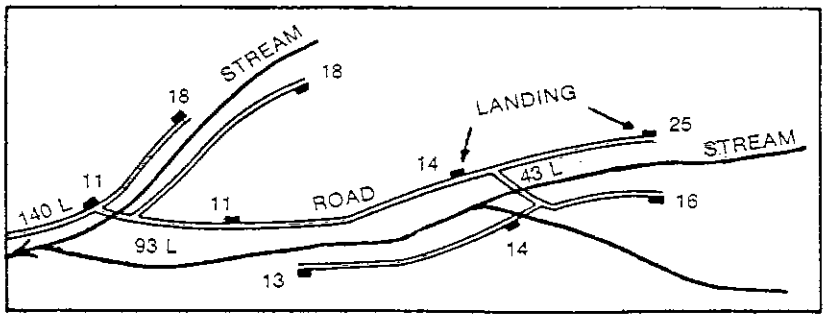
* Fewer Miles of Roads Needed
* Less Time to Build—Planning takes time but may **save time** and **money** in the long run
* Less Construction Cost
* Increased Hauling Efficiency
* Less Maintenance on Roads and Equipment
* More Use in Bad Weather
* Looks Better—Better Public Image
* Provides for Future Access
* Less Mud in the Stream From Erosion



Things To Consider On All Jobs

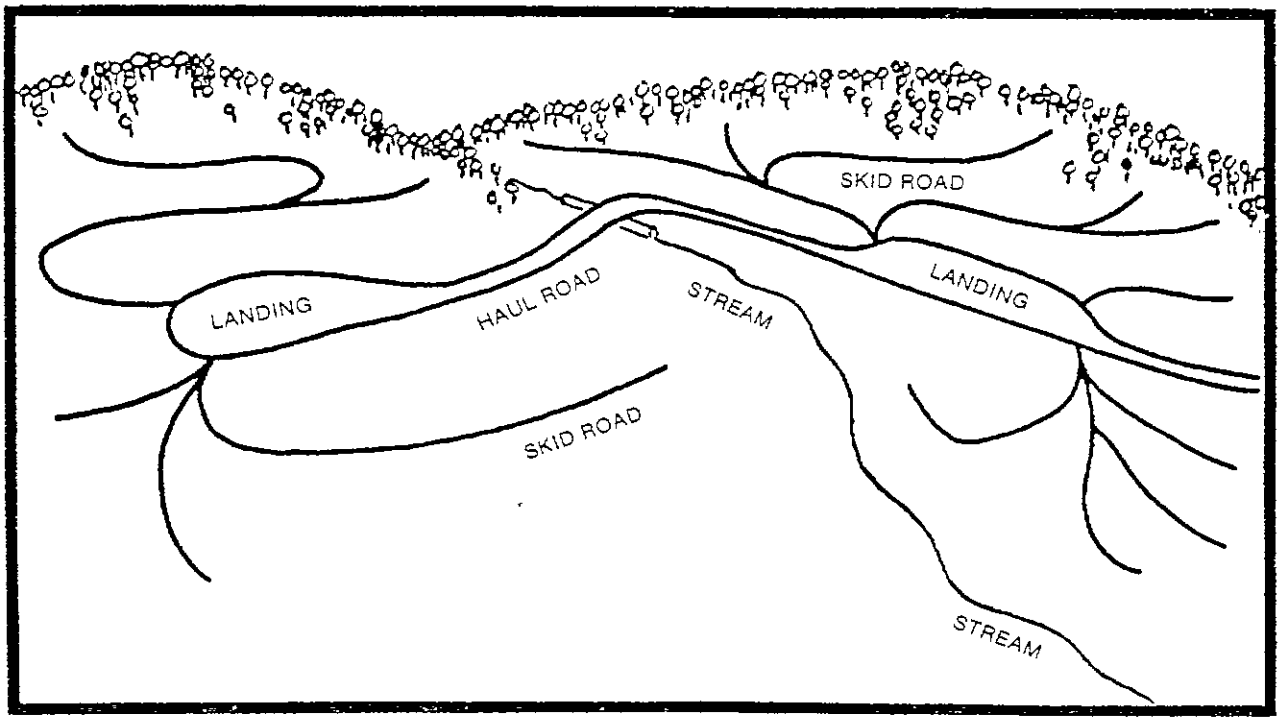
a. **Consider layout of road system.** Often this is a climbing main haul road with skid roads leading off the haul road. Plan roads to fit the lay of the land. You will also have to keep in mind the property boundary lines, concentrations of timber, and stream location. Locate landings first. Skid road approaches to landings should have low grades so that water will not be likely to flow down into a landing. Space skid roads as far apart as practical.

Method for sizing up road use on a planned logging job in terms of number of loads that will be hauled over the road.

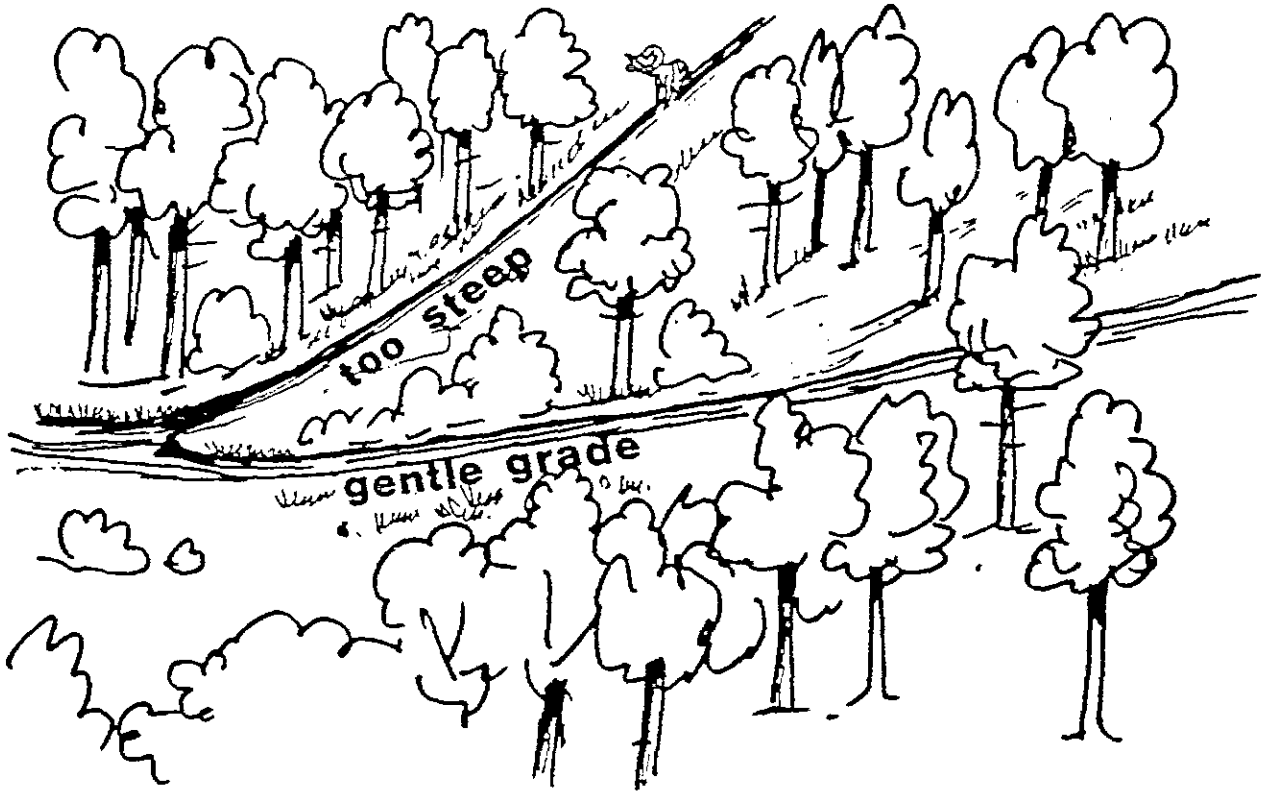


Loads at landings are computed from estimate of timber that will be skidded to each landing. Where timber is uniformly distributed, this can be determined from the area served by each landing.

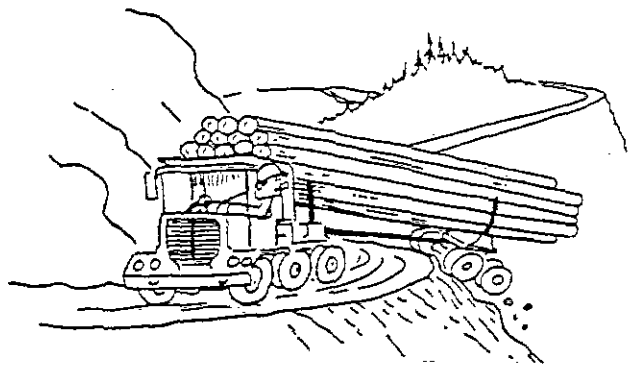
Expressing the proposed use of a logging road in terms of number of loads that will be hauled over it can serve as a guide to the design and standards to which the various sections and spurs need to be constructed.

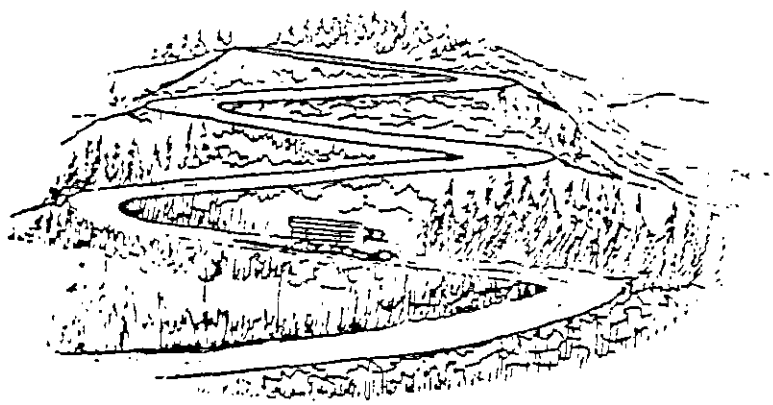


b. **Consider grade of road.** Grade is shown in this manual in percentage. A 10% grade has a rise of 10 feet per 100 feet of length. Haul Roads should be 3-10% (to 15% with special treatment). Skid Roads may be up to 15% (to 20% for short segments). Keep road grades as low as possible. Do not go straight up the slope, but proceed slanting up the hill. Break the grade occasionally to avoid long straight grades which permit runoff water to build up and cause erosion. Dips, grade breaks or other drainage structures should be installed on main skid roads. Wherever possible, build the road from the top down—it is much easier. The only way to reduce road grades is to build longer roads; in other words, "go the long way around." Often this does not mean building more miles of road on the whole job, since the area would be roaded anyway. It is also important to provide a cross-drain immediately above extra steep pitches in the road and below bank seepage spots. If you plan to upgrade wheeled skidder roads into roads suitable for other vehicles at a future date, they must be laid out with that in mind.



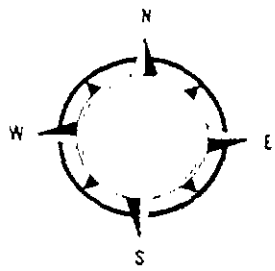
c. **Consider road curves.** Curves should have a minimum 35-foot radius and nearly level grade. A slight slope on the grade will help provide drainage. Fender logs or high stumps are recommended on the edge of skid roads on steep slopes, and also at turns and switchbacks, to prevent logs from rolling off the skid road (causing more side casting of earth) and to protect adjacent standing timber from damage.



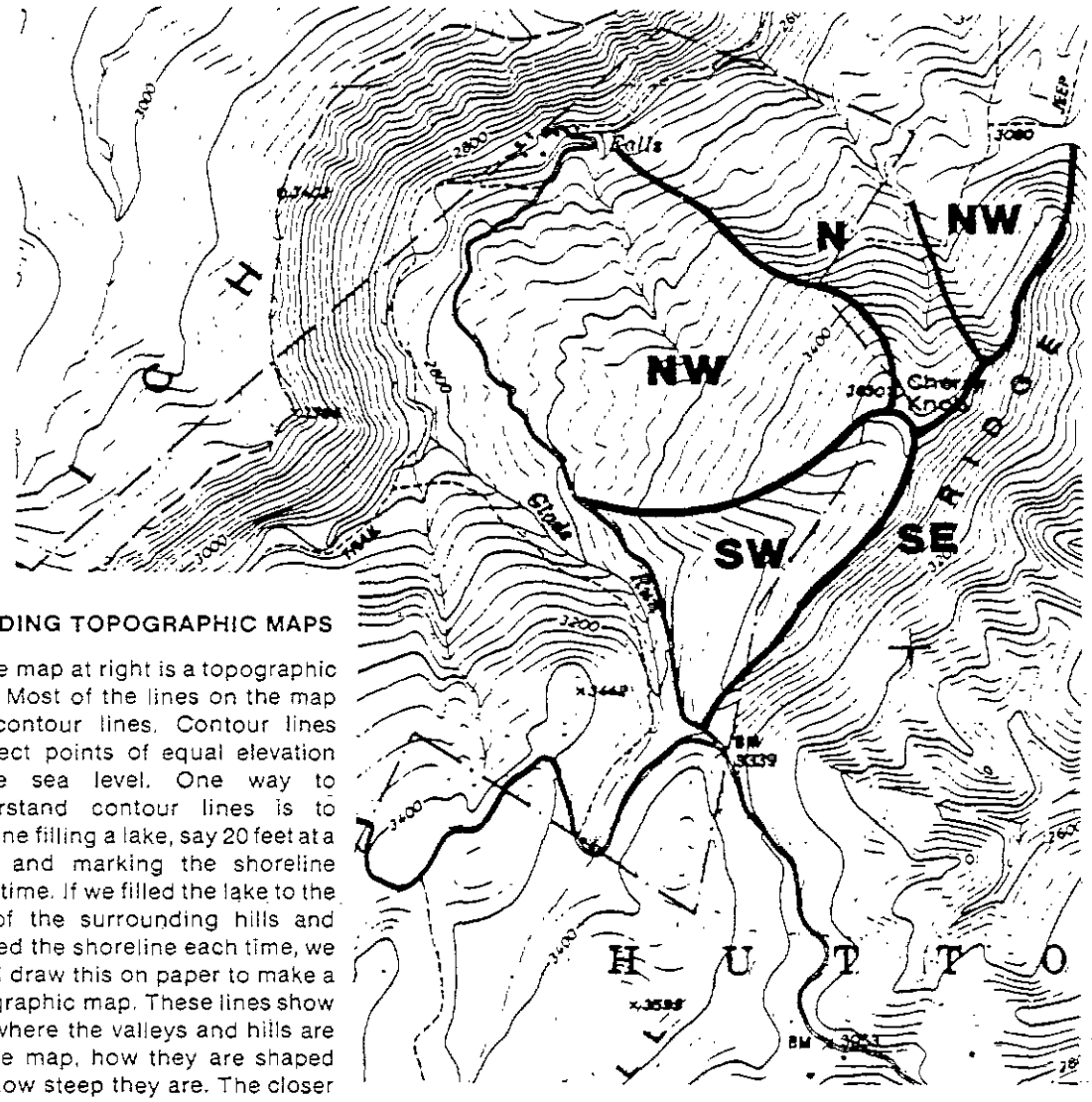


d. **Consider slope and aspect (compass direction) of hillside.** South and west-facing hillsides are driest; north and east hillsides are wettest and normally steepest. Locate major haul roads on sunny south and west slopes whenever possible. They dry faster than shady north and east slopes.

The topographic map below shows a mountain divided into major slopes. We would expect the southwestern (SW) slope to be driest.



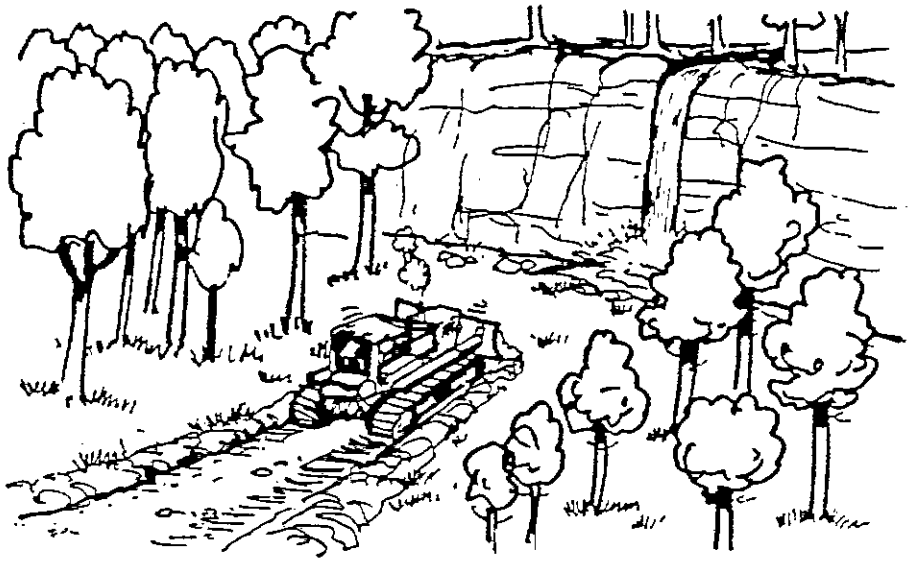
COMPASS ROSE shows compass direction



READING TOPOGRAPHIC MAPS

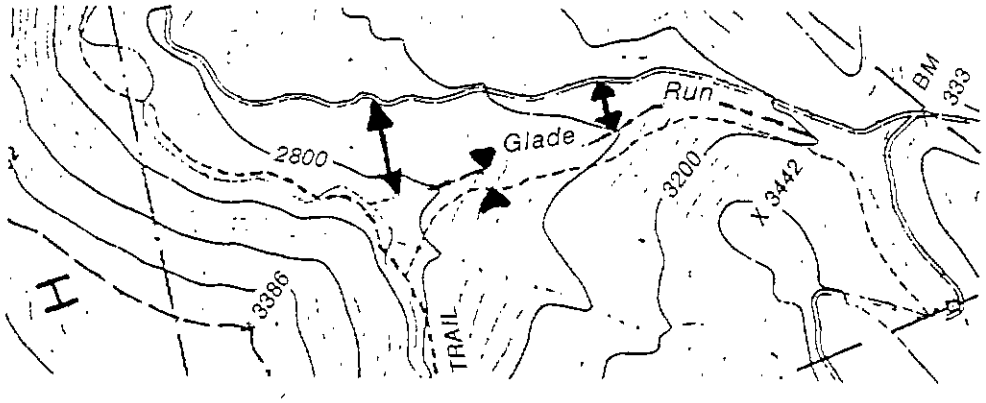
The map at right is a topographic map. Most of the lines on the map are contour lines. Contour lines connect points of equal elevation above sea level. One way to understand contour lines is to imagine filling a lake, say 20 feet at a time, and marking the shoreline each time. If we filled the lake to the top of the surrounding hills and marked the shoreline each time, we could draw this on paper to make a topographic map. These lines show you where the valleys and hills are on the map, how they are shaped and how steep they are. The closer the contour lines, the steeper the slope. The contour interval is the vertical distance between contour lines. In the example above, the lake was filled 20 feet at a time, so the contour interval is 20 feet.

e. **Avoid obstacles.** Rock (cliffs), easily eroded soils (such as clay), seeps, swampy places, flat ridgetops. All may affect ease of road design and the likeliness of water pollution (mud in the stream).

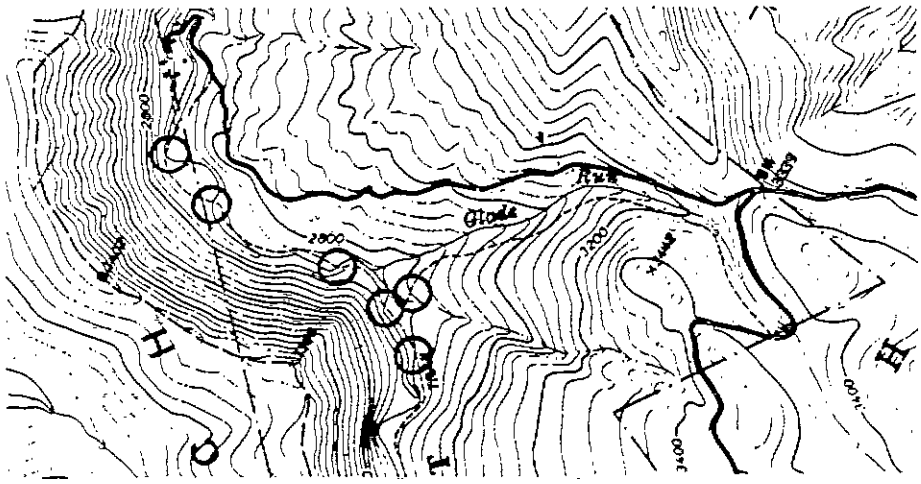


**"THIS IS A REAL DEAD END—
WE SHOULD HAVE MARKED THE ROAD BEFORE CONSTRUCTION."**

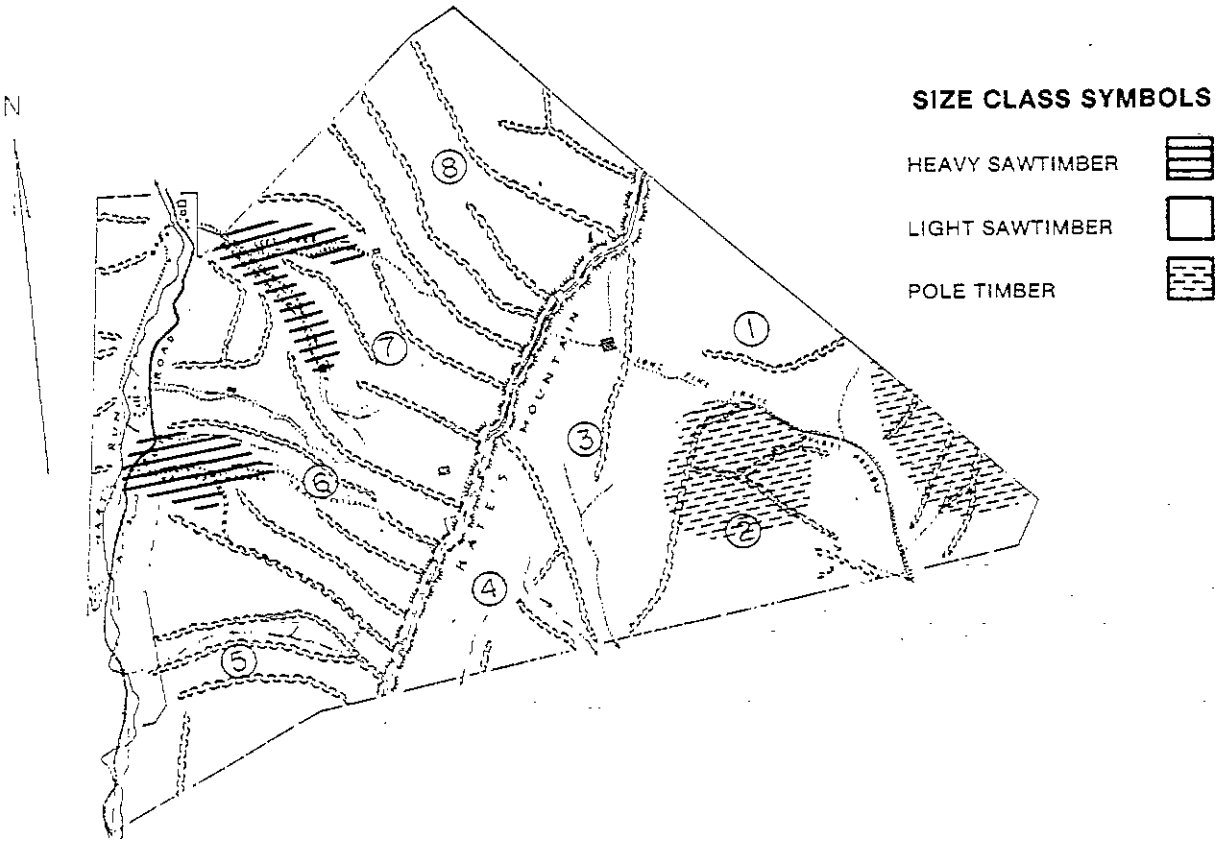
f. **Consider distance from streams.** You should stay at least 25 feet from streams on level ground and stay further away on slopes. It is good to stay at least 100 feet from streams if possible. This means keeping land disturbance (roads and fills) away from streams by providing filterstrip areas between road or landing and the stream to absorb any muddy water which could enter the stream. Trees may be removed from the filterstrip area, but no roads (or landings) should be built in it, except where proper stream crossings are made.



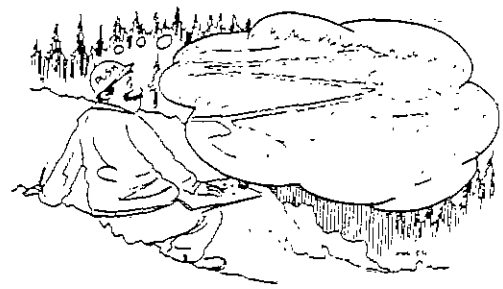
g. **Consider stream crossings.** Cross at a right angle if possible. Construct small bridges or install culverts at live stream crossings and seeps (springs). Roads leading down to a stream crossing should be drained so that water will not run down the road into the stream. Logs should not be skidded through flowing streams.



h. **Consider distribution and volume of timber to be removed.** The more timber that is hauled from an area, the better the road that is needed.



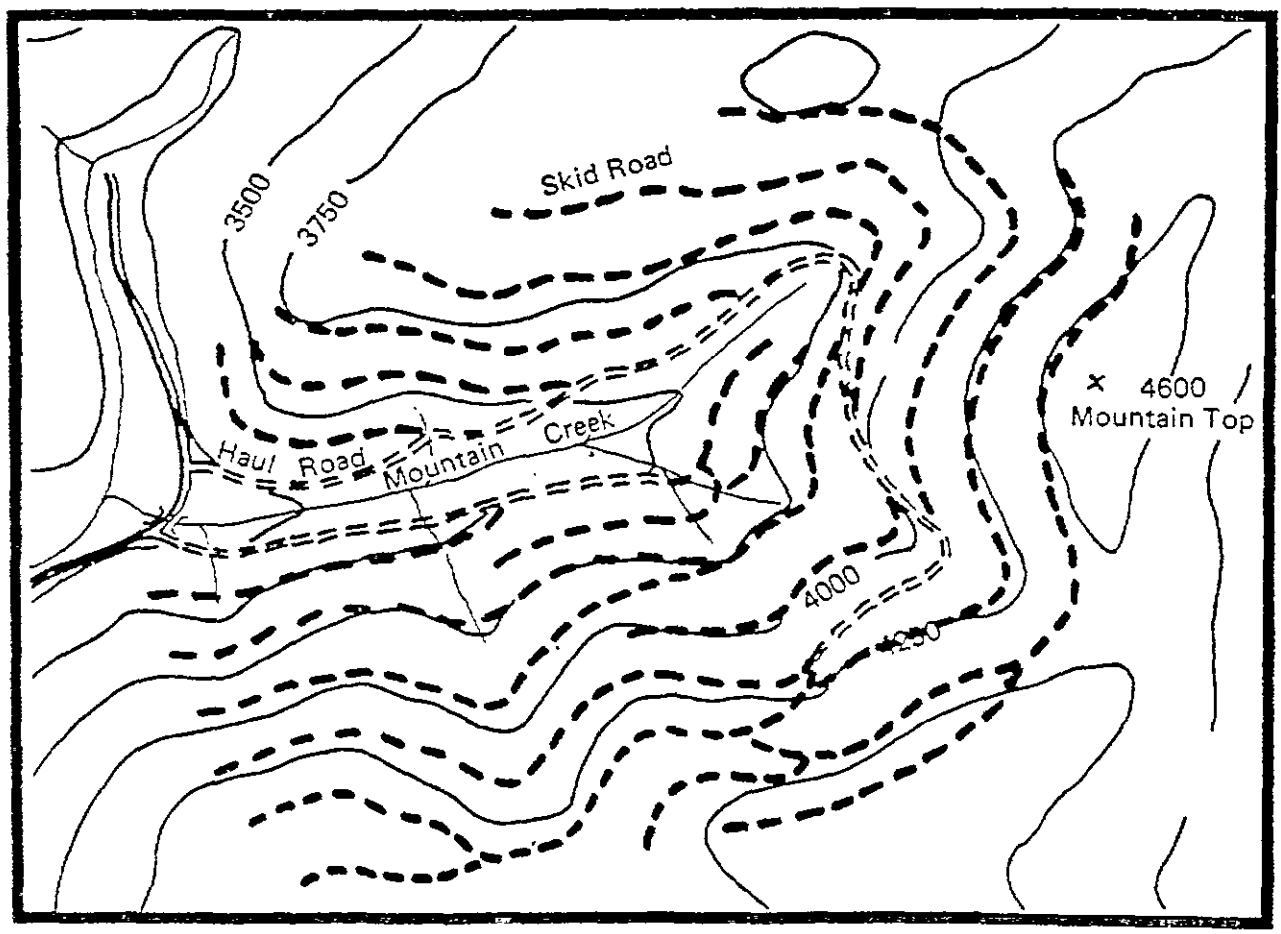
Planning Step #1—Plan on Paper



It may be helpful, especially with large jobs, to locate haul and skid roads on a map. A topographic map works best.

* Draw in proposed haul and skid roads and landings.

* Mark proposed drainage or water control structures: bridges, culverts and dips, outslope or inslope of roads, grade breaks, critical areas to be graveled.

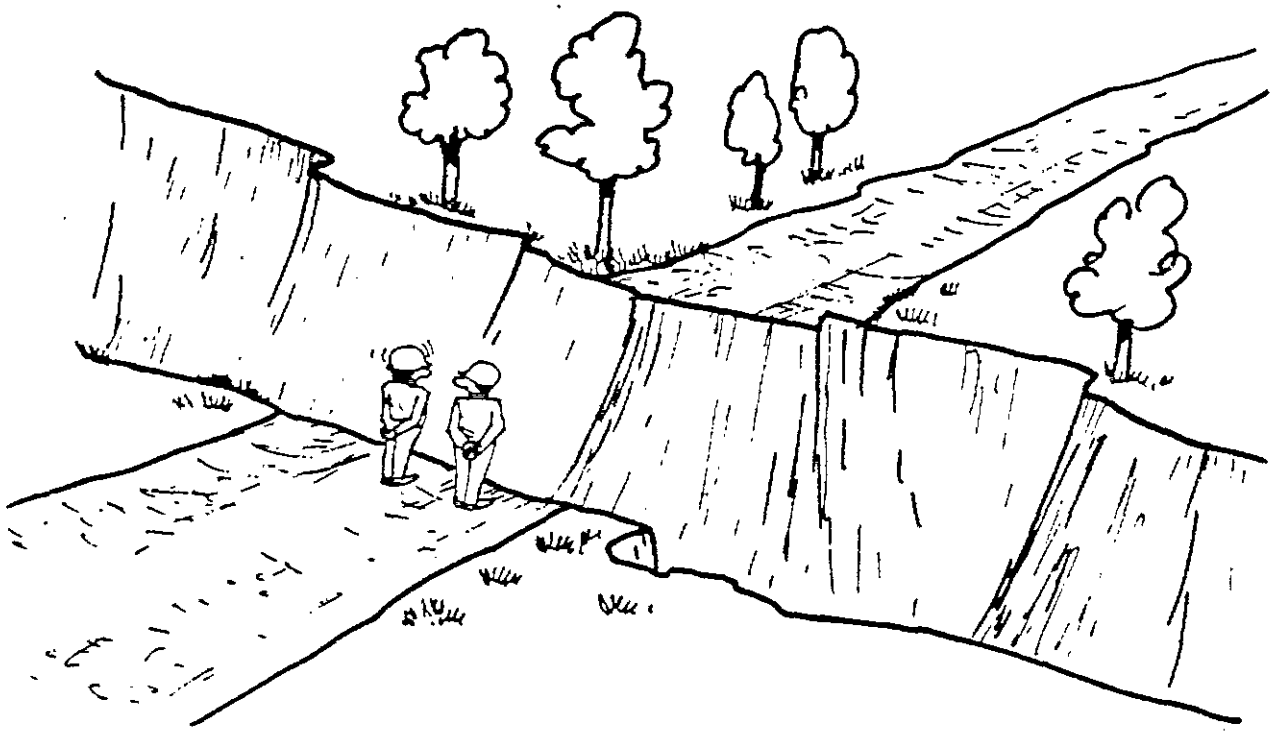


This topographic map shows a logger's plan for his road system. Haul roads are double-dashed lines and main skid roads are single-dashed lines. Numbers on topographic contour lines show elevations in feet.

Planning Step #2—Plan on the Ground

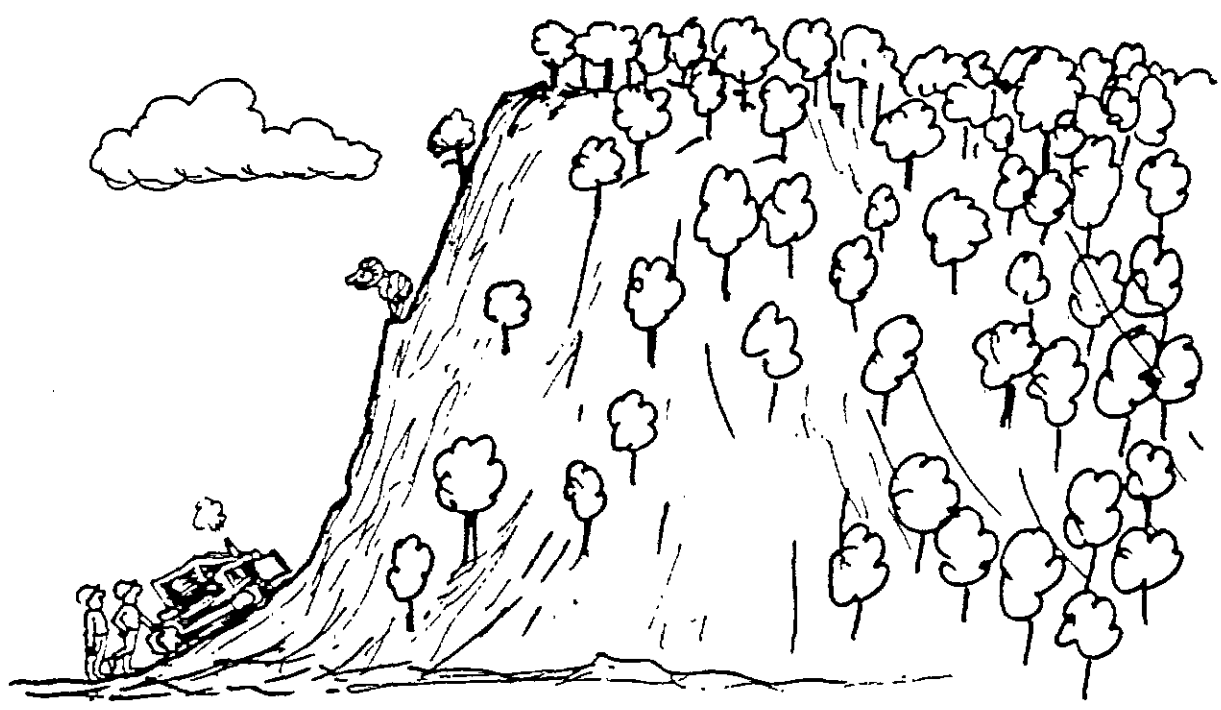
It is very important to locate roads on the ground before construction begins. A Suunto clinometer or Abney level may be helpful in determining grades of roads. A grade meter is provided at the end of this manual.

* Walk entire length of proposed roads. This is very important because it can prevent costly problems later.
* Flag or blaze grade line—it may take several trail runs to get a satisfactory grade. This job is easier after the leaves have fallen.
* Flag proposed drainage structure locations.



"MAYBE WE NEED A BRIDGE."

CONSTRUCTING LOGGING ROADS



"THIS GRADE MAY BE A LITTLE TOO STEEP."

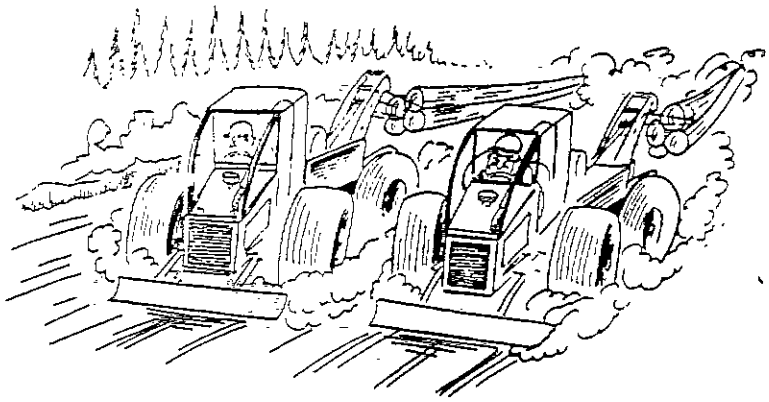
Constructing Logging Roads (and Landings)

1. **Clear right-of-way and daylight where necessary.** Follow flagging or blazes carefully where roads have been marked. Often roadbed construction is done at the same time as clearing.

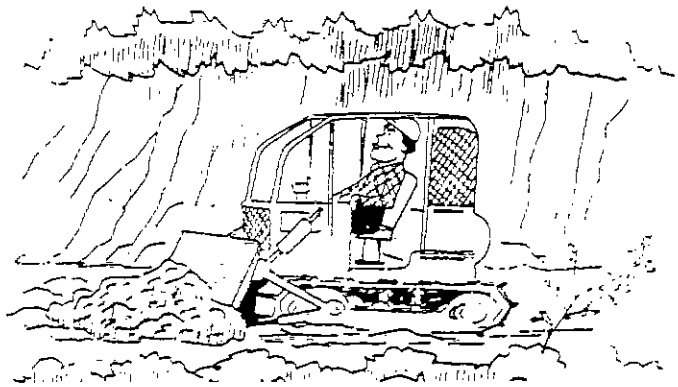
   * Remove merchantable timber/push away standing trees.
   * Push away nonmerchantable trees and brush.
   * Provide for daylighting (removing trees along the road to allow the sun to dry it).

2. **Construct Roadbeds.** Use the greatest care near streams.

   * Control width—use narrowest width road that will do the job safely.



   * Control inslope (or outslope) and ditching for drainage.
   * Maintain temporary water bar during construction on a day-to-day basis in case of a storm.

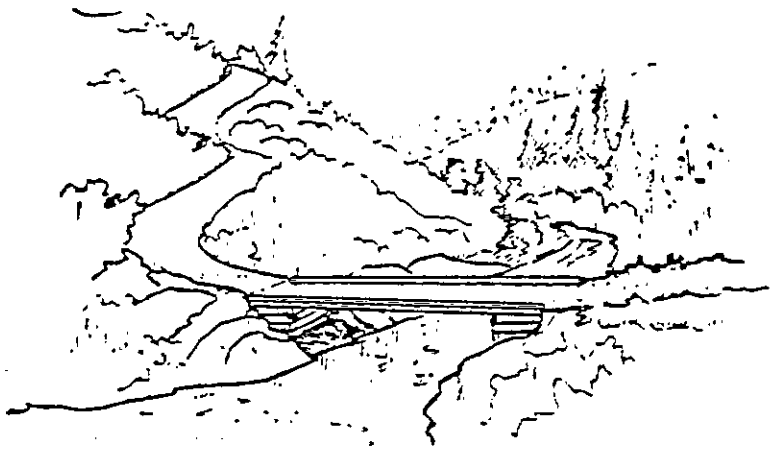


3. **Install drainage structures.** Drainage structures include bridges, outslope or inslope of road, culverts, water bars, dips, grade breaks and log crossings.

Bridges

Use bridges to cross streams that are too big for culverts. Careful consideration should be given to alternate road locations before deciding that a bridge is really necessary to transport timber out of a certain tract of woodland. It may be less expensive in the long run to move the timber in another direction over a longer route rather than to build a bridge. A bridge should not be constructed if a crossing can be made by less expensive means such as a culvert pipe or stable ford.

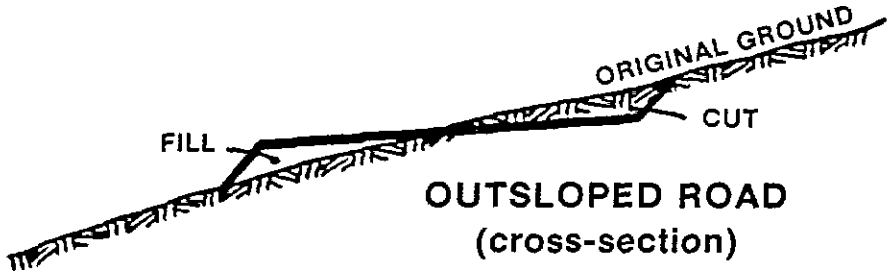
All crossing sites should be selected at right angles to the stream and should not interfere with natural stream flow. Roads should climb away from stream crossings in both directions to prevent high water from running down roads. Streams permitted to overflow onto logging roads can wash tremendous quantities of mud into the streams in a very short time. Open-top culverts or dips on both sides of the crossing site will divert road runoff into filterstrips and prevent dirty water from running directly off roads into streams. Open-topped culverts are not generally recommended.



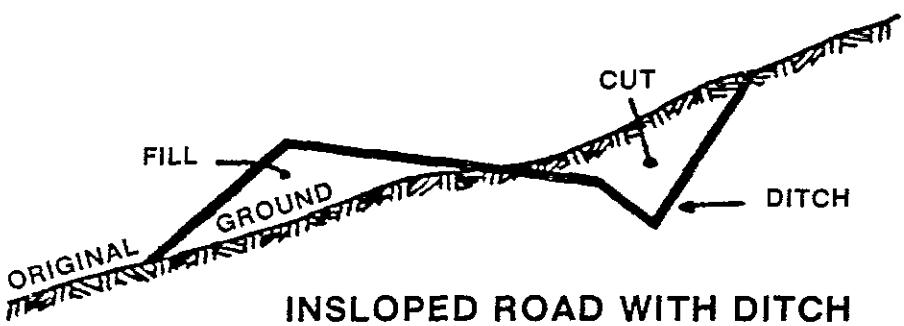
Outslope or Inslope of Road

Outsloping the entire width of the road toward the fill bank provides good surface drainage and may reduce the number of culverts needed, and hence reduce the construction costs. The outslope should be only enough to divert the water, generally ¼-⅜ inch to the foot. If the slope is apparent to the eye, it is usually too great. A road should not be outsloped in steep country. Truck travel becomes hazardous under such conditions.

Insloping the road toward the cut bank may be done to prevent erosion or as a safety precaution. An insloped road requires the installation of culverts or stable dips to remove water from the road.



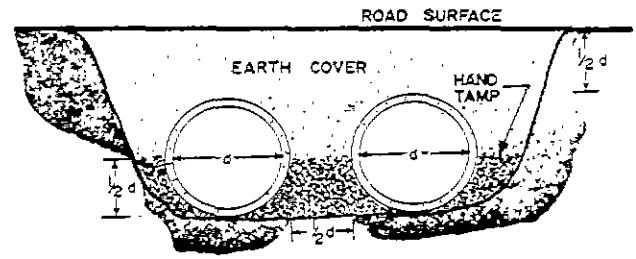
OUTSLOPED ROAD
(cross-section)



INSLOPED ROAD WITH DITCH
(cross-section)

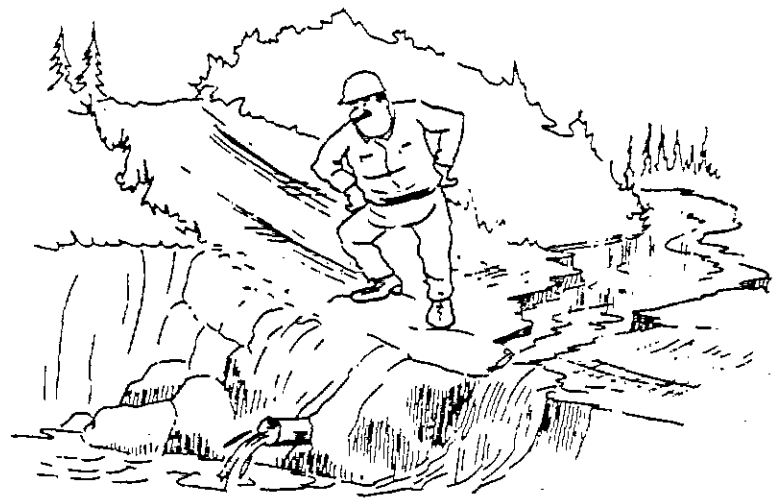
Culverts

Culverts are the most commonly used road drainage structures and are also used for crossing small streams. Culverts used on logging roads are made of corrugated steel, used natural gas pipe, corrugated aluminum, lumber, plastic concrete or hollow logs. Hollow logs should not be considered as permanent structures and must be removed when the road is retired.

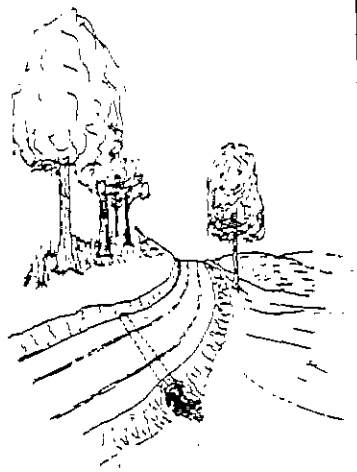


Culvert Installation. Earth (not rock) should be hand-tamped at least halfway up the side of the pipe. Space between pipes in a multiple culvert should be half the pipe diameter. The earth cover over pipes should also be half the culvert diameter in depth, but not less than 1 foot. The larger the culvert the more care required to install it. Heavy steel natural gas pipe is often installed and then pulled up when the logging is finished. This pipe is very strong and can be handled with less care than other kinds of pipe.

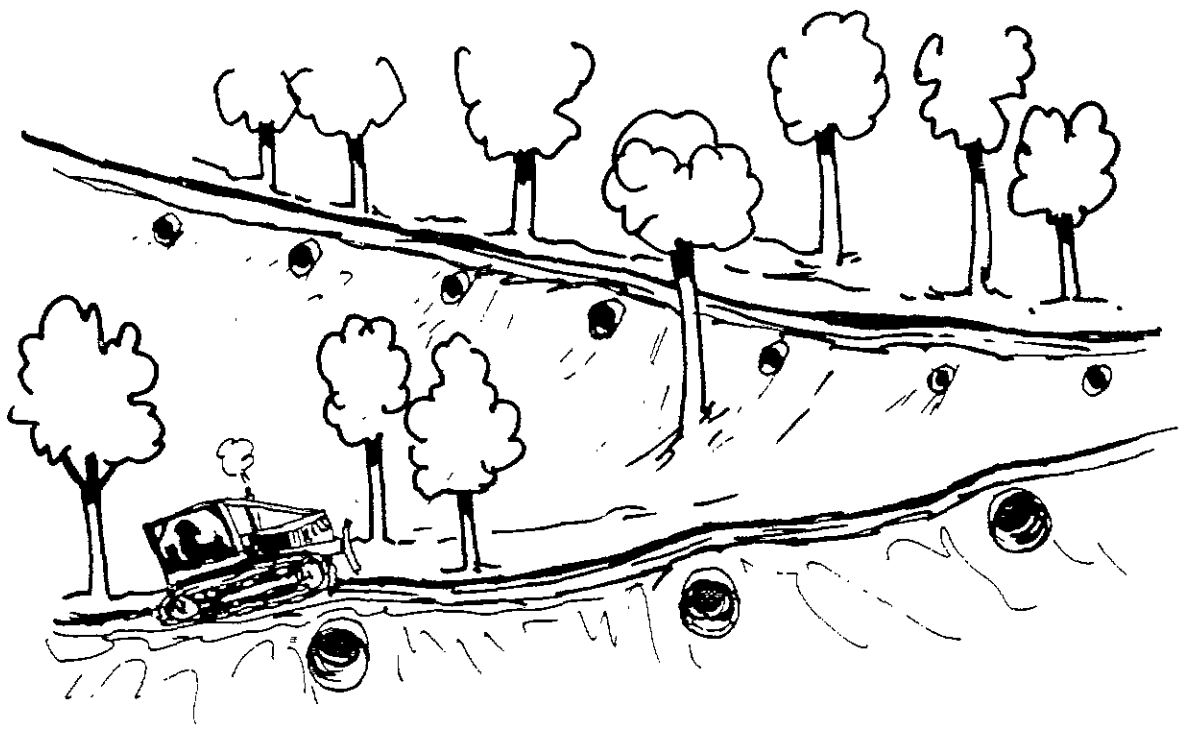
Normally, a culvert is placed on a 2-4 percent grade to prevent clogging. The outlet end of a culvert should be placed at or below the toe of the fill, and an apron of rock or other material should be provided for the outflow to spill on. The culvert should be large enough to handle the water flowing in a heavy rain.



Ditch relief culverts are used to move water under the road before the flow gains sufficient volume or head to erode the ditch. On an 8-10 percent grade, the culverts should be spaced 200-300 feet apart; on a 4 percent grade, about 325 feet apart is sufficient. These figures will vary locally, depending on type of soil, amount of rainfall, and width of road. Ditch relief culverts should cross the road at about a 30-degree angle (culvert outlet downgrade about half the road width) to make water enter the upper end more easily.



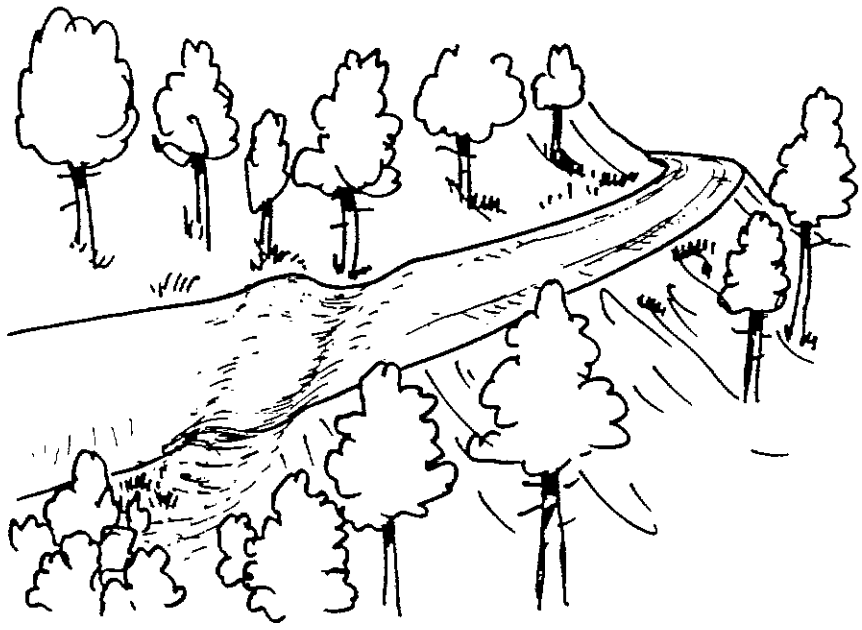
If you expect to continue use of the road after completion of the immediate logging job, it is more economical to install drainage structures of metal or concrete pipe. This will avoid costly maintenance and early replacement of temporary culverts.



"I WONDER IF WE PUT IN ENOUGH CULVERTS?"

Water Bars or Shallow Drainage Dips

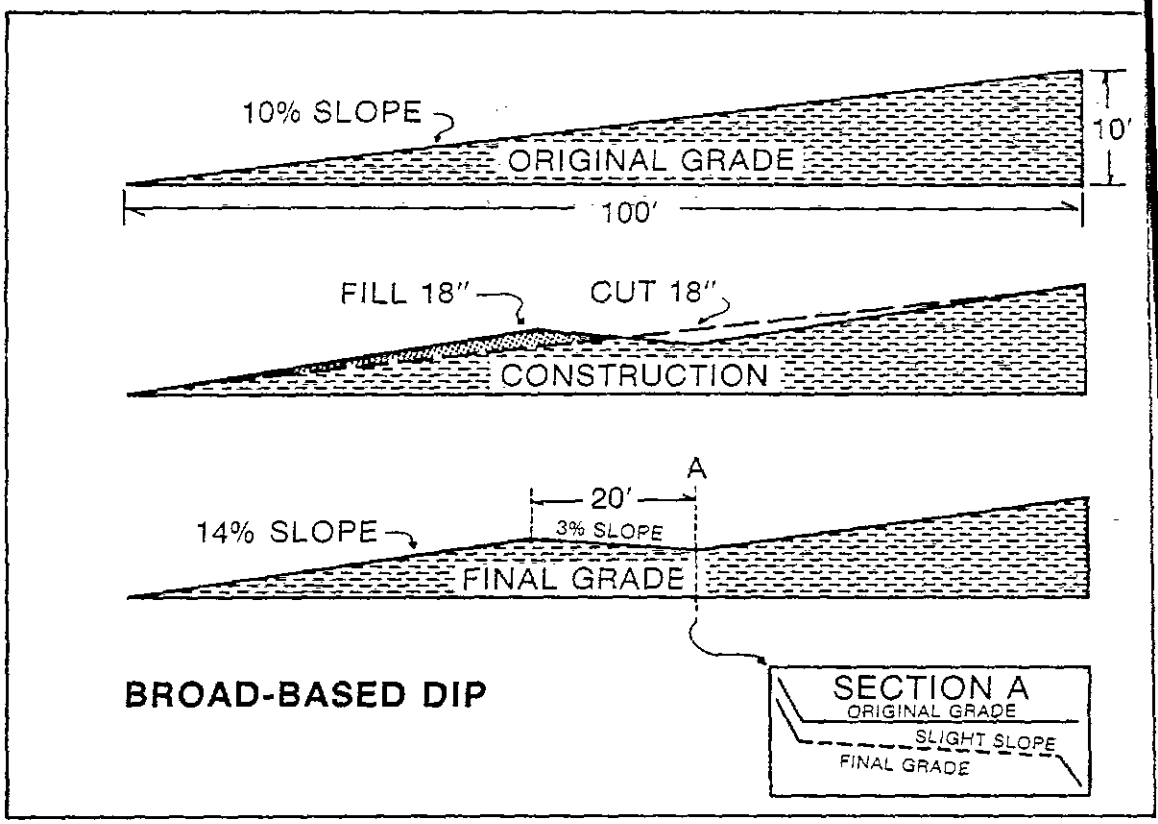
Earth water bars are frequently used on logging roads. These should be placed at an angle to make water flow from the cut bank to the outside of the road and into the leaves and plants on the ground. Rocks or brush may be placed outside the lower end to help slow the flow of water.



It is difficult to properly maintain water bars on skid roads during active logging. These structures are best used to retire roads. The larger broad-based dips and grade breaks are more practical on active skid roads.

Broad-based dips

A frequently used drainage structure on logging roads is the broad-based dip. This is a carefully outsloped section of road which acts as a water catchment and drainage channel. It must be constructed accurately. Length and depth must be adequate to provide drainage, yet not excessive to endanger traffic at normal speeds. Dips should not be installed to handle live (constantly running) streams.



BROAD-BASED DIP

A broad-based drainage dip is constructed by building a 20-foot long, 3-percent reverse grade into the existing roadbed.

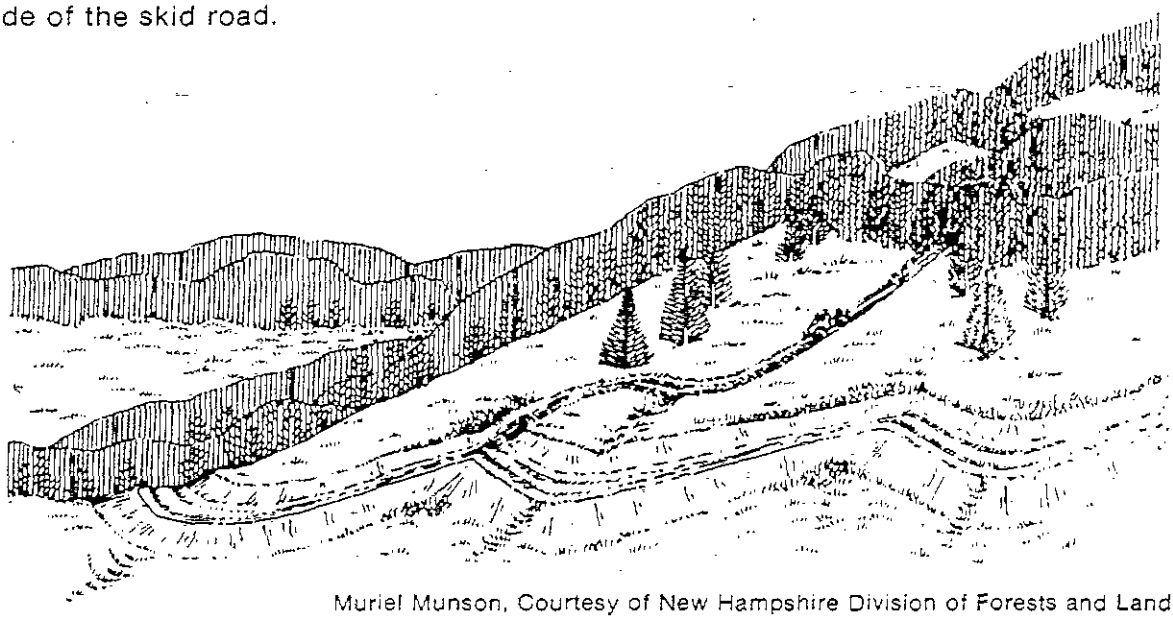
You can use broad-based dips instead of culverts for cross drainage where no streams are present. They can be used effectively on both skid and truck roads when road grades do not exceed 10 percent. Broad-based dips do not increase wear on vehicles or reduce hauling speed when properly installed, and they have the added advantage of providing erosion control, even after intensive use, without much additional work. In addition, you don't have to install water bars on roads protected with a good system of broad-based dips.

The biggest disadvantage of broad-based dips is that bulldozer operators must receive some preliminary training before they can construct them properly. Broad-based dips are often made too small. A properly constructed broad-based drainage dip should be large enough so that a logging truck can be parked in it.

Because of their many advantages, more broad-based dips should be used on logging roads.

Grade Breaks On Skid Roads

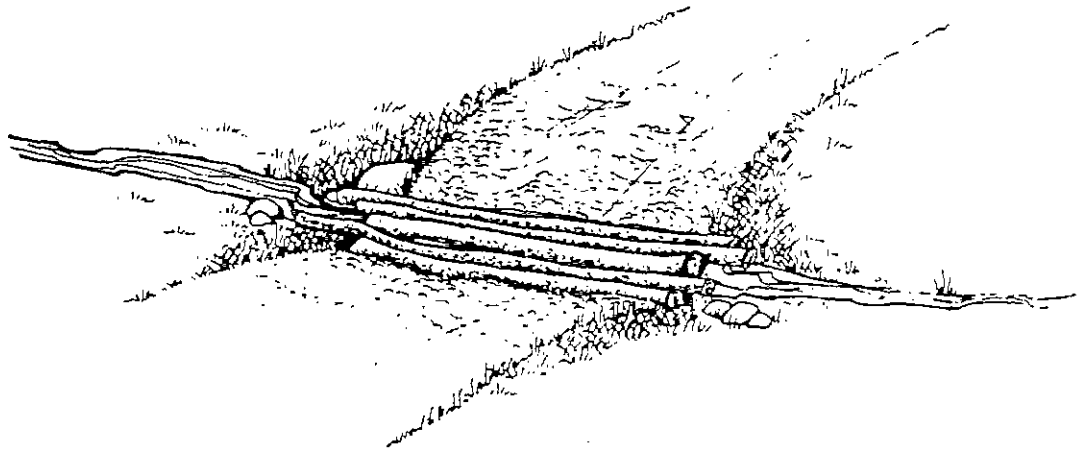
You can take advantage of natural cross drainage by locating skid trails on hillsides and changing (breaking) road grade as the slope changes. Additional drainage can be obtained by turning the skid trail up the hill a few feet, then turning downhill again, where no natural grade breaks exist. By reversing grade in this way, water will run off the downhill side of the skid road.



Muriel Munson, Courtesy of New Hampshire Division of Forests and Lands

Log Crossings of Streams

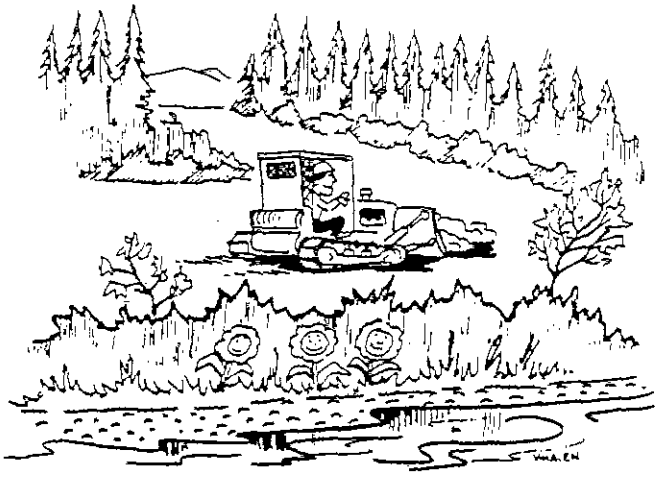
Temporary crossings of **small streams** may be made by placing logs side by side in the stream bed. The logs must be removed immediately after use. Caution should be used with this practice; earth should not be placed on top of the logs or pushed into the stream bed.



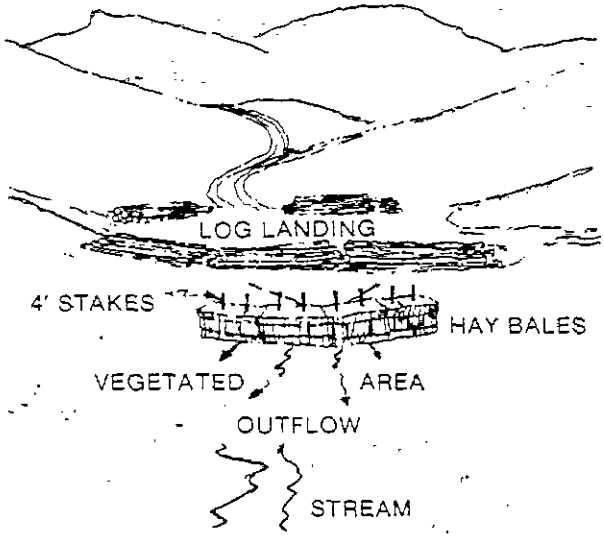
Muriel Munson, Courtesy of New Hampshire Division of Forests and Lands

4. Construct Landings

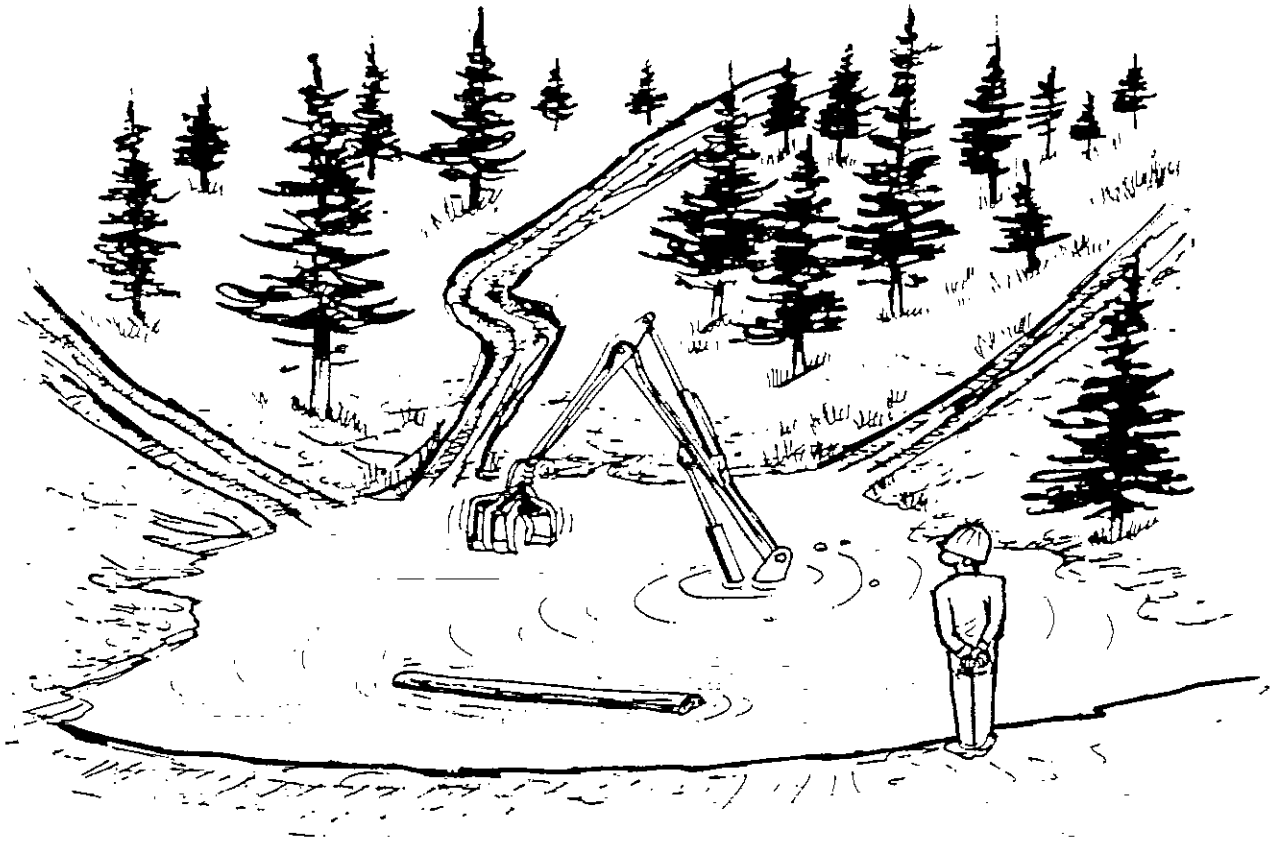
Landings (including spoil and debris) should be placed at least 25 feet away from streams. Placing them 100 feet or more away is better, and locating on dry places like ridgetops or small flats is preferred.



When closer than 25 feet other precautions, such as hay bale barriers between landing and stream, are desirable. The landing surface should have a slight slope to allow for drainage. Drainage dips or culverts should be provided on any approach roads which lead down to the landing, and a diversion ditch is recommended around the uphill side of landings where water would run off a bank into the landing. The idea is to keep water drained off the landing.



Courtesy of Vermont Department of Forests, Parks and Recreation



IT'S IMPORTANT TO PROVIDE DRAINAGE ON LANDINGS

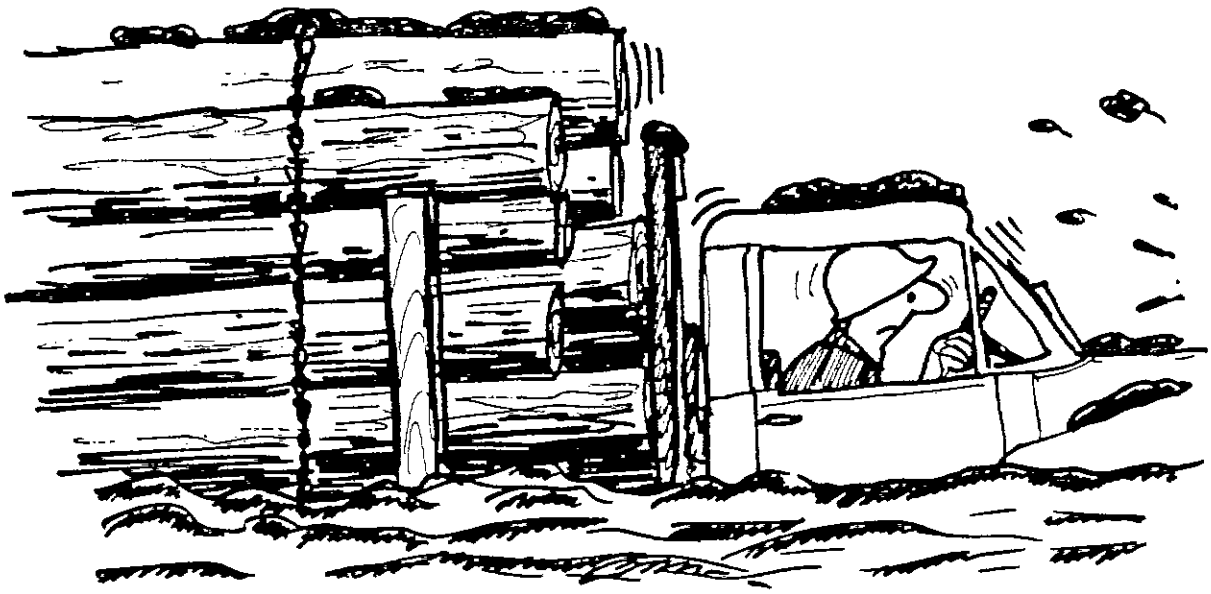
5. **Gravel**

Roads entering onto paved roads should be covered with heavy gravel for about 200 feet to reduce the amount of mud carried onto the highway. Approaches to stream crossings should also be surfaced with gravel to reduce siltation of the stream.

6. **Settling**

If possible, allow newly constructed roads to settle several months before using. This will pack the soil and reduce erosion of the road during logging.

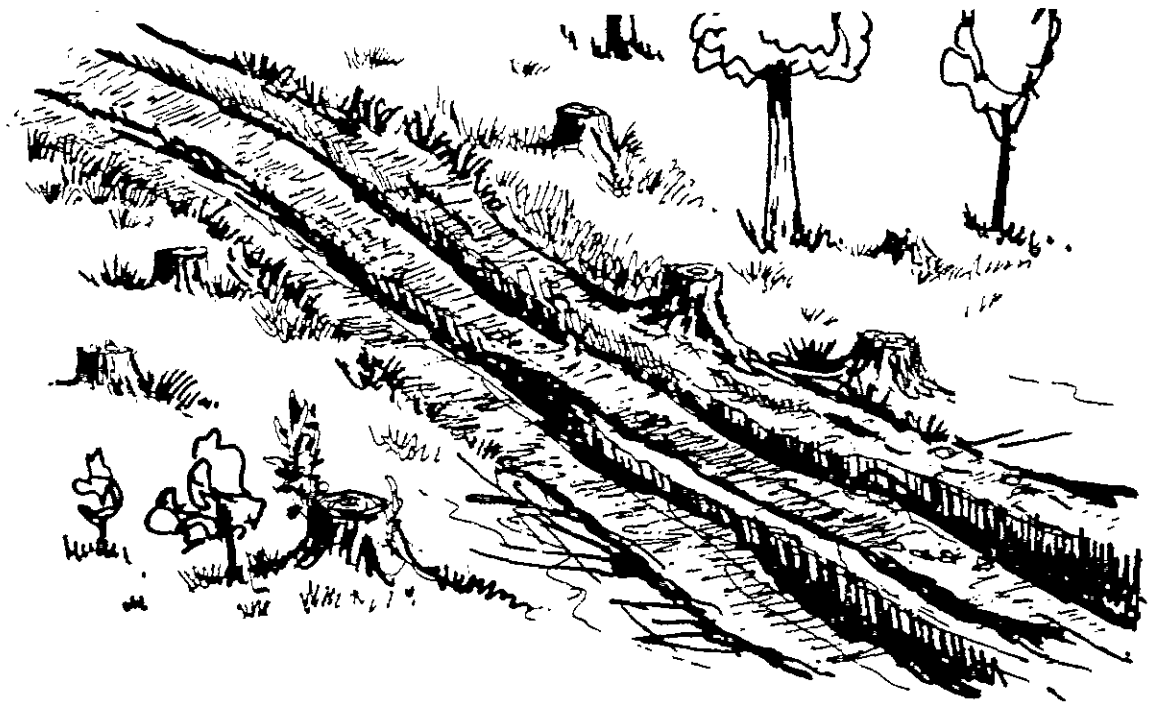
MAINTAINING LOGGING ROADS



"...GUESS I SHOULD HAVE CLEANED THAT CULVERT BEFORE IT RAINED."

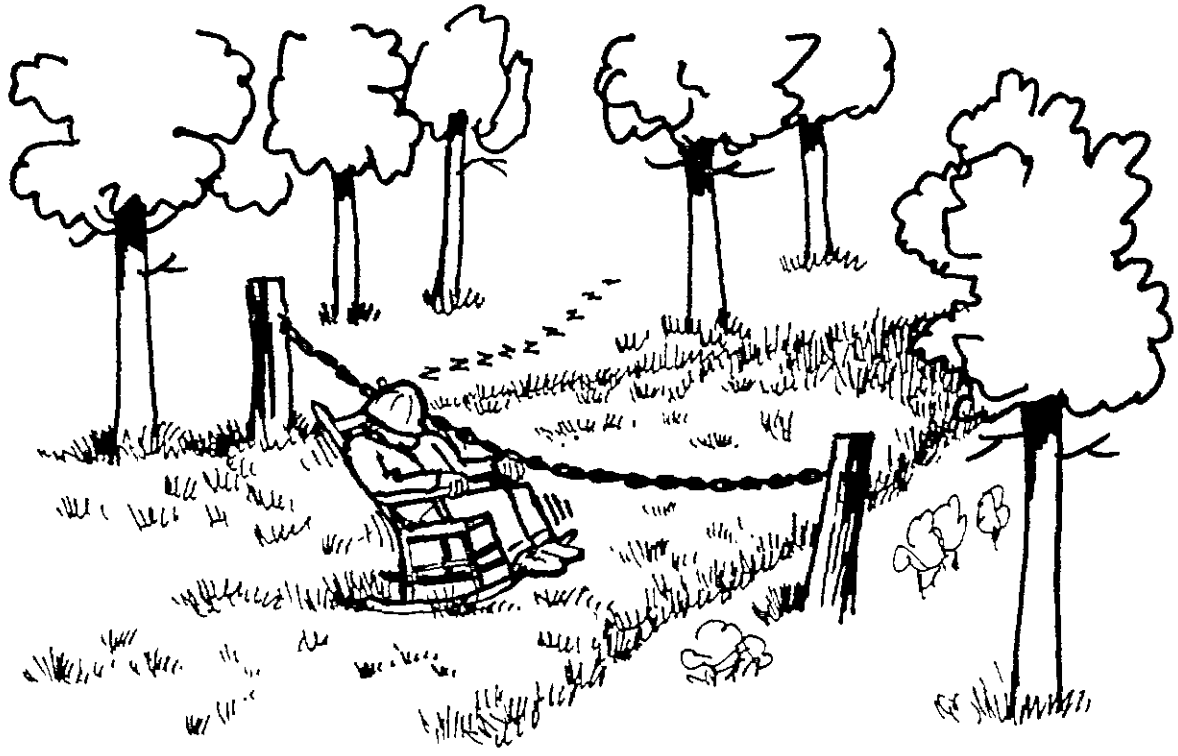
Maintaining Logging Roads (during active operation)

* During the logging operation, roads, ditches, dips and culverts should be maintained to perform properly. If you notice muddy water entering a stream on your logging job, take steps to correct the problem. If all planned BMPs are in place and a pollution problem still exists, a custom solution (such as hay bale barriers or a sediment pond) may have to be designed and constructed. Restrict traffic during unfavorable (wet) weather when possible.



* Regrade periodically to remove deep ruts.
* Do not allow skidding on truck haul roads.
* Inspect drainage structures and water control: clean structures (ditches, dips, culverts, etc.) and install any needed additional measures to limit erosion or improve utility.
* Maintain skid roads during periods of use: Keep the surface water drained off. Maintenance will allow better production. Some operators use the truck driver or anyone else available for filling in holes and cleaning ditch lines and culverts.
* Do not push logging debris from roads or landings toward or into streams.
* Litter such as cans, bottles, old tires, used oil, and equipment should never be put in streams. It should be removed from the job and disposed of properly.
* Tree tops and slash felled into a stream can cause increased stream bank erosion. For this reason it is desirable to use directional felling near streams: fell at a right angle to the stream. When directional felling is not possible, yard the felled tree uphill before delimbing or pull the tops from the stream.

RETIRING LOGGING ROADS



"ME AND MY JOB ARE RETIRED."

Retiring Logging Roads. Logging roads should be retired as soon as they are not needed for removing timber. Do not wait until the whole job is completed.

* Smooth and grade landings and main haul road for drainage, utility and appearance.
* Clean ditches and culverts which are permanent.
* Pull out temporary culverts and bridges and regrade cross-ditch. All natural drainages should flow across, **not down,** the road.
* Plant a cover crop on all exposed soil using lime, fertilizer, mulch and seed such as Kentucky 31 fescue (grass) as needed. As a minimum, seeding should be done on steep roads and banks, **especially near streams.**
* Gate road or use a deep trench to eliminate vehicle access.
* Plan for future maintenance—the cleaning or repairing of water control structures.
* Special steps for skid roads are:

  Install water bars or water-breaks at recommended intervals to provide for proper drainage. Be sure water bar spans the entire road and that the outlet end is open. Removing raised shoulders and outsloping may be used on gentle slopes instead of water bars. Rocks, brush, and logging debris can often be used as water retardants on skid trails.

ASSISTANCE AVAILABLE

Technical assistance is available from the Division of Forestry Service Foresters (listed below) and from consulting foresters on request. Industry foresters will assist when you contract to log with them. These foresters will help you plan your operation to keep mud out of the streams.

DISTRICT I

District Forester
1304 Goose Run Road
Fairmont, WV 26554
366-5880

SERVICE FORESTERS

1304 Goose Run Road
Fairmont, WV 26554
366-5880

P.O. Box 122
Kingwood, WV 26537
329-0184

P.O. Box 447
New Martinsville, WV 26155
455-2771

Rt. 2, Box 321-D
Philippi, WV 26416
457-4555

Rt. 3, Box 201-C
Clarksburg, WV 26301
623-3006

201 Scott Avenue
Morgantown, WV 26505
285-3140

303 Methodist Buildilng
Wheeling, WV 26003
232-8120

DISTRICT II

District Forester
1 Depot Street
Romney, WV 26757
822-4512

SERVICE FORESTERS

P.O. Box 66
Inwood, WV 25428
229-5828

P.O. Box 578
Petersburg, WV 26847
257-4334

P.O. Box 55
Franklin, WV 26807
358-2316

253 Carskadon Lane
Keyser, WV 26726
788-0311

Rt. 1, Box 302
Moorefield, WV 26836
538-2397

P.O. Box 1930
Romney, WV 26757
822-4512

DISTRICT II (Cont'd.)

401 Wilkes Street
Berkeley Springs, WV 25411
258-5481

DISTRICT III

District Forester
P.O. Box 38
French Creek, WV 26218
924-6266

SERVICE FORESTERS

P.O. Box 572
Weston, WV 26452
627-2200

P.O. Box 67
Operations Center
Elkins, WV 26241
636-1767

801 State Street
Gassaway, WV 26624
364-5040

P.O. Box 187
Summersville, WV 26651
872-5069

P.O. Box 372
Webster Springs, WV 26288
847-2935

P.O. Box 38
French Creek, WV 26218
924-6266

Rt. 1, Box 142
Dunmore, WV 24934
799-6151

DISTRICT IV

District Forester
General Delivery
MacArthur, WV 25876
256-6775

SERVICE FORESTERS

477 Ragland Road
Beckley, WV 25801
256-6770

P.O. Box 635
Fayetteville, WV 25840
574-2106

717 N. Jefferson Street
Lewisburg, WV 24901
647-7425

Agriculture Service Center
114 Gott Road
Princeton, WV 24740
487-1406

DISTRICT IV (Cont'd.)

P.O. Box 48
Pineville, WV 24874
732-7487

P.O. Box 125
Panther, WV 24872
938-2392

DISTRICT V

District Forester
P.O. Box 189
Milton, WV 25541
743-6186

SERVICE FORESTERS

P.O. Box 189
Milton, WV 25541
743-6186

State Capitol
Charleston, WV 25305
348-2283

General Delivery
Lakin, WV 25250
675-1820

8116 Dingess Avenue
Hamlin, WV 25523
824-5858

DISTRICT VI

District Forester
2309 Gihon Road
Parkersburg, WV 26101
420-4515

SERVICE FORESTERS

2309 Gihon Road
Parkersburg, WV 26101
420-4515

P.O. Box 556
Ripley, WV 25271
372-3253

P.O. Box 183
Harrisville, WV 26362
643-2520

P.O. Box 47
Middlebourne, WV 26149
758-2512

P.O. Box 52
Spencer, WV 25276
927-2920

P.O. Box 62
West Union, WV 26456
873-2531

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Kochenderfer, J.N. and G.M. Aubertin. 1975. Effects of Mangement Practices on Water Quality and Quantity: Fernow Experimental Forest, West Virginia. USDA Forest Service, Forest Service General Technical Report NE-13, pp. 14 - 24, illus.

Kochenderfer, J.N. and G.W. Wendel. 1980. Costs and Environmental Impacts of Harvesting Timber in Appalachia With a Truck—Mounted Crane. USDA Forest Service, Forest Service Research Paper NE — 456, 8 p. illus.

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U.S. Environmental Protection Agency, **et al.** 1979. Forests Protect Water Quality – The Clean Water Act of 1977. 12 p., illus. Atlanta, Ga.

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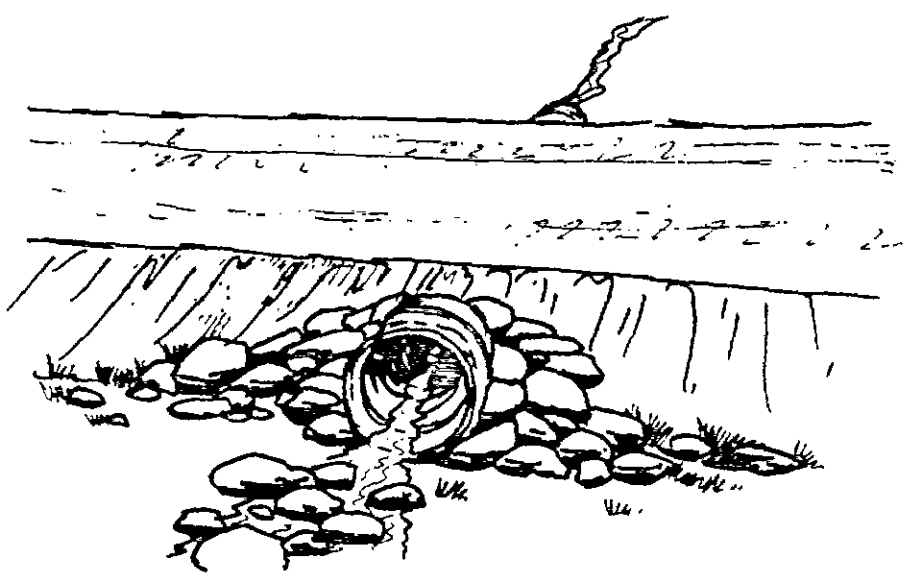


SIGHT ACROSS THIS TOP EDGE TO PERSON OR OBJECT AT YOUR EYE LEVEL

Fold here over edge of plywood or board

GRADE METER

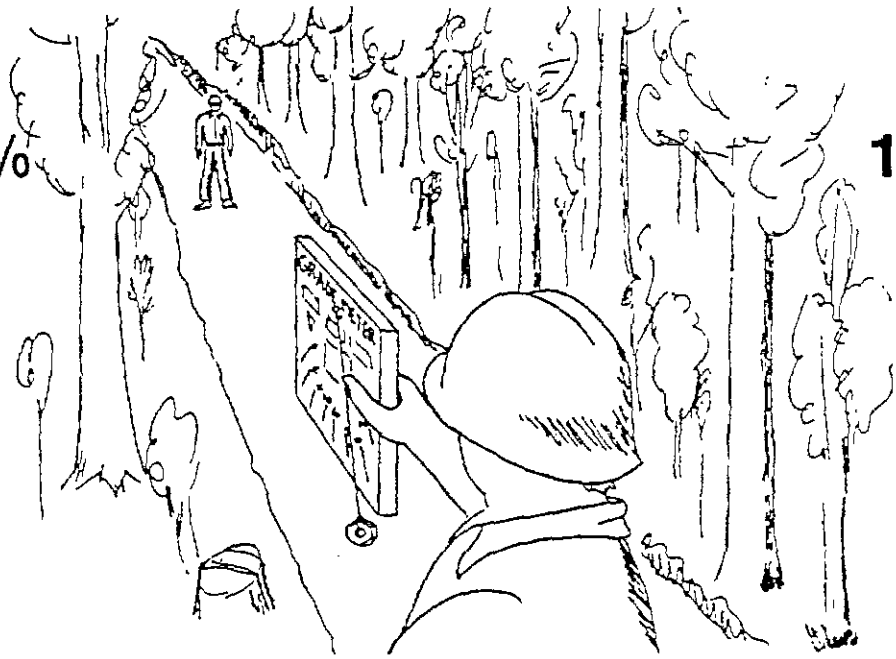
Put tack or nail here and attach string with nut or bolt on end.

DIRECTIONS FOR MAKING THIS GRADE METER

1. Remove this page from the manual
2. Fold over at dotted line
3. Cut plywood or board to size of paper below fold.
4. Put glue over entire back side of paper and attach paper to board.
5. Spray with clear varnish or other waterproofing.
6. Put tack or nail at top center point and attach 15" string with nut or bolt on other end. Make sure string swings around nail.

CLEAN STREAMS & BETTER LOGGING

1. Plan your road system. keep road grades low.
2. Stay away from streams.
3. Use care when you must cross streams.
4. Keep water drained off roads and landings
5. Retire roads as soon as they are not needed.



100% (45°)
90%
80% (39°)
70%
60% (31°)
50% (27°)

100% (45°)
90%
80% (39°)
70%
60% (31°)
50% (27°)

DIRECTIONS FOR USING THIS METER

1. Sight across top edge to person or object at your eye level. Keep the meter vertical so string hangs.
2. When the edge is lined up, hold string against front and read scale of meter for grade (slope) of road or hill.
3. This meter gives a rough measure of grade. For more exact measurement use an Abney level or Suunto clinometer.

LEVEL

40% (22°) 30% (17°) 20% (11°) 10% (6°) 0% (0°) 10% (6°) 20% (11°) 30% (17°) 40% (22°)

SKID ROAD GRADES

HAUL ROAD GRADES

Best Management Practices

Wood Culvert (Open top)—A three-sided wooden trough with cross braces, usually made from 2x8 rough sawn timber and installed at a 30-degree angle downgrade and flush with the road surface to intercept and divert small sources of water from road surfaces.

Diversion Ditch—Any ditch or trench dug to divert water from an area where it is not wanted.

Broad-based Drainage Dip—An earthen water control structure constructed in roadbeds in such a way that vehicles can traverse them. It also intercepts and diverts water from road surfaces.

Filterstrip—A band of minimally disturbed forest floor between a road and a stream which traps sediment and other debris that may be suspended in the water draining from a road surface.

Grade Break—A change in road grade, abrupt or gradual, which collects and diverts water from road surfaces.

Insloped Road—A road slightly sloped (1-3%) in toward the cut bank.

Haul Road—A road constructed to a standard upon which loaded trucks can negotiate safely with reasonable speed.

Landing—A place where trees are bucked and logs are accumulated, sorted, and perhaps scaled prior to loading and hauling to market.

Outsloped Road—A road surface that is slightly canted 1-3 percent to the fill side to permit surface water to drain off the road.

Skid Road—A road for use by wheeled skidders or tractors to move logs from the cutting area to a landing.

Slash Cover—The debris left after logging.

Water Bar—A water control structure constructed across a road, usually from earth, to intercept and divert water from road surfaces.