A METHOD for REGULATING TIMBER HARVEST and ROAD CONSTRUCTION ACTIVITY for WATER QUALITY PROTECTION in NORTHERN CALIFORNIA

VOLUME I

PROCEDURES and METHODS

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CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

ABSTRACT

The report develops a systematic method for assessing, regulating and controlling the impact on water quality by logging, road building and similar land disturbing practices in north coastal California. The report is in two volumes -- Volume I deals with Procedures and Methods. Volume II includes a review of the problem and an annotated bibliography. These summarize much of the legal, administrative and technical material used to prepare the concepts expressed in Volume I.

Volume I examines the land and water resource environment of north coastal California and relates this to the regulatory functions of the regional water quality control board. Legal and administrative authority and options available to the regional board are examined. Proposed field inspection methodology is designed to screen for potential water quality damage. Those areas having a predicted low order of threat would possibly be excluded from intensive follow-up actions.

The report develops the concept of a "critical discharge area". This is defined as land along a waterway that has a high probability for erosion and silt runoff (waste discharge) if the area is disturbed. Using systematic numerical ratings, the regional board would identify "critical discharge areas".

Once minimum critical discharge areas are established, the report suggests a staged "Risk Evaluation System" for proposed logging operations. This system would examine and interpret watershed-stream characteristics and determine the level of risk for a threatening waste discharge. Depending upon the results of this evaluation, the regional board selects appropriate alternatives to protect water courses from the proposed land use activity.

The procedures proposed in this report are new and relatively untried. They represent a departure from conventional field methods for assessing nonpoint source discharges associated with logging and road construction. Field testing should now determine whether the proposed systems are workable or if modifications are necessary.

KEY WORD DESCRIPTORS

California, North Coastal, logging and road construction, damage to water quality, administrative control procedures, water pollution control.

April 30, 1973

Mr. Bill B. Dendy
Executive Officer
State Water Resources Control Board
1416 Ninth Street
Sacramento, California 95814

Dear Mr. Dendy:

We are submitting herewith the final report of the study to develop the guidelines and methods necessary to assess impacts of logging practices on the aquatic environment of North Coastal California. The report was done by Jones & Stokes Associates, Inc., in association with J. B. Gilbert Associates and Professor Ray B. Krone per Standard Agreement No. 1-5-018.

This report consists of: Volume I - Procedures and Methods, and Volume II - Review of Problem and Annotated Bibliography. Fifty Xerox copies of Volume I and camera-ready copies of both Volumes I and II are herewith transmitted.

The procedures and methods proposed in this report are new and relatively untried. They represent a departure from the historic way of dealing with the non-point waste discharge associated with logging and road construction. Because this is a pioneering effort, we foresee a need for considerable testing and perhaps modification of the proposed system. Testing and modification may be done through use of the system during its early implementation stages.

It is our intent that these reports be accepted as fulfillment of our contractual obligation to the State Water Resources Control Board.

Please contact us if clarification is needed on any facet of the report.

Sincerely,

Robert L. Jones

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PREFACE

On June 30, 1972, the California State Water Resources Control Board contracted with Jones & Stokes Associates, Inc., to develop methods for assessing, regulating and controlling the impact of logging practices on water quality in North Coastal California. The study was done in association with J. B. Gilbert Associates and Professor Ray B. Krone of the University of California at Davis.

We wish to acknowledge the cooperation of many state and federal agencies throughout the western United States in providing information necessary for this study. Special thanks are due Robert H. Lewis and Gilbert Fraga of the Division of Planning and Research of the State Water Resources Control Board and Dr. David C. Joseph and the staff of the North Coast Regional Water Quality Control Board.

Assistance in review of the draft report was provided, in addition to those listed above, by the California Department of Conservation, the California Region of the U.S. Forest Service and by the California Forest Protective Association.

Dr. Charles Hazel of Jones & Stokes Associates, Inc., served as project leader with the assistance of John Baker and Joseph Holmberg. Jerome B. Gilbert and James Wernicke of J. B. Gilbert Associates and Dr. Ray B. Krone prepared sections of the report and provided guidance in project planning, review and editing.

This report fulfills the terms of Standard Agreement No. 1–5–018 between the State Water Resources Control Board and Jones & Stokes Associates, Inc.

Printing and distribution of this report as Publication No. 50 was authorized by the State Board on June 21, 1973.

The findings reported herein are those of the contractor and do not necessarily reflect the opinion or policies of the State Water Resources Control Board.

SUMMARY

This report is in two volumes -- Procedures and Methods, and Review of Problem with an Annotated Bibliography.

The Procedures and Methods volume initially examines the environment of North Coastal California and relates it to the regulatory problems of the Regional Water Quality Control Board (RWQCB). Legal and administrative authority and options available to the North Coast Regional Water Quality Control Board are examined. An administrative procedure is presented which reviews notices of intent for logging and road construction activities and evaluates their potential for causing discharges of earthen or organic material into waterways.

The concept of a "Critical Discharge Area" (CDA) is defined and methods for its determination and use are described. The CDA is land along a waterway, that inherently has a high probability for waste discharge if the area is disturbed. Such discharge or threat of discharge would be in violation of RWQCB policy. The minimum or basic discharge area is defined as the projected 100 year flood plain or the flood plain defined by the highest observable water mark on the bank. Additional increments may be added to the basic CDA that increase its width in response to environmental or operating conditions.

The procedures of a two-phased Risk Evaluation System are described. This system examines and interprets watershed and stream characteristics and determines the level of risk for a threatened waste discharge. Based on level of risk and the assignment of a "Risk Class", additional width may be added to the basic Critical Discharge Area. The recommended procedures are:

Stage I - Copy of Notice of Timber Operations and Fish and Game 1601 and 1602 forms goes to Water Quality Control Board in advance of start of operations.

Stage II (Initial Risk Analysis) - Regional Board makes an analysis of risk to water quality on proposed timber operation. In this Initial Risk Analysis the relative hazard to water quality is analyzed on a scale of 1 to 20 for each of 5 categories:

Beneficial use of water for fishery
Beneficial use of water for other than fishery
Erosive hazard of soil
Existing land use classifications-such as wild river
Type of activity-such as clear cutting or road building

The summation of the points in each category determines if the Detailed Risk Analysis of Stage IV is needed.

A total of 40 points for an operation on a permanent stream, and 60 points for one on an intermittent stream, requires a Detailed Risk Analysis.

Regardless of point total, however, a Detailed Risk Analysis may be required if any of the following criteria are met:

- Direct municipal water withdrawal within 1 mile downstream.
- Critical anadromous fish spawning area within the zone of influence of the operation as defined by the Department of Fish and Game.
- Very highly erosive soils with more than 50% of dominant cover removal on slopes 45% or greater.
- Classification as a State or Federal Wild, Scenic or Recreational River.
- Tractor yarding on slopes greater than 45%.
- Road construction on slopes greater than 60%.
- Land conversion within the Minimum Critical Discharge Area.
- Proposed operation in designated Critical Discharge Area.

Critical Discharge Areas would be designated along all streams as defined. The minimum extent of the Critical Discharge Area would be to the high water mark of the 100-year flood or the highest observed water line. Activities within this area would be done only according to a plan which convinces the water board that a threatened waste discharge does not exist. The width of the Critical Discharge Area may be extended farther up the slope if the Detailed Risk Analysis of Stage IV shows additional potential hazard to water quality.

If after the Initial Analysis the staff determines that no additional report is necessary, it will provide the operator with notice to proceed with his activity. A period of ten working days is proposed for this review.

Stage III - In cases where a Detailed Risk Analysis is indicated, the operator would be requested to submit a "Report of Waste Discharge" within 10 working days.

Stage IV (Detailed Risk Analysis) - When the Report of Waste Discharge is returned to the Regional Water Quality Control Board, a detailed analysis of anticipated risk to water quality would be made of the operating area.

Twenty-nine different parameters are considered:

- Physical characteristics of the stream such as width and gradient.
- Physical characteristics of the watershed such as rainfall, erosive hazard of soil, slope and cover.
- Water quality characteristics such as temperature and turbidity.
- Aesthetic and recreational characteristics such as fishing and swimming.
- Proposed activity such as type of logging, distance to stream, road cuts and fills, surface exposure expected.
- Considerations requiring protection such as fishery and wild river.

A point scale of 1 to 10 is used for each parameter, with the total points then divided by the number of parameters. This produces a risk class of I, II, III and IV for each operation. Risk classes of I, II, and III would require a wider Critical Discharge Area. For example, a high risk I operation on a permanent stream would require an additional 100 feet on each side of the stream for the Critical Discharge Area. It is anticipated that the Detailed Risk Analysis by the Regional Board would require 20 days, except in situations which may require the setting of Waste Discharge Requirements.

Stage V - The conduct of the approved operation.

Stage VI - Monitoring and surveillance of approved logging and road construction operations to assure compliance with the Board's prohibitions.

CHAPTER I

INTRODUCTION

General

On June 30, 1972, the State Water Resources Control Board contracted with Jones & Stokes Associates, Inc., to develop methods for assessing the impact of logging and road construction practices on the aquatic environment in North Coastal California. Portions of the study were undertaken with the assistance of J. B. Gilbert and Associates and Professor Ray B. Krone.

The study was divided into two basic work efforts. The principal effort was to develop administrative and survey methods which could be used by the state to control and regulate logging and road construction operations to assure that water quality would not be adversely affected. These methods are to be implementable with the least effort on the part of either the state or the logging and road construction industry and within the authority provided in the Porter-Cologne Act. This phase of the project constitutes Volume I of this report. The second was to review literature in the technical and legal-administrative fields to determine the extent of adverse water quality effects caused by logging and road construction operations, and the regulatory practices and procedures used by the federal government, by other states, and by other state agencies within California. The results of this review and an annotated bibliography appear as Volume II of this report.

It is important to note that the scope of the contractor's work is based on the assumption that there are some unreasonable adverse effects on water quality resulting from current logging and road construction activities in the North Coast, and that to the greatest extent possible, these effects should be reduced through the activities of the California Regional Water Quality Control Board, North Coast Region (RWQCB).

It is generally recognized that it would be best to regulate forest land uses through a comprehensive program that can account for the total watershed problem -- problems of water quality, air quality, aesthetics, timber production, logging techniques and transportation problems. Such a comprehensive approach to the regulation of logging activities is not in operation in California, although several proposals are pending before the Legislature. A

comprehensive forest practices act could lead to simplified administrative procedures and better coordination of the activities of such agencies as the Department of Fish and Game, the Division of Forestry, the Regional Water Quality Control Board, and other interested agencies. However, the Legislature has made it clear that the responsibility for protecting water quality rests with the State and Regional Water Quality Control Boards. Consequently, activities affecting streams remain in the purview of the RWQCB.

Information gathered and summarized in Volume II served as a basis for the development of the administrative, investigative and evaluation methods presented in Volume I. Volume I, after extensive testing by the RWQCB could be made into a manual of operation. CHAPTERS IV through VII serve this purpose in this report. This manual should outline the administrative and risk evaluation and classification procedures to be used by the regional board staff, both in evaluating the potential impact of a proposed logging or road construction operation and in establishing methods to assure compliance with water quality regulations during the operation itself.

Overview of Problem

The forests of the North Coast are a major part of California's natural resource heritage. These forests serve as a source of supply for badly needed forest products and have immense economic benefit to both the North Coast region and the state. They are often exploited for the single purpose of timber production to the detriment of other beneficial uses. However, society is developing a greater appreciation for the value of long-term resource productivity and protection as opposed to the value of short-term economic benefits. Increasing concern for the immediate protection of fishery resources, aesthetic factors and water supplies, as well as an increasing concern for long-range factors, are reflected in changing regulations in the field of water quality and proposed regulations in the field of land use at national, state and regional levels.

The harvesting of timber on lands bordering watercourses may degrade water quality. Exposing a stream to the sky by removing the forest canopy alters stream temperatures to the detriment of trout and salmon. Disturbance of soils increases erosion and muddies streams. The alteration of surface drainages may concentrate flows causing large gullies during rain storms. The environmental relations between logging, road construction and degradation of water quality are manifest particularly when overt

consequences of some operations are viewed by persons driving through the North Coast area. General associations between protected beneficial uses and water quality characteristics are shown in Table 1.

Although it would mean an adjustment on the part of industry to greater levels of restriction, we believe that it is possible for industry and government to work together in an effective forest and water quality management program -- one that would provide protection for the productive capability of our forest as well as provide for the short and long-term protection of water quality and in-stream resources. It is our aim in this study to recommend a regulatory program that would be both effective and efficient and that recognizes that water quality regulations should dovetail with other governmental regulation of resource management programs.

Recognizing the sources of many water quality problems, the State Water Resources Control Board adopted prohibitions against the discharge or threatened discharge to streams or watercourses of wastes normally associated with logging and road construction operations (Appendix A). Implementation of the prohibitions was left to the North Coastal Regional Water Quality Control Board pursuant to Water Code Section 13267(b), and the Regional Board adopted initial guidelines for this purpose (Appendix B). Procedures and potential actions implied by their guidelines were subsequently incorporated in the objectives of this study. Because of the non-point nature of the waste discharge, a central issue relates to the discovery of threatened and actual discharges detrimental to protected beneficial uses of water so that these discharges may be prevented or corrected under the authority of the law. Inherent to the issue is the discovery of threatened discharges since the prevention of detrimental waste discharges is the only reliable way to protect other beneficial uses of water. The concepts that follow were predicated on the idea that prevention is the only practical way to approach regulation of waste discharge from logging and construction activities. Thus, identification of the threatened discharge sets the pattern for the following sections of this report.

Approach

Preliminary planning for the project coincided with a review of pertinent technical, legal and administrative information (see Volume II). It was assumed that Regional Board office review of "notices of intent" would have to suffice for the majority of operations while a Report of Waste Discharge and more detailed evaluation would be applied to some lesser number but potentially most damaging operations. Expectedly, this number will amount to less than 10 percent of all operations.

ASSOCIATION BETWEEN BENEFICIAL USES TO BE PROTECTED AND ALTERATIONS TO WATER QUALITY BY LOGGING AND ROAD CONSTRUCTION

Affected Water Quality Feature	Freshwater Beneficial Use to be Protected[1/]										
	Municipal and domestic	Agriculture	Industrial	Scientific study	Aesthetic enjoyment	Hydroelectric power	Freshwater habitat	Groundwater recharge	Fish spawning	Fish migration	Recreation
Color	+	-	-	-	+	-	+	o	-	-	+
Suspended Solids	+	+	+	o	+	o	+	-	-	o	+
Bottom Deposits	-	-	-	o	o	-	+	-	+	-	+
Floatables	+	+	+	o	+	o	o	-	-	-	+
Biostimulants	+	-	o	o	o	o	+	o	o	-	+
Toxicants	+	o	o	+	o	-	+	o	+	+	+
Total Dissolved Solids	o	o	o	o	-	-	o	+	-	-	o
Dissolved Oxygen	o	o	o	+	+	-	+	o	+	+	+
pH	o	o	o	+	+	o	+	o	+	+	+
Temperature	o	o	o	o	o	o	+	-	+	+	o

\+ Major effect
o Discernible effect
\- No discernible effect
1/ As recognized by California Regional Water Quality Control Board - North Coast Region (1971a, 1971b).

4. To anticipate new regulations and regulatory requirements which may arise as a result of pending forest practice legislation.

5. To seek to avoid duplication of effort between agencies, and make maximum use of existing reporting procedures of other agencies such as the Department of Fish and Game and the Division of Forestry.

6. To provide for advance notice to the regional board of all logging and road construction operations, but avoid causing lengthy delays in the commencement of such operations.

7. To permit the regional board's authority to be selectively used to provide a balanced approach to the regulation of waste discharges from logging and road construction operations.

The foregoing objectives can best be implemented through an approach that includes the following:

1. The establishment of prohibitions for defined critical discharge areas adjacent to streams, with the inclusion of guideline provisions for exceptions in cases where a discharger can demonstrate that his activities will not adversely affect water quality.

2. The development of provisions for obtaining advance information on all logging and road construction operations so that they can be screened to select those which would require reports of waste discharge.

3. A monitoring and technical report system which emphasizes the need for surveillance on those logging and road construction operations most likely to create risks to water quality.

4. The selective use of waste discharge requirements in situations where operations would create unreasonable risks to water quality.

5. A selective inspection system which would emphasize major operations and operations located in critical areas in order to place them under additional controls when necessary.

The foregoing objectives should be implemented through a two-pronged approach. Basically, a procedure was developed for obtaining advance information on all operations so that a minimum Critical Discharge Area could be designated and the operations screened to select those that require detailed evaluation and possibly RWQCB action. Secondly, a method based on judgment evaluations is described that permits screening and technical evaluation of operations to discover those that potentially violate RWQCB waste discharge prohibitions. The end product of the technical evaluation is the establishment of an enlarged Critical Discharge Area which reflects the magnitude of potential risk for violation of waste discharge prohibitions. In these locations logging and road construction operations must be curtailed to a level that satisfies the RWQCB that discharge or threat of discharge does not take place. This may be done through submission of a satisfactory logging plan. If deemed necessary to protect water quality from deleterious effects the RWQCB may establish waste discharge requirements including monitoring and surveillance programs.

This report presents a pioneering effort for controlling non-point source sedimentation from logging and road construction operation. Extensive testing by the RWQCB will be necessary to ascertain the effectiveness of the proposed system in reducing logging and road construction induced sedimentation. After testing, the number of watershed variables included in the proposed risk evaluation system and their relative importance may be revised. Any ultimate adoption for use by the RWQCB will depend upon the results of testing and the final form assumed by the system.

CHAPTER II

NORTH COASTAL CALIFORNIA - THE ENVIRONMENT

The North Coast Regional Water Quality Control Board headquartered in Santa Rosa, California, has jurisdiction over all river basins in northern and northwestern California shown in Figure 1. This area includes Lower Klamath Lake and Lost River basins and all basins draining into the Pacific Ocean from the California - Oregon state line to the southerly boundary of the watershed of Estero de San Antonio and Stemple Creek in Marin and Sonoma Counties. For planning purposes the basin is divided into subregions 1A and 1B. Within this region are situated a substantial portion of California's most productive timberland and some of the state's most unstable landforms. It is widely believed that logging and road construction operations are causing unreasonable adverse effects on water quality in some locations because of the combination of extreme instability of much of the region's landforms and careless or ignorant operating practices.

The area under the jurisdiction of the North Coast Regional Water Quality Control Board (Figure 1) encompasses over 19,200 square miles of land and water. Within its boundaries are perhaps the widest variety of topographical and vegetal features in the state of California ranging from fog-bound coastal redwood forests to arid sagebrush plateaus. Elevations range from sea level to 14,162 feet and rainfall from 10 to over 100 inches annually. Soils are generally highly erosive and the parent rock is generally weak and fractured. The terrain is mostly mountainous with small areas of valley land. The natural resource based economy is largely dependent upon forest products, outdoor recreation, commercial fishing and associated commerce.

The major streams draining the North Coast Region are the Smith River, Klamath River, Trinity River, Redwood Creek, Mad River, Eel River and Russian River. The first three streams are in Basin 1A--the Klamath River Basin; the remaining in Basin 1B--the North Coastal Basin (Figure 1). All of these streams have several beneficial uses made of their water, hence the great concern for water quality. This report prescribes procedures and methods to determine how water quality can be maintained and logging and road construction can continue despite the difficult environmental conditions endemic to the region and despite the normally anticipated accelerated sedimentation from these operations.

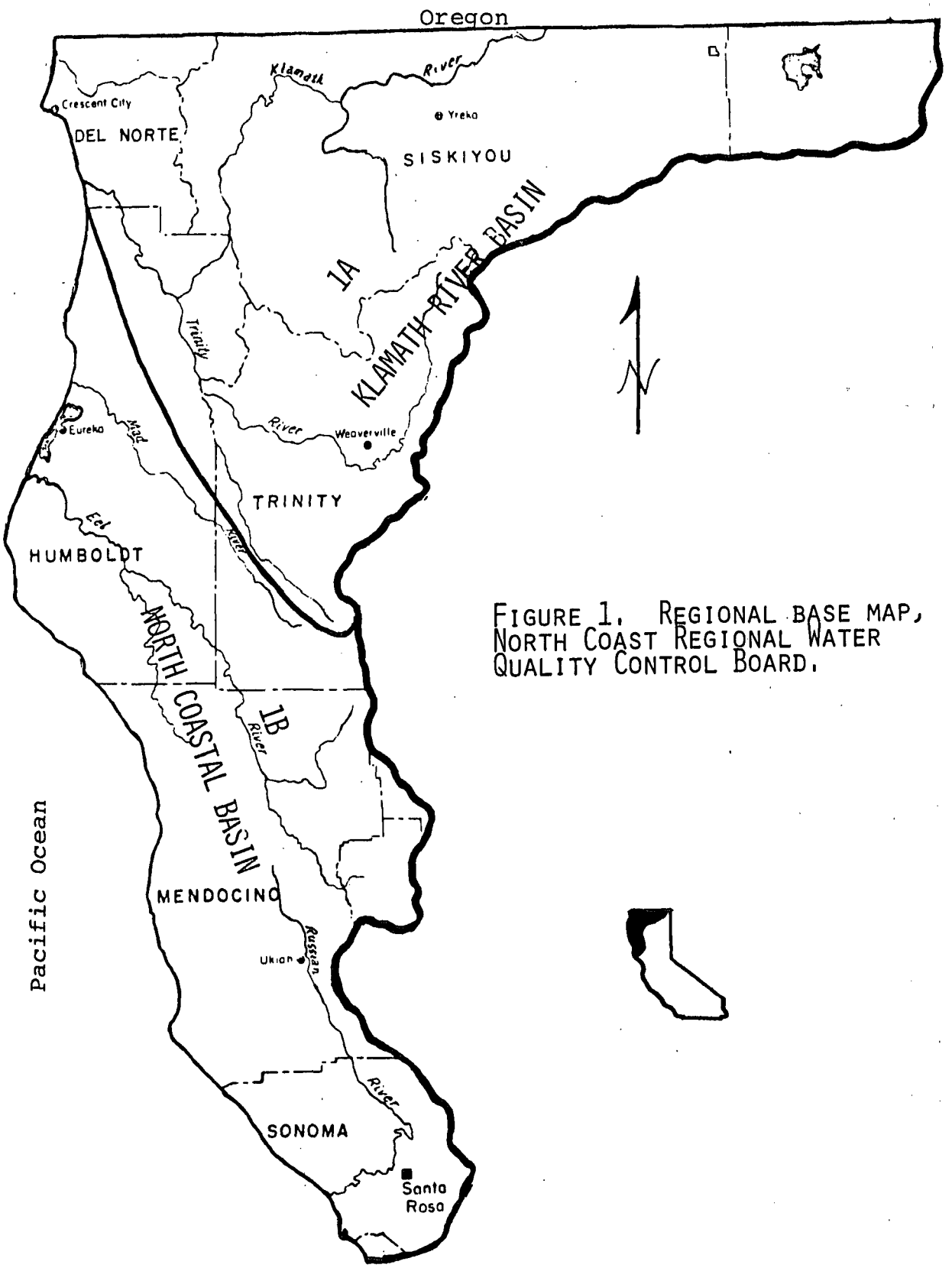


FIGURE 1. REGIONAL BASE MAP, NORTH COAST REGIONAL WATER QUALITY CONTROL BOARD.

Sedimentation, a highly visible form of water pollution, reflects man's stewardship of the land. The nature and extent of sedimentation depends upon underlying geology, surface soil, topography, vegetative cover and climate as explained in Volume II. Each of these environmental parameters is examined by basin.

Klamath River Basin (Basin 1A)

The Klamath River Basin contains a complex mixture of rock types with hard volcanics in the eastern part, deformed and metamorphosed sedimentary and intrusive rocks in the central part, and softer folded and faulted rocks of the Franciscan Formation in the western coastal areas (U. S. Department of Agriculture [USDA], 1972). The Franciscan Formation and some metasedimentary rocks are extremely erodible when disturbed. About 25 percent of the Basin contains rock of this nature.

The western two-thirds of the Basin generally has very steep topography. Steep slopes increase the susceptibility of soil to erosion. The U. S. Department of Agriculture (1972), after consideration of slope, texture and structure of Klamath River Basin soils, listed 50 percent of the soils as having very high erosion hazard while an additional 30 percent had a high hazard (Figure 2). Half of the land in the Basin is dedicated to timber production with about 3 percent of that logged each year (USDA, 1972). Almost all of this land consists of soils having a high to very high erosion hazard.

Sixty to 100 inches of rain (Figure 3) is common annually in the Smith River and Lower Klamath River watersheds, but lesser amounts (10-15 inches) reach the eastern portion of the Basin (U. S. Weather Bureau, 1963). Intense orographic storms which reoccur on a frequency of once in a decade may deposit over 14 inches of rain (Figure 4) in a three-day period (U. S. Weather Bureau, 1961). These storms result in high runoff causing many mass soil movements.

North Coastal Basin (Basin 1B)

About 80 percent of the North Coastal Basin is underlain by Franciscan Formation rocks or rocks generally associated with the Formation (USDA, 1970; USDA, 1972). The Formation is highly unstable because of large and small faults and shear zones. These weak structural features combined with high rainfall, intense storms, high peak flows and rugged topography, account for the widespread slope instability and erodibility of the Formation. Consequently, landslides, stream bank erosion, and soil creep are common (USDA, 1970).

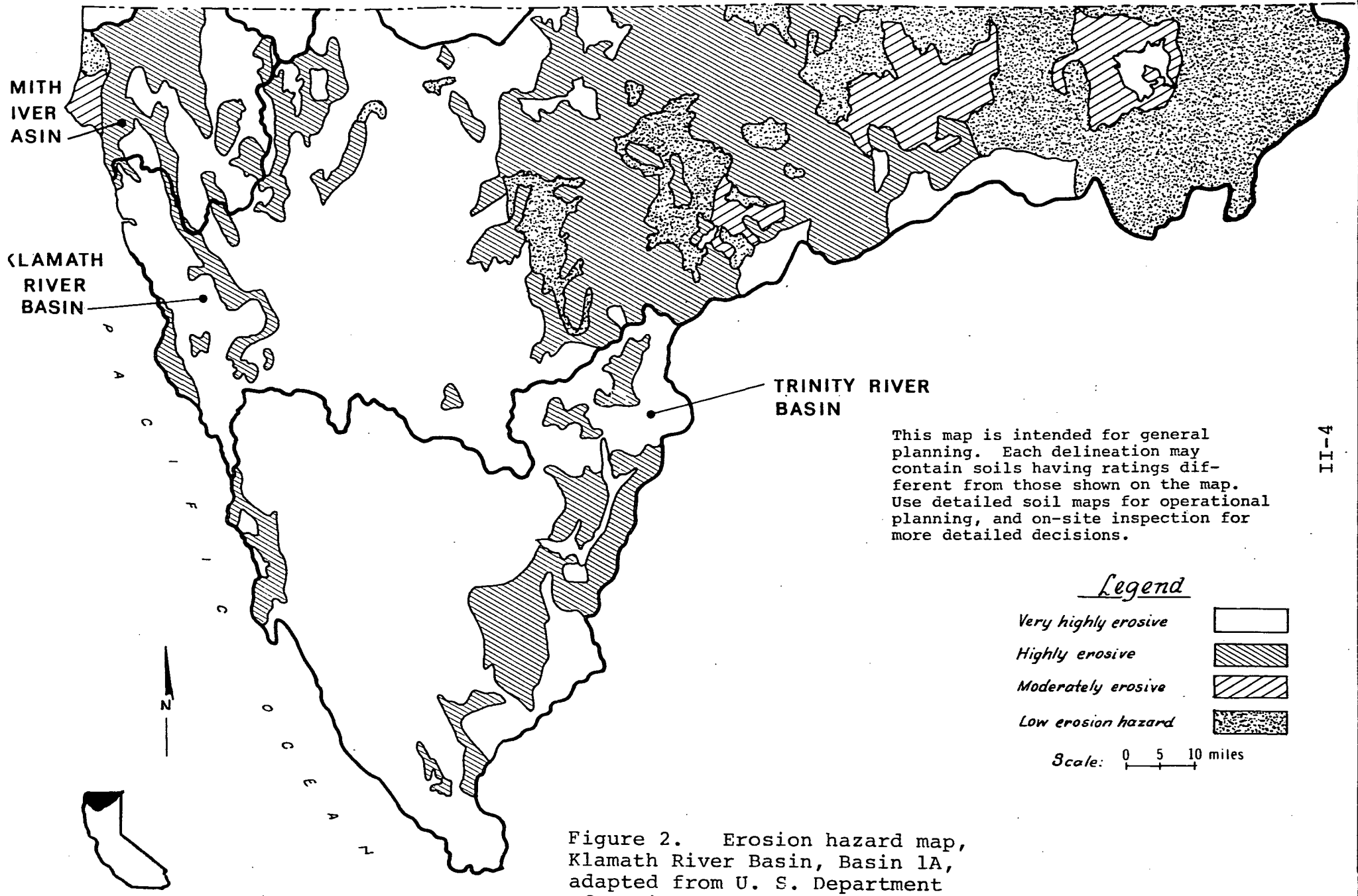


Figure 2. Erosion hazard map, Klamath River Basin, Basin 1A, adapted from U. S. Department of Agriculture (1972).

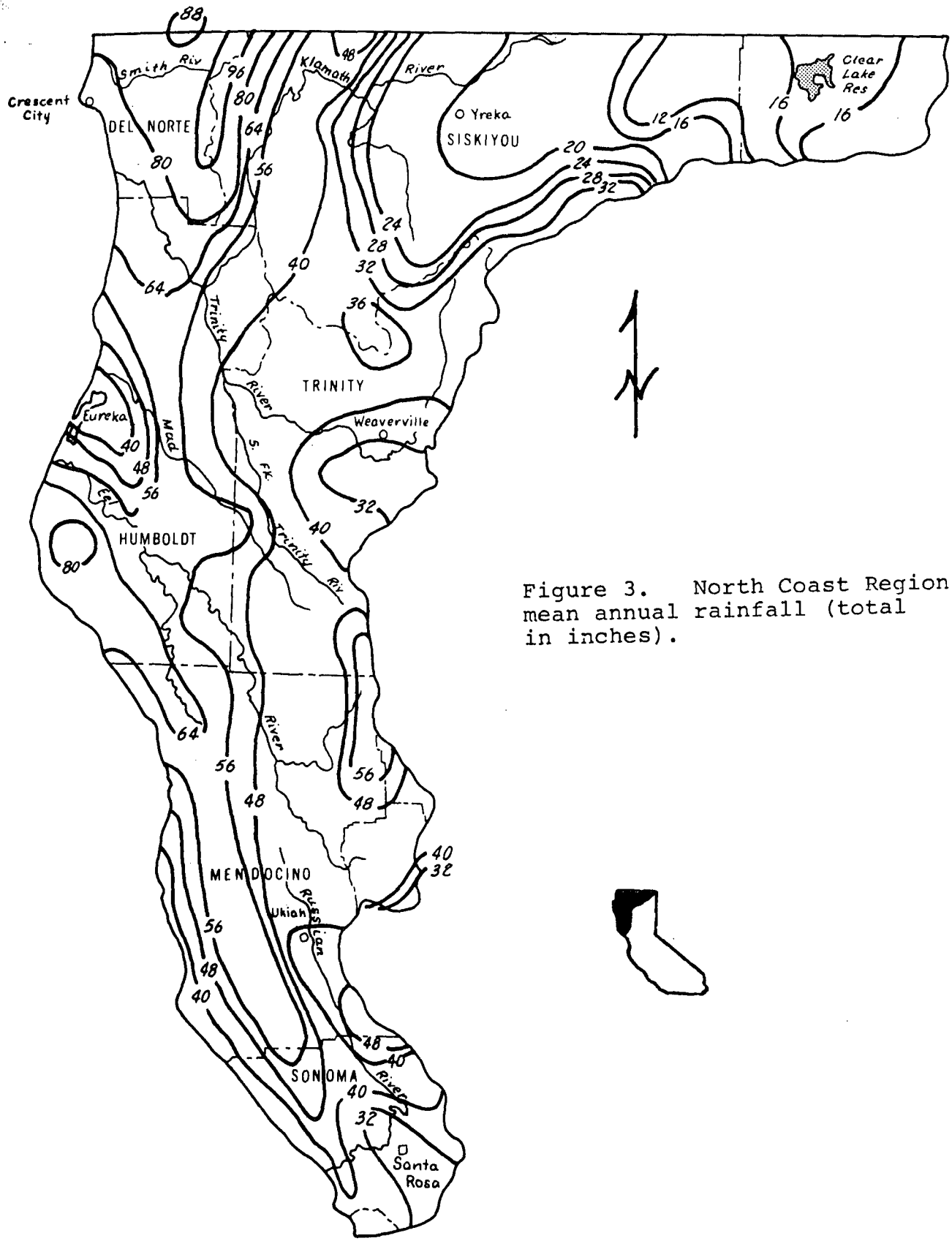


Figure 3. North Coast Region mean annual rainfall (total in inches).

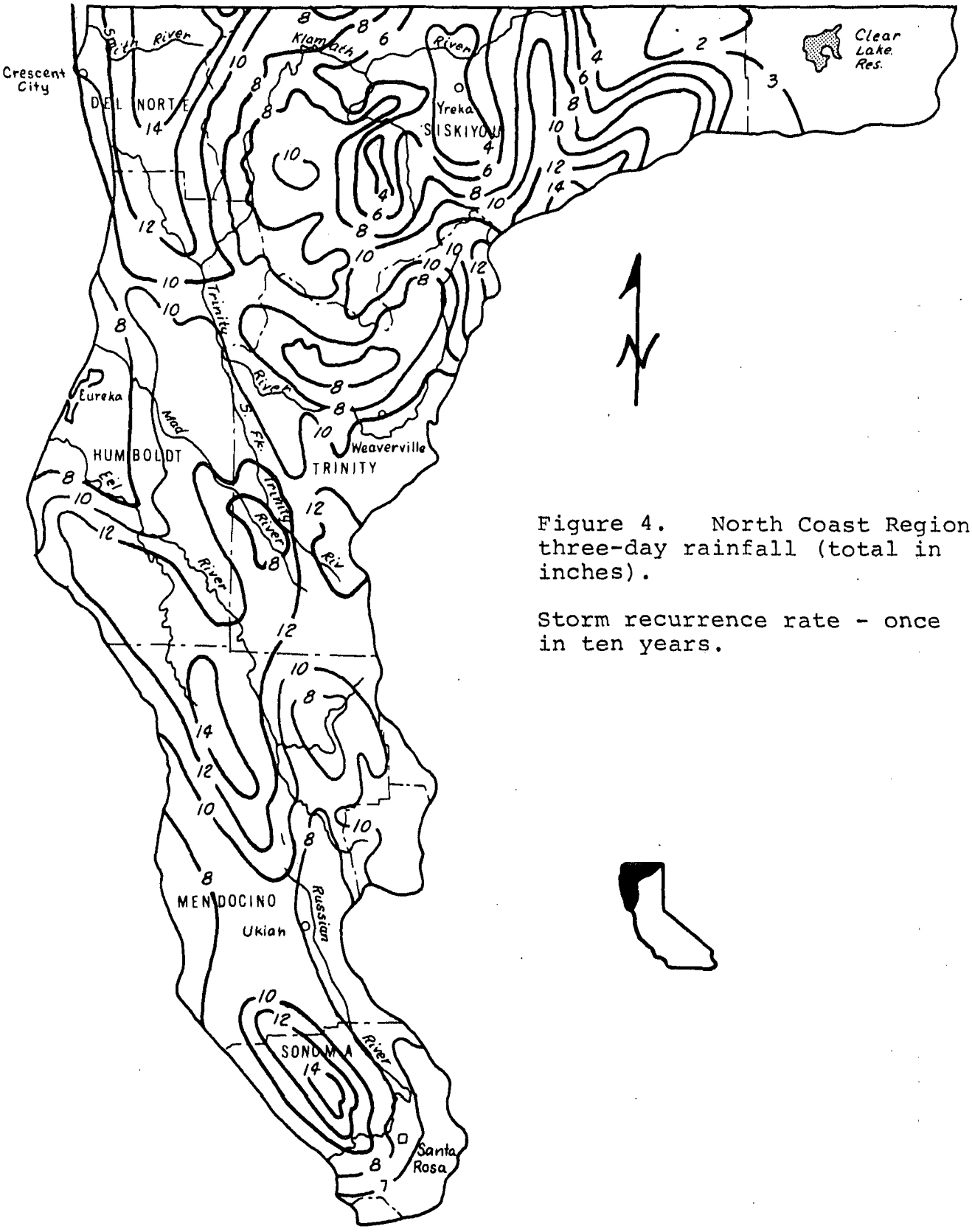


Figure 4. North Coast Region three-day rainfall (total in inches).

Storm recurrence rate - once in ten years.

About 35 percent of the soils in the Basin are very highly erosive and 45 percent are highly erosive (Figure 5). This Basin is less extensively forested than the Klamath River Basin -- only 30 percent. Three percent of this is logged each year (USDA, 1972).

Annual rainfall (Figure 3) in the Basin ranges from 30 inches in the southern interior to 80 inches along the northern coast (U. S. Weather Bureau, 1963). Intense storms of long duration (Figure 4) frequently occur in the Basin and sometimes drop as much as 14 inches of rain in a three-day period (U. S. Weather Bureau, 1961).

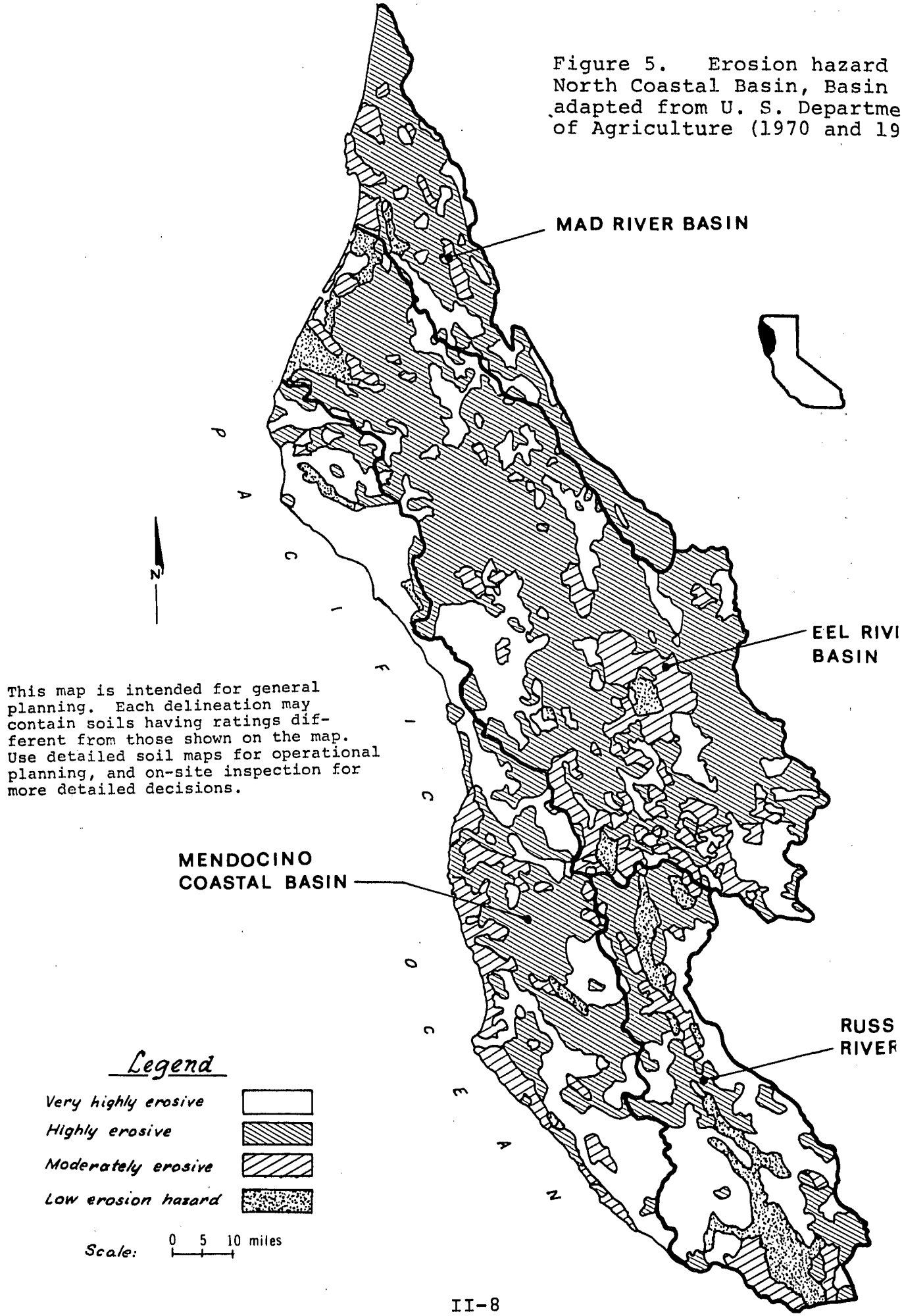
The Soil Erosion Problem

The combination of heavy, intense rainfall; steep, erosive soils; vegetative cover manipulations, and unstable geologic formations inherently presents a severe potential for soil erosion. This combination of environmental factors resulted in high sediment yields even before modern man started adding his manipulations to the vegetative cover. Both the normal, natural erosion rates and land use related erosion are accelerated by the intense storms. Even today the majority of the sediment yield is attributed to natural causes (USDA, 1970; USDA, 1972). This, however, does not diminish or make unimportant man's contribution to the yield. The U. S. Department of Agriculture (1970 and 1972) determined that 35 percent of the sediment production of the Klamath Basin, 24 percent of the Eel-Mad River watershed and 33 percent of the southern North Coastal Basin was caused by man's activities. Such increases in the total sediment yield certainly represent a substantial and significant influence of man and should be controlled so as to prevent the removal of soil at a faster rate than is naturally created.

The seriousness of the accelerated erosion problem is cited in many sources (for summaries see: California Assembly Subcommittee, 1967; USDA, 1970; California Division of Soil Conservation, 1971; USDA, 1972; California Division of Forestry, 1972).

From a sediment yield standpoint, the most studied watershed in the North Coast Region is that of the Eel River. Brown and Ritter (1971) found that the Eel had the highest recorded average annual suspended-sediment yield per square mile of drainage area than any river its size or larger in the United States. Warhaftig and Curry in their contribution to the California Assembly Subcommittee (1967) study noted that soil regeneration in North Coast Ranges was 1/10 to 1/100th the rate of soil destruction. They postulated that if this rate continued, in a few centuries

Figure 5. Erosion hazard
North Coastal Basin, Basin
adapted from U. S. Departme
of Agriculture (1970 and 19



insufficient soil would remain to support much vegetation and the region would become largely barren. Orme (1972) agrees that soil is being lost more rapidly than it is forming but disputes the time frame arguing that this accelerated rate has been going on for an unknown period of time and may persist for an equally unknown period of time.

Most of the sedimentation by volume occurs during flood periods when it is difficult to distinguish between man-caused and natural erosion. During intense storms and flood periods the entire landscape appears to be moving and massive changes are occurring. Brown and Ritter (1971) noted that 51 percent of the sediment load computed for the Eel River at Scotia for an entire 10-year period passed that station in a 30-day period in December 1964 and January 1965. Following catastrophic flooding much sediment remains in the stream channels and is gradually moved downstream over the next several years. Control of such catastrophic events is, of course, impossible, but it is believed that utilization of proven watershed management techniques, including good logging and road construction practices, can significantly reduce at least that portion of the sedimentation volume not ascribed to nature.

CHAPTER III

LEGAL AND ADMINISTRATIVE

Review of Regional Water Quality Control Board's Responsibility and Authority

The decision to extend water quality controls to waters adversely affected by earthen or organic debris originating from logging or construction operations must contend with several obstacles. Most of the potential timber harvest acreage in the North Coast is located in areas where geology and hydrology create substantial risks of erosion and run-off whenever the soils are disturbed or the vegetal cover removed. This condition presents a challenge to the efficient utilization of regulatory and surveillance efforts, and it limits the state's ability to provide complete protection for all the potentially hazardous water quality areas in the region. Many North Coastal streams and lakes have relatively high levels of discoloration, turbidity, floating debris, and bottom deposits occurring naturally. Thus, attempts to distinguish degradation of water quality caused by logging or road construction operations are complicated.

In addition to the problems created by the physical complexities of the North Coast, water quality controls must contend with several problems created by current legal and administrative practices. Enforcement efforts are complicated by distinctions made between the parties who might ultimately be held responsible for a degradation of water quality. A single logging operation might involve a land owner, a timber owner and a logging operator. Problems are also presented by the existence of several state agencies having interest and influence within forest lands. Efficient water quality regulations require extensive cooperation between these agencies.

On a broader scale, it is important to realize that regulations protecting water quality in forest lands may create situations where logging and road construction may be uneconomic and thereby effectively prevented. This situation may occur because the composition of some ecosystems is such that no means are currently available whereby protective measures can adequately ensure even a minimum standard of protection of water quality. These situations may raise constitutional law issues in respect

to a "taking" of property.[1] The resolution of this issue usually depends upon the facts of each case and is beyond the scope of this report. In general, however, courts have been willing to uphold zoning ordinances which restrict land use, and local and state laws provide that the adverse effects of land use can be regulated and controlled in the public interest.[2] Irrespective of the "taking" issue, situations where forest land may be removed from potential harvest activity require a balancing of the state's interests. The state's interest in maintaining water quality will have to be weighed along with the state's interest in maintaining a productive timber industry.

Legal

There are basically two approaches the Regional Board may follow in regulating water quality in the North Coast forest lands. First, the Board may choose to wait until after a logging or road construction operation has caused a degradation of water quality and then proceed with after-the-fact enforcement measures. These measures include the summary judicial abatement procedure found in Section 13340 of the Porter-Cologne Act. This section gives the Board the authority to request the Attorney General to petition a superior court to issue an injunction prohibiting harmful discharge of waste. Prior to requesting such action, however, the Board must find that a logging or road construction operation is discharging waste, or is threatening to discharge waste, that will cause a condition of pollution[3] or nuisance[4]. In addition, the

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1/ The 5th Amendment to the U. S. Constitution prohibits the taking of property without just compensation. Thus it can be argued that the amendment requires the state to compensate a timber owner when water quality controls significantly reduce his timber harvest.

2/ The Porter-Cologne Act includes a legislative declaration to the effect that the people of the state have a primary interest in the conservation and control of the water resources of the state and that the activities and factors which may affect water quality must be regulated. See California Water Code, Section 13000.

3/ "Pollution" is defined in Section 13050(l) of the Porter-Cologne Water Quality Control Act. Unless otherwise indicated, further references to sections of the Porter-Cologne Act will be made by Section number only.

4/ "Nuisance" is defined in Section 13050(m).

Board must find that the condition of pollution or nuisance constitutes an emergency which requires immediate action in order to protect the public health, safety or welfare. Under Section 13223 of the Act, referral to the Attorney General can be made without prior board action.

Another after-the-fact enforcement measure available to the Board is set forth in Section 13304 of the Porter-Cologne Act. This section provides the authority for the Board to issue orders directing persons who discharge wastes into the waters of the state to clean up such waste or to abate the effects thereof. If a discharger violates such an order, it may be enforced through later judicial action.[5/] Prior to issuing the order, the Board must find that an operator has intentionally or negligently caused a discharge of waste which creates, or threatens to create, a condition of pollution or nuisance. This same procedure can also be followed in cases where an operator has deposited waste where it may be discharged and cause a condition of pollution or nuisance.

The second approach the Board may choose to follow is to implement Porter-Cologne provisions designed to take effect prior to an actual degradation of water quality. This approach can provide more effective water quality controls than an approach which relies exclusively on after-the-fact measures. It can reduce the risk of harmful discharges occurring or if they should occur, it might at least limit the amount of harm the discharges cause to the receiving waters. This course is the recommended one and is basic to the procedures and methods prescribed in this report.

There are several Porter-Cologne provisions the Board can employ in cases where water quality has not yet been affected by an operation. To an extent these include the previously discussed Sections 13340 and 13304 since they apply to threatened discharges. However, the Act provides other, more effective regulations for use prior to an actual degradation of water quality. This includes Section 13240 which provides the authority for the Board to formulate and adopt water quality control plans for all areas within its region. As a part of such a plan, the Board may specify conditions or areas where the discharge

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5/ See Section 13304(a) which authorizes the Board to require the Attorney General to petition a superior court for injunctive relief and Section 13350 which authorizes the Board to request the Attorney General to seek civil monetary remedies of up to $6,000 for each day a violation occurs.

of waste or certain types of waste will not be permitted.[6] This authority permits the Board to regulate with reference to both 1) the types of waste an operation would discharge such as soil, slash or sawdust and 2) the areas in the North Coast where such discharges will be permitted, limited or prohibited.

In preparing a water quality plan that regulates discharges from logging and road construction operations, the Board first needed to draft prohibitions for inclusion in existing water quality plans for the North Coast region. Initially this required a determination of the scope of the prohibitions, a decision influenced by both environmental and economic considerations.[7] This was resolved in State Water Resources Control Board Order No. 72-21 (Appendix A) which adopted and described the prohibitions. In addition, the Board needed to determine the amount of flexibility required in administering the prohibition. Flexibility was provided through guidelines which were developed by the North Coast Regional Board (Appendix B) and which are used as a means of implementing the terms of the prohibition.

A prohibition, once included in a water quality plan is difficult to modify or revise. Revision involves significant amounts of time and effort since it requires notice, a hearing and State Board approval.[8] On the other hand, guidelines to implement prohibitions can be modified or added within a relatively brief period of time. Even the very comprehensive prohibitions against all discharges of waste from logging and road construction operations in quantities deleterious to beneficial uses, is made flexible through accompanying guidelines with reference to either the quantities of a particular discharge or to the characteristics of the receiving waters. Since exact standards are embodied in guidelines, they can be modified with relative ease so as to reflect any change in Board policy or any change in technical data which would justify a less comprehensive prohibition. The procedures and methods prescribed in this report are expected to be adjuncts to existing guidelines.

The effectiveness of regulating discharges through a water quality plan depends on the Board's ability to provide sufficient publicity and clarity as to the nature and extent of the prohibition. Prospective operators should

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[6] Section 13243.

[7] Section 13241.

[8] Sections 13244 and 13245.

be fully aware of the prohibition's existence and it terms. In addition, accompanying guidelines should be made available to prospective operators and they should be precise enough that operators will be able to determine to some extent what type of logging and road construction practices they will have to follow to protect water quality in the area of their operation. Again the procedures and methods described herein are expected to assist in this function.

Another procedure the Board may follow prior to an actual degradation of water quality is to establish waste discharge requirements pursuant to Section 13263 of the Porter-Cologne Act. Under this section, the Board may, after any necessary hearing, set requirements as to the nature of discharges that might occur as a result of a logging or road construction operation. The requirements can be enforced with judicial proceedings should an operator refuse or be unable to comply with the requirements.[9] In setting the requirements, the Board must consider the water quality control plan that it has developed for the region as well as the beneficial uses that are to be protected. The requirements may contain a time schedule and they may be reviewed and revised.[10] Prior to establishing discharge requirements for a particular operation, the Board must investigate the operation, give notice to all affected persons, and then conduct a hearing for the purpose of adopting the requirements.[11] In addition, should the Board find that an operator is violating requirements, it must conduct another hearing, after giving notice to all affected persons, for the purpose of issuing a cease and desist order.[12]

The use of waste discharge requirements in the forest lands of the North Coast provides a thorough but costly and cumbersome method of protecting water quality. Discharge requirements can reflect the particular characteristics of both the water and the lands in a timber harvest area, and they can also provide relatively precise standards to assist individual operators in planning their operations. There are however, some limitations to the effective use of discharge requirements in a region as large and as complex as the North Coast.

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[9] Injunctions and civil monetary remedies are made available through Sections 13304(a) and 13350.

[10] Sections 13242(b) and 13240.

[11] Section 13244.

[12] Section 13302.

Discharge requirements require significant amounts of time to establish and process. For example, if data are not available, background erosion rates of an area may require study for one or more years. Each individual operation would first have to be inspected and then water quality requirements for each of the affected streams and lakes would need to be formulated. Prior to adopting the requirements the Board would have to give notice and conduct a hearing. Similar notice and hearing procedures would have to be followed whenever the Board sought to commence enforcement actions for any violations of the requirements. In addition to these limitations, the scope of the requirements themselves is limited since the Board is only authorized to provide an operator with current information as to how he might comply with requirements,[13] and cannot specify in the requirements the design, location and type of construction or particular manner by which an operator may comply.[14]

A review of other state and federal forest practice laws as they relate to water quality appears in Volume II.

Administrative

The administrative aspects of implementation of legal strategies in the North Coast forest lands can be divided into three major categories. First, the Board needs to establish procedures for the receipt and processing of initial reports. Under Section 13260(a) of the Porter-Cologne Act, any person discharging waste or proposing to discharge waste that could affect water quality must file a report of the discharge with the Regional Board. As a result, the Board could require all proposed logging and road construction operations that intend to harvest in areas where their activities might affect water quality to file such a report. Failure to file a report will cause the operator to be guilty of a misdemeanor.[15] The Board can also request the Attorney General to petition a superior court for issuance of a temporary restraining order or injunction against the continuance of the

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[13] Section 13301.1.

[14] Section 13360.

[15] Section 13261.

operation.[16] The Board has authority to waive this report requirement when a waiver would not be against the public interest,[17] and the Board also has the authority to determine what information the report should contain.[18] This procedure is germane to the methods prescribed in this report.

In addition to requiring waste discharge reports pursuant to its own authority, the Board might utilize the report requirements that are presently being used by the Division of Forestry and the Department of Fish and Game. Logging operators, under the Forest Practices Act, are required to notify the State Forester of their intention to harvest timber prior to actually beginning their harvest activities. For an example of such a notice, see Appendix C. These notices contain information as to the location, size and time of the proposed activity.[19] If copies of these notices were forwarded to the Board, the Board could, on the basis of the information contained in the notices and on information determined through the Initial Risk Analysis described later in this volume (CHAPTER VI), decide whether or not to require the operator to submit a waste discharge report to the Board. Similar information could be obtained from notices a logging operator might need to submit to the Department of Fish and Game. These notices are more limited in scope since they do not apply to all logging operations. However, they can serve to inform the Board of any logging operation and any road construction operation that intends to divert or obstruct a stream or in any way intends to make use of materials from a stream bed. The Board may, upon the basis of this information, want the operator to submit a discharge report to the Board even if the operator had previously submitted such a report.[20]

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[16] Section 13262.

[17] Section 13269.

[18] Section 13260.

[19] Recent legislation, SB 889, requires that public agencies issuing permits or other entitlements for use for projects which may have a significant effect on the environment to prepare an environmental impact report. Another recent bill, SB 740, has exempted the report of waste discharge procedure of the SWRCB from this requirement.

[20] The Board is authorized to require additional reports if a discharger intends to make a material change in the character, location or the volume of the discharge. Section 13260(b).

A major category of administrative concern involves monitoring and surveillance efforts. The Board could undertake these tasks on its own but such an approach is probably beyond the Board's capabilities. It would require far too much time and effort for the Board to attempt to provide adequate surveillance efforts for all of the logging and road construction activities which take place in the North Coast. Instead, the Board may require that the operators submit technical and monitoring program reports pursuant to Section 13267(b) of the Porter-Cologne Act. The Board's actions in this respect could then be restricted to selective monitoring efforts designed primarily to assure that the program reports they receive are accurate. In addition, the Board might attempt to make use of data from the monitoring efforts of other state and federal agencies such as the Department of Fish and Game and the U. S. Forest Service.

Another administrative concern involves the gathering and processing of information regarding any violations of existing regulations. Much of this information will be the result of field monitoring efforts. However, the Board will probably still need to inspect in detail individual operations for possible violations. Some of the burdens that the procedure would impose on the Board's staff can be alleviated if the Board can establish working agreements with other state and federal agencies so that any information as to possible water quality violations can be made immediately available to the Board.

Coordination with Other Agencies

There are many agencies that have indirect responsibilities for the water quality effects of logging operations, road construction, and other land use activities. Each of these state and federal agencies has its own statutory authority, regulations and individual responsibilities. To some extent the individual responsibilities of these agencies may conflict. Nevertheless, many of these agencies participate in certain common activities such as the collection of information, the issuance of permits, and research and investigative efforts.

The notice stage (Stage I) of the procedural outline described in CHAPTER V makes extensive use of the permit and notice forms of other state and local agencies, particularly the forms used by the Division of Forestry and the Department of Fish and Game. The data supplied by these forms would play an important part in the Initial Risk Analysis were the Board's staff to make a determination regarding the extent of regulatory effort a proposed

operation will require. It is therefore important that these forms contain as much useful data as possible in respect to describing the size and location of an operation as well as the dates within which operations are to be conducted and the waters that may be affected. It is also important that these forms be made available to the Board as soon as possible in order that the Board's staff will have adequate time to make an analysis of water quality risks without causing the operator excessive delays in the commencement or continuation of his harvest or construction activity.

The notification form pertaining to Fish and Game Code Sections 1601 and 1602, presently used by the Department of Fish and Game (Appendix D) appears to be adequate for the Regional Board's purposes with the exception that it might be extended to provide a more precise description of the waters that would be disturbed. In this respect, a description of affected streams, rivers, or lakes could be made with reference to a USGS quadrangle sheet. Also, it should be noted that in instances where an operator will submit a Fish and Game 1601 and 1602 form, he proposes to directly affect the water environment. As a result, the Board's regulatory activities will in most cases likely involve more comprehensive data than the form could provide.

The current form used by the Division of Forestry (Appendix C) would provide the Board with only a minimum amount of data for determining the water quality risks of a particular operation. However, the regulatory authority of the Division of Forestry may soon be changed to include designated responsibility for water quality and this could present the Regional Board with an opportunity to recommend to the Division of Forestry some additional data requirements for its notice forms. Specifically, these notice forms should provide for the inclusion of data regarding the streams, rivers, and lakes that the harvest activities may affect, and the data should be referenced to a USGS quadrangle sheet. Also, the form should provide for the inclusion of data on the size of the operation, not only data on the acreage involved but also data as to the amount of stand to be harvested, the type of harvesting equipment and the number and location of roads to be constructed. Revision of the Notice of Timber Operation form to require the data appearing on the first two pages of the Division of Forestry's Timberland Conversion Plan (Appendix E) would substantially improve the RWQCB staff's ability to quickly assess the nature of the planned operation.

There is an urgent need for a greater amount of inter-agency coordination, cooperation and responsibility sharing among the agencies with concerns in the forest lands. This need can be satisfied in part through the use of interagency agreements. It would be possible to have a large number of individual agreements between the various state or federal agencies, however, the agreement process could be simplified through the use of the following three classes of comprehensive agreements:

1. SWRCB-DF&G-Division of Forestry Agreement

   A three-way agreement between the principal state agencies concerned with the logging activities would be most appropriate. The agreement would provide initially that the Division of Forestry would, upon receipt of a notice of proposed logging operations, notify the Regional Water Quality Control Board and the Department of Fish and Game of the proposed logging activity or provide them with a copy of the "Notice of Timber Operation". Upon receipt of this information, the Regional Board and the Department of Fish and Game could follow up as appropriate with requests for any additional information that they may require.

   A second phase of the agreement would provide for the exchange of inspection and surveillance information between these three agencies. This information can be most effectively exchanged between the agencies' field inspection personnel. As a result, the agreement should avoid establishing excessive formalities and instead provide that the inspection personnel of the agencies will be directed to exchange information following direct and informal procedures.

   The third phase of the agreement would provide for coordinated enforcement efforts. The Department of Fish and Game and the State Water Resources Control Board have discussed coordinated enforcement activities These discussions should be extended to include co-operative enforcement efforts with the Division of Forestry. In the case of a threatened violation of any of the agencies' regulations, all three agencies should cooperate to eliminate the threat. In cases where enforcement is necessary, it would be appropriate to conduct a pre-enforcement conference among the agencies to determine the most effective enforcement action. Although time considerations would not permit extensive cooperation in cases of actual violations, the agencies should attempt to exchange advance notice of expected enforcement actions.

In addition to outlining the procedures the agencies will follow in exchanging notice, inspection and enforcement data, the agreement should also provide for the following:

a. The designation of the Division of Forestry as the agency to which an operator should maintain a single line of communication except when special technical problems develop.

b. The establishment of a single reporting form that would include the data required by each of the individual reporting forms now used by the agencies.

c. The development of a single inspection reporting form capable of providing sufficient data so that any one of the agencies may determine whether their particular regulations have been violated.

2. SWRCB-EPA-Forest Service-Soil Conservation Service Agreements

It is important to develop a method for state review of forest activities in federal lands and there is a need for federal and state inspection, surveillance, research and investigation efforts to be coordinated. It would be desirable to have a federal-state agreement providing information on forest contracts, the environmental impact analysis of forestry activities, and the opportunity for the state to comment on upstream federal forest land activities that affect the state's waters. It would also be desirable to have federal-state agreements on the methods by which the agencies can jointly plan future investigation and research programs.

3. SWRCB-State Division of Highways-County Agreements

One of the significant causes of water quality degradation on the North Coast is road construction. Since a large portion of road construction activities, both for subdivision and public roads, is under the jurisdiction of County government and the State Division of Highways, it would be appropriate to have a memorandum of understanding or agreement among North Coast counties, the North Coast Regional Board, and the Division of Highways concerning the exchange of information on all road construction activities, including reports of violations and the procedures to be followed.

CHAPTER IV

RISK EVALUATION SYSTEM - CRITICAL DISCHARGE AREA

General

Evaluation of the environmental characteristics of streams and watersheds permits the identification of features sensitive to adverse change from land use activity. This often results in the need to limit activity or set aside portions of the environment in which activity is prohibited. Classification of land relative to a permitted activity is common to our society. Classification of streams is a relatively recent phenomena, but one which is becoming increasingly common. In the West, classification is usually associated with the protection of the fishery from the deleterious effect of logging and road construction.

Classification systems have been developed by the State of Washington (1971) and the Pacific Northwestern Region of the U. S. Forest Service (1972). The California Region of the U. S. Forest Service (Evans, personal communication, 1972) is currently developing a system. All of these sources refer to their land use zoning as a "stream classification system". While streams and their physical characteristics are central to these logging oriented classification systems, others are more narrow in their viewpoint (Montana, 1965; Idaho, 1968; and Wyoming, 1971) and were devised to rate streams solely according to fishery value.

The "systems" established by the State of Washington and the Pacific Northwest Region of the U. S. Forest Service, for application on their lands, are intended to keep soils in place during logging operations and thereby to reduce the possibility of soils and debris from entering watercourses. These systems are built around a list of activities which are either permitted or prohibited adjacent to or in a stream. These activities depend on an environmental sensitivity classification. Neither system establishes a measurable degree of risk nor goes into much detail in evaluating stream and watershed characteristics. Table 2 compares two classification systems.

The State of Oregon classifies its streams according to uses as either Class I - valuable for domestic use, important for angling or other recreation use or used by significant numbers of fish for spawning, rearing or migration routes; or as Class II - having limited or indirect values principally on quality and quantity of downstream Class I waters (Oregon Forest Protective Association, 1972). The

Table 2

Comparison of Stream Classification Systems

State of Washington	Forest Service
Evaluated	**Evaluated**
Water flow continuity Size of stream Recreational use Use of water Fish life Type of stream bed	Water flow continuity Recreational use Use of water Fish life Effect on downstream quality
Result	**Result**
Cleanup and protection guidelines (more stringent depending upon class)	Water quality and fishery protection (more prohibition depending upon class but all classes getting some restrictions)
Activities controlled	**Activities controlled**
Yarding, felling, woody debris	Yarding, felling, woody debris, roads
Streamside management zone	**Streamside management zone**
None	Width is land manager's decision based on activity and potential effect

Oregon forest practice rules require leaving hardwood trees, shrubs, grasses and rocks wherever they afford shade over Class I streams or maintain the integrity of the soil near such streams. If insufficient non-merchantable trees exist, merchantable trees may be required to be left. However, neither optimum nor minimum widths for buffer strips are set. Stabilization strips of undergrowth vegetation are required on all Class II streams in widths sufficient to prevent washing of sediment into Class I streams.[21/]

The system proposed in this report is more comprehensive in nature than those previously discussed. It proposes to combine both the classification of environmental sensitivity and an evaluation of the probability of a waste discharge to describe locations which are critical for the protection of water quality. These areas are delineated as Critical Discharge Areas (CDA) because it is judged that logging and construction operations in these areas will violate the Board's prohibitions against waste discharge or threat of waste discharge.

Critical Discharge Area

The Critical Discharge Area (CDA) is an area of land in and bordering a watercourse[22/] in which ordinary logging and road construction operations will have a higher probability to cause a violation of the Regional Board's prohibition of discharge of sediment and debris (Figure 6). However, operations may take place in the CDA if done according to a plan deemed appropriate for the area by the RWQCB. Conversely, operations done before they are judged appropriate would be assessed for violation of Board policy and dealt with accordingly. The boundaries of the CDA depend on a scale which is based on project site conditions. In addition to a minimum size, incremental areas may be added as determined by a systematized evaluation which will be explained as the Detailed Risk Analysis. A possible alternative to the Detailed Risk Analysis for determining additions to the CDA is the computation of the streamside area susceptible to sloughing, and using this distance as an increment added to the minimum CDA

21/ 1971 Oregon Laws, Chapter 316; Section 24-446. Oregon Forest Practice Rules.

22/ In the Board's guidelines for implementation of the prohibition (Appendix B) a watercourse is interpreted as being designated by a solid line or dash and three dots symbol shown in blue on the largest scale USGS Survey Topographic Map most recently published. A similar interpretation of watercourse is made in this report.

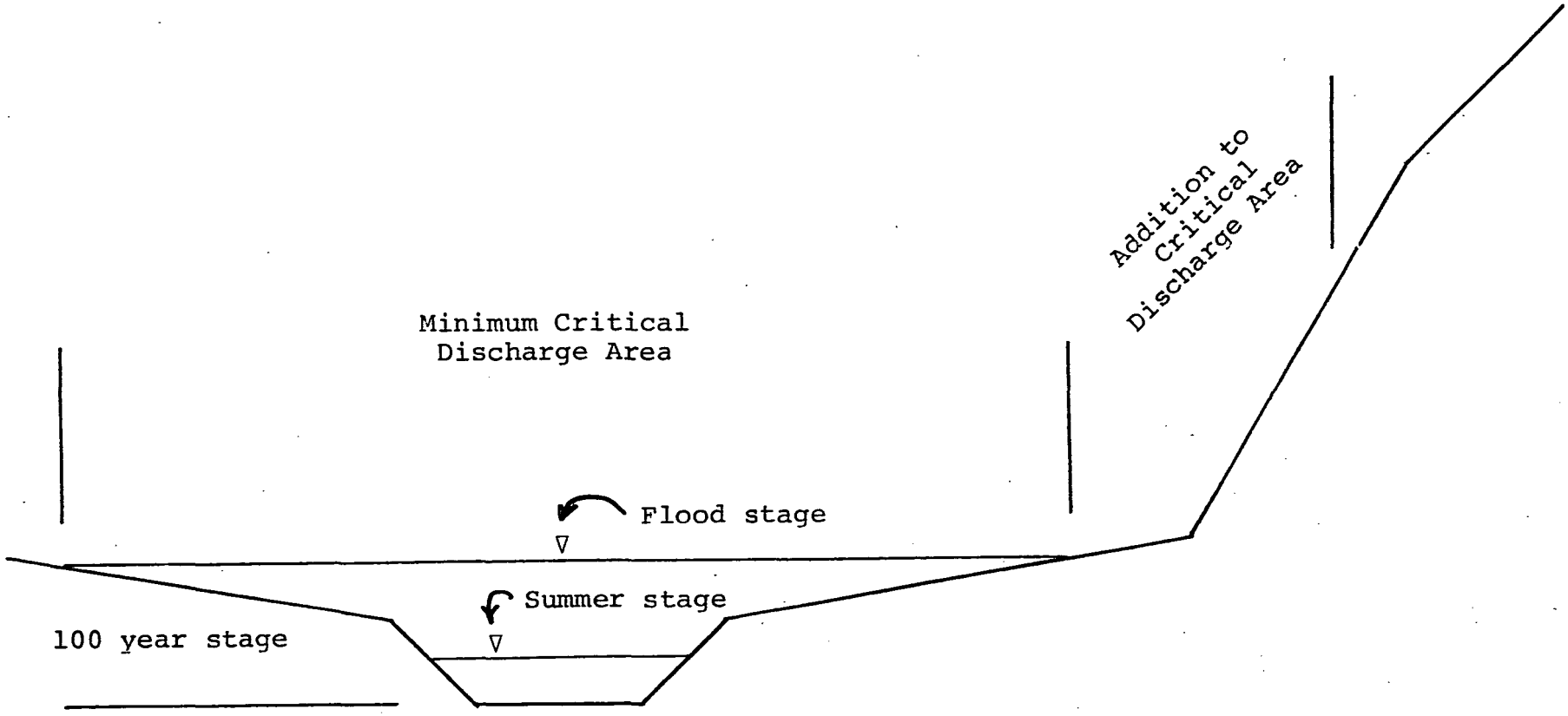


FIGURE 6. HYPOTHETICAL CROSS SECTION OF CRITICAL DISCHARGE AREA

The leaving of an undisturbed strip of vegetation or the restriction of certain activities adjacent to streams is a useful management tool to protect the beneficial uses of streams and watersheds. The U. S. Forest Service (1972) refers to this strip as a "Stream Side Management Unit", the California Region of the U. S. Forest Service (Evans, personal communication, 1972) refers to it as a "Stream Protection Strip", in the State of Washington (1971) it is a "Leave Strip", and the Bureau of Land Management (Sadler, 1970) calls it a "Buffer Strip". Choice of Critical Discharge Area instead of one of the other terms was made since the North Coast RWQCB is primarily interested in the prevention of discharge of sediment and debris into streams and not in regulating logging and road construction per se. Establishment of the CDA is done to reduce the level of risk of a threatened waste discharge, not the prevention of all activity along a stream; hence the terminology Critical Discharge Area.

The width of the CDA and the discouragement of certain activities within it provide a mitigating and filtering effect between the land use activity and the watercourse. Presumably it would prevent waste discharge in violation of Board policy. The setting of the CDA by the Board and its adherence by the timber and road construction industry should reduce the threatened and actual discharge of soil, silt, bark, sawdust or other organic and earthen materials into watercourses and, thereby reduce the effects of such materials on water quality. While a CDA may be established for an operation, activities may take place in the area if done according to a plan approved by the RWQCB. Activities tentatively discouraged in the Critical Discharge Area are: heavy equipment operation, road construction, landings, clear cutting, tractor yarding, and gross disturbance of the soil mantle. Researchers (Cordone, 1956; Bullard, 1963; Packer, 1967; Anderson, 1970; Streeby, 1970; Brown and Krygier, 1971; and Burns, 1972) have shown that the conduct of these operations in close proximity to a stream compounds the potential of the entire operation to degrade water quality. A large proportion of the waste material which degrades water quality and fish habitat emanates from the stream side zone. Care and consideration for protection of stream values through the establishment of a CDA would materially reduce unreasonable sediment and debris production, and it should reduce bank failures and sloughing in and near streams caused by man. Although a CDA would not appreciably lessen the total mass soil movement, a particularly critical problem in Northwestern California, it should provide a reasonable safeguard to the beneficial uses of water recognized in the RWQCB's Interim Water Quality Control Plans (1971a and 1971b).

Requiring operators to prepare specific plans for operation in the Critical Discharge Area alerts the operator to the incipient environmental risks of his activity. Such awareness in itself is expected to reduce significantly the unreasonable discharge of waste materials to streams. The Board, after reviewing and arbitrating the plan of operation in the CDA, can determine whether or not waste discharge requirements need to be established.

Minimum Critical Discharge Area. Removing trees and brush and disturbing the soil of lands closely bordering streams can adversely affect the quality of stream waters by exposing the stream to direct solar energy, thereby altering water temperatures, and by aggravating erosion of soil materials which both muddies the water and deteriorates the land. It is not as widely understood, however, that removal of trees along the banks of streams and in flood plains very significantly reduces the channel resistance to flood flows. The result of such removal is sharply increased flow velocities in the stream and additional erosion of stream banks. Not only are velocities higher because of reduced friction, but also the rates of rise and fall of the water surface are increased, which causes sloughing of stream banks. Bottomland soils that have developed over thousands of years can be lost during a few flood flows unless stabilized. Needs for stream water quality and for conservation of valuable forest soils indicate the desirability of cautious management of forest lands in flood plains and along borders of streams.

The width of border lands depends primarily on the slope of the land surface adjacent to the stream, soil stability, vegetative type, amount and occurrence of precipitation, and on subsurface drainage. Steep slopes, when exposed, erode rapidly both by surface erosion and by sloughing when subsurface drainage is limited. Flat slopes such as flood plains, on the other hand, may be submerged frequently, and erosion rates depend on stream velocity and previous disturbances to the vegetation and soil.

Because of the high risk for the discharge of earthen material and debris in flooded channels, especially when channels have been altered, it seems prudent to assume that the probability of a waste discharge from such places is very great. Consequently, it is recommended that the calculated 100 year flood plain or the flood plain defined by the highest water line on the bank be designated the Minimum Critical Discharge Area. That is, any operation in the Minimum CDA is presumed to be a threatened waste discharge. Activity in this zone should only be done according to a plan which convinces the RWQCB that a threatened discharge does not exist. A method for computation of the Minimum CDA follows.

Calculation of Minimum CDA. The heights of flood stage vary widely, and at best only a statistical description is possible. Selection of the flood stage against which protection is sought depends ultimately on the risk of loss society is willing to take. One approach to the selection of a flood stage criterion is as follows:

Most trees in the North Coast area become firmly established within ten years of sprouting. After a devastating flood (one with flows above that of the design flood) it would be very desirable to have a ten year period during which occurrence of the design flow or greater is improbable; say the probability of such flows, R, during a ten year period, p, is 10 percent. The recurrence interval, T, for the design flood can be calculated from Viessman, et.al., (1972).

$$R = 1 - \left(1 - \frac{1}{T}\right)^p \qquad (1)$$

or $$0.10 = 1 - \left(1 - \frac{1}{T}\right)^{10}$$

from which T = 95.4 years. For a rounded 100 year recurrence interval p = 10.5. The 100 year recurrence interval seems appropriate.

Recurrence intervals are routinely calculated from stream or precipitation records. In view of the purpose here, the simplest method seems desirable. Annual maximum values are tabulated, ranked in the order M, the recurrence interval is calculated as $T = \frac{N + L}{M}$, where N is the number of years for which maximum floods were obtained. The discharge vs. recurrence interval data are then plotted on extreme probability paper and extrapolated to the 100 year value of T. The discharge value (Q_{100}) corresponding to the intersection of the line and the 100 year ordinate is then obtained. A more elaborate method that possibly is better suited to use by a state agency is presented in the Water Resources Council Bulletin No. 15, "A Uniform Technique for Determining Flood Flow Frequencies" (1967). This method is used in all federal planning, and its use by the Board staff would provide results that are compatible with those of other agencies.

The 100 year flood stage can be calculated for a reasonably straight section of stream by first measuring and plotting several stream cross-sections in the same figure, then taking an average section. Planimeter the plot of cross sectional area for a number of stages, and measure the wetted perimeter. Then plot stage on the ordinate vs.

area, A, wetted perimeter, P, and $\frac{A}{P} = R$, the hydraulic radius on the abscissa using arithmetic scales. The slope of the stream channel, S, can be surveyed at the time the cross sections are measured.

Manning's formula,

$$Q_{100} = \frac{1.5}{n} AR^{2/3} S^{1/2} , \quad (2)$$

from which $$AR^{2/3} = \frac{nQ_{100}}{1.5S^{1/2}} \quad (3)$$

can be calculated. Values of the roughness coefficient, n, can be obtained from Chow, (1959) (Appendix F). Several values of $AR^{2/3}$ can be calculated for each of several stages to find the correspoding stage by trial and also plotted in the figure. The value found from equation (3) can be interpolated from this plot. An example is shown in Figure 7. The stage thus found can be drawn on the cross-section plot and its intersection with the land used to define the border.

This procedure is most appropriate for downstream portions of larger streams. In all other cases vegetation on benches and bars upstream should be maintained to the highest flood stage discernible from flood effects on banks and on vegetation. This is the highest discernible water mark on the bank.

Increment Increase in CDA. Depending on the results of the Detailed Risk Analysis, additional surface distance width may be added to the Minimum CDA. In the Detailed Risk Analysis a Risk Class is determined based on the judgmental evaluation of up to 29 parameters. Depending on the particular Risk Class determined, additional increments of from 50 to 150 feet or more may be added to the Minimum CDA. A detailed method for determining the larger CDA is presented in CHAPTER VI.

An alternative to the Detailed Risk Analysis is available by determining the length of the upslope area which is susceptible to sloughing. This alternative evaluation procedure is more quantitative but it greatly oversimplifies the nature of the problem and perhaps is more restrictive than it need be. Preferably the alternative is included as an adjunct to Detailed Risk Analysis. Procedures for doing this alternative are included in CHAPTER VI.

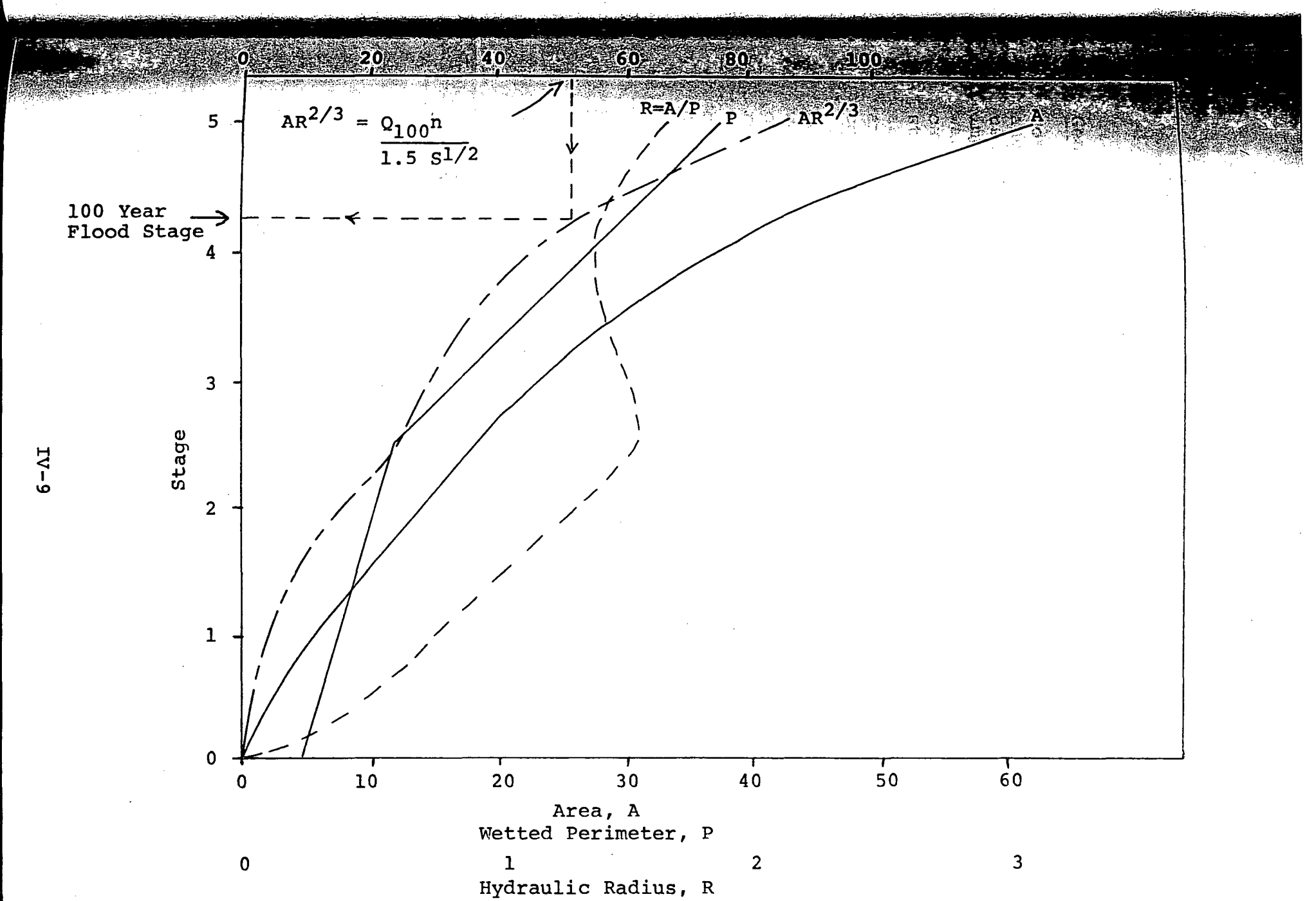


FIGURE 7. PLOTS FOR FINDING 100 YEAR FLOOD STAGE.

CHAPTER V

RISK EVALUATION SYSTEM - ADMINISTRATIVE PROCEDURE

General

Most of the North Coastal region has serious sedimentation and debris problems stemming from both natural and land use characteristics peculiar to the area. The adverse impact of this situation on the beneficial uses of the watercourse is widely discussed. However, detailed cause and effect description resulting from technical study is in short supply. Logging and road construction are known to discharge significant amounts of sediment and debris to watercourses. Such discharges could be controlled by the use of established engineering practices.

Upon discovery, the discharge of deleterious amounts of wastes to streams may be dealt with under several sections of the Porter-Cologne Act. Ordinarily this action requires an investigation to determine the nature and extent of a violation. If a violation can be shown to be deleterious, it can often be cleaned up or otherwise abated. These are after-the-fact actions and are taken in those situations where a discovery is made relative to gross deleterious effect. Regulation of the problem through after-the-fact enforcement procedures is considered inadequate. Because of the nature of a non-point source discharge it is very difficult and costly to link damage to source even though general damage can be shown.

We believe that regulation and mitigation of the overall effects of logging and road construction can only be obtained by the prevention of discharge of deleterious amounts of sediment and debris. Consequently, efforts to regulate the problem must concentrate on the waste discharge prohibition in Chapter VI(b) of the SWRCB Order No. 72-21:

> "The placing or disposal of soil, silt, bark, slash, sawdust or other organic and earthen material from any logging, construction or associated activity of whatever nature at locations where such materials could pass into any stream or watercourse in the basin in quantities which could be deleterious to fish, wildlife or other beneficial uses is prohibited."

The techniques for prevention, or at least retardation of discharge of wastes from logging and road construction activities are described in several sources and readily available to operators, but the extent of their use is not universal. It is suggested that actions of the RWQCB enforcing prohibitions against the placing of wastes in locations where they are likely to be discharged to a watercourse will stimulate the use of improved logging and road construction practices. Identification of threatened discharges in an operation plan and consequent correction would ideally mitigate the effects of land use on water quality in the North Coast. Identification after the start of operation and correction before the rainy season would also be useful but would come about at a greater cost. In any case treatment of a threatened discharge is the only course of action that can adequately protect water quality on a wide scale basis.

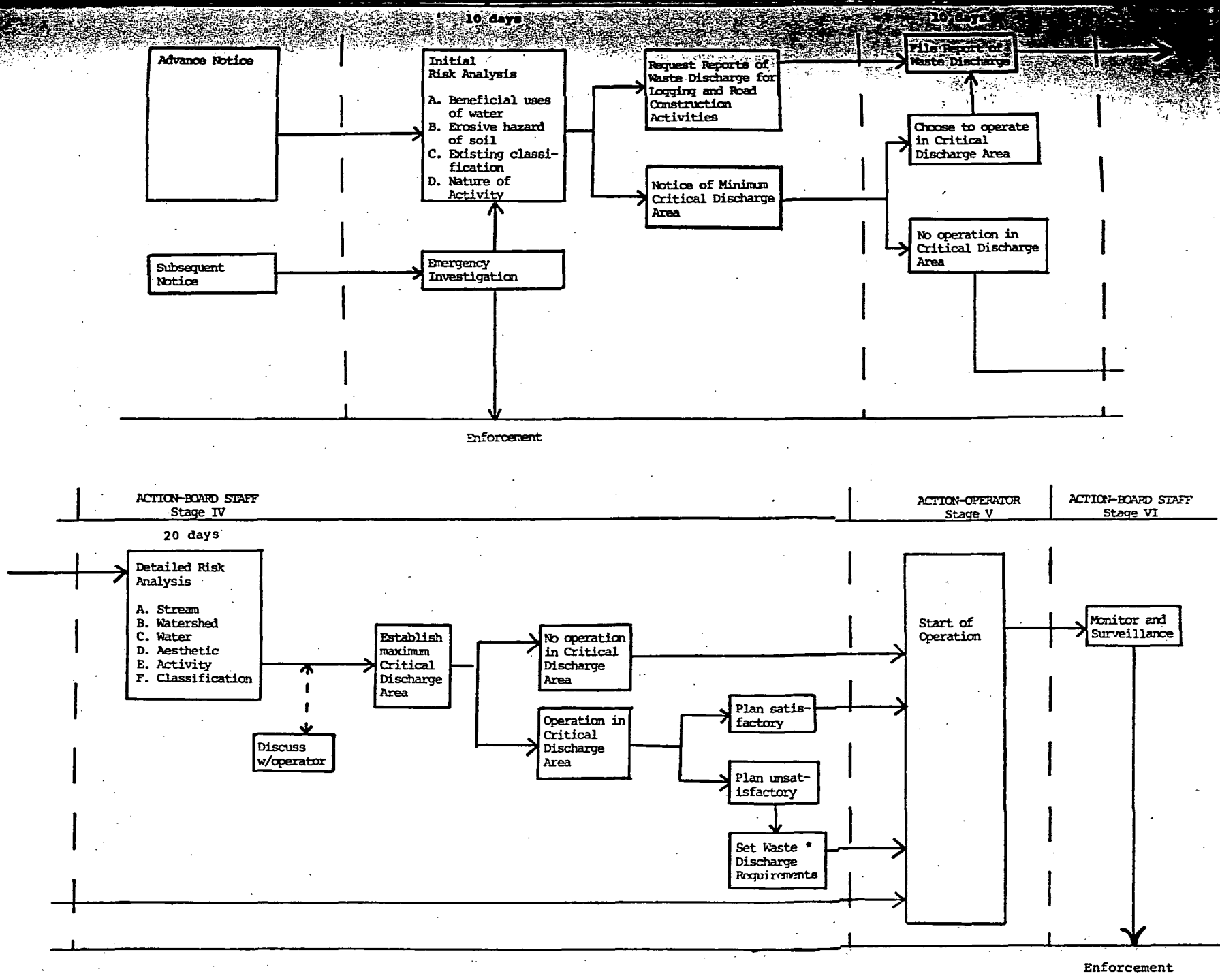
In this chapter of the report a system is described through which the RWQCB staff may evaluate the level of risk of occurrence for a threatened discharge and then classify operations relative to their potential to degrade water quality. The system is based on a rational analysis of relationships between the environment, beneficial uses of watercourses, and proposed land use activities.

The objective is to select those situations where the potential for discharge of deleterious amounts of waste appears great and to investigate those cases to discover the level of risk for violation of the prohibition against waste discharge. The opportunities for degradation of water quality are then lessened through arbitration or the establishment of waste discharge requirements. The key activity is to screen and select those situations and operations which should receive intensive inquiry by the Board. Less than 10 percent of all operations are expected to receive the detailed scrutiny of the Board.

The recommended procedural outline for regulating discharges of waste from logging and road construction operations has been divided into six stages (Figure 8).

Recommended Administrative Procedures

Stage I. The receipt of notification of proposed logging or road construction operations by the Regional Water Quality Control Board is the first stage of the recommended administrative procedure. When notices of proposed operations are received by various federal, state,


10 days
10 days
Advance Notice
Initial Risk Analysis
A. Beneficial uses of water
B. Erosive hazard of soil
C. Existing classification
D. Nature of Activity
Request Reports of Waste Discharge for Logging and Road Construction Activities
File Report of Waste Discharge
Choose to operate in Critical Discharge Area
Notice of Minimum Critical Discharge Area
No operation in Critical Discharge Area
Subsequent Notice
Emergency Investigation
Enforcement
ACTION-BOARD STAFF Stage IV
ACTION-OPERATOR Stage V
ACTION-BOARD STAFF Stage VI
20 days
Detailed Risk Analysis
A. Stream
B. Watershed
C. Water
D. Aesthetic
E. Activity
F. Classification
Discuss w/operator
Establish maximum Critical Discharge Area
No operation in Critical Discharge Area
Operation in Critical Discharge Area
Plan satisfactory
Plan unsatisfactory
Set Waste * Discharge Requirements
Start of Operation
Monitor and Surveillance
Enforcement
* May take longer than

and county agencies, copies should be forwarded by pre-agreement to the RWQCB. The mechanics of forwarding notices are discussed in the Coordination With Other Agencies section of this report (CHAPTER III). Notices should be received well in advance of commencement of harvest activities or initiation of road construction. However, there may be occasions when an operation is in progress or even completed before being brought to the attention of the RWQCB. All notices are then reviewed on an emergency basis according to the procedure described in Stage II. Genuine emergencies, especially those associated with fire or similar catastrophies may cause actions to occur before written analyses of the situation can be made; consequently, such operations would be excluded from the routine procedure.

Stage II (Initial Analysis). A risk analysis procedure, designed to initially screen Notices of Intent for the potential of the proposed activities to cause water quality degradation is the initial action of the RWQCB staff in this stage and is intended to indicate those operations that may present problems. This Initial Analysis examines beneficial uses of water, erosive hazard of soil, the nature of the proposed activity and any existing stream classifications. During evaluation the staff may request supplementary information from the operator or perhaps discuss with him the particular practices he expects to follow. Based on the results of the Initial Analyses (method described in detail in CHAPTER VI), the staff will determine whether or not to request the operator to file a Report of Waste Discharge for Logging and Road Construction Activities (RWD). If an RWD is needed, the operator would be so notified. If the risk for degrading water quality is low and a RWD is not needed the staff would then provide the operator with notice of the decision and a copy of the Regional Board's policy on discharge of earthen and organic debris into waterways including copies of applicable prohibition, special notices and guidelines. Additionally, the staff would establish a Minimum Critical Discharge Area (CDA) (described in CHAPTER IV) for those operations not requiring a RWD. The operator receiving notification that a RWD was not required could proceed with his activity if he did not desire to operate within the minimum Critical Discharge Area. If he did wish to operate in the CDA he would be required to prepare a RWD and his treatment would be similar to a high potential risk operation. Staff action may subsequently include an investigation of the operation to determine whether it has been conducted in accordance with the Board's established minimum CDA. Should the investigation find that violations have occurred enforcement procedures would be immediately considered.

All action by the RWQCB staff would be done within ten calendar days of the receipt of notification except in the case of subsequent notices which may require a lengthier time.

Stage III. If the RWQCB staff required a Report of Waste Discharge for Logging Road Construction Activities the operator would have ten calendar days to complete the form (Appendix G) and return it to the RWQCB. The information to be supplied in the RWD should be readily available to the operator. If, however, he experiences difficulty in gathering the data he could request a ten calendar day extension.

Stage IV (Detailed Risk Analysis). After receiving the RWD the Regional Board's staff would have twenty calendar days to conduct a Detailed Analysis (method described in CHAPTER VI). The Detailed Analysis examines stream and watershed characteristics as well as facets of the proposed operation. During the Analysis the operator may be requested to supply supplementary information and an inspection of the proposed site may be desirable. From the Detailed Analysis a risk classification for causing a threatened waste discharge can be determined which may result in increases in the width of the Critical Discharge Area.

The operator would then be provided with a description of the enlarged CDA, and asked if he desires to operate within the indicated CDA. If he does not intend to operate in the CDA, he would be provided with a copy of the Board's policy on discharge of earthen and organic debris into waterways including copies of applicable prohibitions, special notices and guidelines. If he does desire to operate in the CDA, the Board's staff would examine closely that portion of the RWD that details his plans for erosion control. If the plans are satisfactory he is provided copies of the usual policies and probibitions; if the plans are unsatisfactory, and cannot be resolved through arbitration with the operator the Board would proceed to adopt waste discharge requirements. The adoption of waste discharge requirements would require more time than the twenty calendar days allotted to this stage.

Stage V. After receiving approval from the RWQCB the operator could proceed with his activity. In low risk situations with no operation in the CDA this stage could be reached in ten days after receipt of notification. About forty calendar days would be required before approval of a project undergoing Stage IV or Detailed Risk Analysis. Several months may be required in high risk situations where setting of Waste Discharge Requirements would be required.

Stage VI. Monitoring and surveillance of approved operations would continue for several years to assure that the Board's prohibitions were not violated. Particular attention would be given to those operations having high risk class for causing waste discharge.

Enforcement

Since regulatory efforts in respect to logging operations would be based on prohibitions and guidelines included within a water quality plan, the board may proceed with enforcement actions based on Sections 13304 and 13305 of the Porter-Cologne Act at any time during the procedural process that a violation occurs. Summary judicial abatement remedies would also be available throughout the administrative process. On the basis of a Board hearing conducted in response to a violation, the Board could choose to issue cleanup and abatement or cease and desist orders pursuant to either applicable waste discharge requirements or the prohibitions and guidelines in the water quality plan. A cleanup and abatement order could also be issued without conducting a board hearing.

CHAPTER VI

RISK EVALUATION SYSTEM - METHOD OF ANALYSIS

Initial Analysis (Stage II)

A large number of notifications concerning timber operations, road construction and land conversion will be reviewed by the RWQCB staff. This could amount to several thousand cases annually particularly if land or resource uses presently not requiring formal notification, such as mining and grazing are included within the Regional Board's purview. It was assumed that the RWQCB cannot and does not wish to investigate and evaluate each proposed operation in depth, but it does wish to deal with those that potentially have a high probability for deleterious waste discharge. To reduce the effort involved in evaluating each notice of intent, an overview in-office examination would first be done. This initial screening would reveal those operations having a low level of risk for deleterious waste discharge and thereby reduce the number of operations to be fully evaluated. Those operations revealed as having a low risk potential by the Initial Risk analysis would not have to file Report of Waste Discharge for Logging and Road Construction Activities. This action is expected to encompass a large majority of operations. The operator would be notified of the Board staff's decision and told to proceed with his activity as long as it does not extend into the Minimum Critical Discharge Area (CDA) which, in these cases is the 100-year flood channel of all watercourses in or bordering his site. Operations in a CDA are considered to be a threatened waste discharge. If the operator wishes to operate in the Minimum Critical Discharge Area a Report of Waste Discharge for Logging and Road Construction Activities (RWD) (Appendix G) would have to filed with the Regional Board. The RWD contains information which permits the Detailed Risk Analysis described later in this chapter. Tentatively, operations in the Minimum CDA must be done to the satisfaction of the RWQCB to avoid presumptive violation of the discharge prohibition policy. A RWD would also be required if certain key site conditions were present, such as a past history of severe erosion or land sloughing.

The Initial Analysis considers all beneficial uses made of the water, the erosive hazard of the soil at the site, any existing legislative or administrative classifications, and the nature of the activity proposed. The format and content of the Initial Risk Analysis follows:

Beneficial Use of Water (exclusive of fishery). The North Coast RWQCB has published interim water quality control plans (California Regional Water Quality Control Board, 1971a and 1971b) that enumerate beneficial uses to be protected (see Table 1). Any logging or construction operation proposed in the region should be examined for its potential to degrade the quality of some of these uses. Many beneficial uses are dependent upon a known range of water quality and continuance of this level of quality is essential. Therefore, the relative importance of a beneficial use and its proximity to a proposed operation must be rated to evaluate the magnitude of potential effect. The beneficial uses of water, exclusive of the fishery which is considered separately, should be examined to determine if the proposed operation will have any effect upon them. As an initial evaluation the following selected beneficial uses are considered and rated. The point values reflect an estimation of the relative importance of the use and likelihood of their being affected by the operation:

Downstream Water Uses	Points
Direct municipal withdrawal within 2 miles	20
Direct municipal withdrawal 2 to 10 miles	10
Direct industrial withdrawal within 2 miles	10
Direct industrial withdrawal 2 to 10 miles	5
Recreational use (body contact) within 2 miles	10
Recreational use (body contact) 2 to 5 miles	5
Recreational use (non-body contact) within 5 miles	5
Agricultural withdrawal within 5 miles	5

The beneficial uses which would be affected by the proposed operation according to the foregoing criteria are noted with the highest numerical value taking precedence for inclusion in the Initial tally.

The basic information needed to complete this phase of the analysis should be available in Regional Board records or the soon to be completed Water Quality Management Plan for Basins 1A and 1B. The Board may find the STORET (Storage and Retrieval of Data for Water Quality Control) (Green, 1964) system useful in storing beneficial use information. A computerized system such as this could quickly supply beneficial uses by type and location. Presently, the STORET system only contains data on water quality sampling stations and waste discharge locations.

Beneficial Use of Water (fishery). The interim water quality control plans also recognize several fish related activities as beneficial uses of water. There are over 7,000 miles of anadromous fish habitat in Northwestern California with an annual spawning escapement of about 1,000,000 adults and many more miles of habitat for non-anadromous fishes. The fishery is the most important use in many streams. Because of the importance of many North Coastal waterways as spawning and rearing areas, the fish related beneficial uses are examined separately to assess the value potentially affected. Potential for anadromous habitat degradation is particularly critical because entire year classes can be eliminated from certain streams and, if this continued for many years, reestablishment of runs would be difficult.

Fishery uses of the waterways are stated to coincide with the destructive potential of the proposed operation. The proximity of the following conditions to the proposed operation should be determined. Relative importance is reflected by the size of the number:

Downstream Water Uses	Points
Significant anadromous spawning, rearing or holding areas (as designated by the Department of Fish and Game) within project area	20
Anadromous spawning, rearing or holding area within 1 mile	15
Anadromous spawning, rearing or holding area 1-5 miles	10
Anadromous spawning, rearing or holding area 6-10 miles	5
Non-anadromous game fish habitat within 2 miles	10
Non-anadromous game fish habitat 2-5 miles	5

The condition most applicable to the waterways bordering or passing through the project is noted and its point value included in the tally. This information is available from regional offices of the Department of Fish and Game in Redding, Eureka and Yountville or from the field station in Sacramento. Unfortunately maps indicating the extent of anadromous fish spawning, rearing and holding areas on the North Coast are not available. However, a summary of fish uses will be included in Basin Water Quality Management Plans. The Regional Board may find it useful to request Fish and Game to prepare a large scale map delineating anadromous fish habitat.

Erosive Hazard of Soil. Nearly 80 percent of the soils in the North Coastal and Klamath River basins are either highly or very highly erosive as revealed from data gathered by the U. S. Department of Agriculture (1970,1972).

Consequently, actions undertaken on soils having this inherent characteristic need careful examination. Although the transmissivity of water through most Northwestern California soil profiles is fairly rapid, the combination of prolonged and intense rainfall and steep slopes causes frequent soil movements. Modification of the existing vegetative cover invariably increases erosional potential. Therefore both the erosive hazard of the soil which includes slope characteristics and the extent of vegetation removal must be determined and rated to provide an estimate of potential for accelerated erosion and presumptive water quality degradation--the greater the potential the larger the number as follows:

Resource Condition (30%-45% slope)*	Points
Very highly erosive soils, more than 50% of dominant cover to be removed	20
Very highly erosive soils, less than 50% of dominant cover to be removed	18
Highly erosive soils, more than 50% of dominant cover to be removed	16
Highly erosive soils, less than 50% of dominant cover to be removed	13
Moderately erosive soils	10
Low erosion potential	5

*Note:
Over 60% slopes add 4 points
45% to 60% slopes add 2 points
15% to 30% slopes subtract 2 points
0 to 15% slopes subtract 4 points

The criteria which most closely describes the proposed project should be noted and its point value included in the tally. The soil information could be interpreted from 1:31680 scale Soil Vegetation Maps prepared by the U. S. Forest Service and the California Division of Forestry or from generalized maps appearing in USDA River Basin reports (1970,1972) which have been adapted in this report and appear as Figures 2 and 5. The estimate of extent of vegetation modification would have to be obtained from the applicant unless the Division of Forestry's Notice of Timber Operations form is modified to include this information.

Existing Classifications. Aesthetic and recreation values of certain Northwestern California waterways have been recognized by the establishment of the California Wild and Scenic Rivers System and in the "California Protected Waterways Plan" (California Resources Agency, 1971).

Furthermore, certain streams are being studied for potential inclusion in the Federal Wild and Scenic Rivers System. Classification under these systems is a recognition of the value in maintaining these streams and the adjacent lands in their present condition. Proposals to alter these values require close examination.

The greater the aesthetic and recreational values affected by the proposed operation the larger the points assigned as follows:

Classification	Points
Classified National Wild, Scenic or Recreational River (PL 90-542)	20
Recognized potential National Wild, Scenic or Recreational River	15
Designated State Wild, Scenic or Recreational River	18
Recognized as a potential State Priority A Waterway	15
Recognized as a potential State Priority B Waterway	10

The classification most descriptive of the project area is noted with the largest value included in the tally. The California Protected Waterways Plan contains most of the data needed to determine existing or potential classification.

Type of Activity. All of man's activities have varying degrees of effect upon the landscape. History has proven that certain activities result in a significant amount of surface disruption and subsequent sediment production. Some activities such as tractor logging often result in severe surface disruption with the magnitude of this disruption compounded by steepness of slope and the proximity of the operation to the waterway. Consequently, this Initial Analysis ranks the proposed activity by its potential for causing waste discharge considering both steepness of slope and proximity of operation to the waterway:

Activity	Points
Tractor yarding on slopes greater than 45%	20
Tractor yarding within 100 feet of a stream	20
Tractor yarding on 30% to 45% slopes	15
Tractor yarding on 15% to 30% slopes	10
Tractor yarding on less than 15% slopes	5
High-lead yarding on slopes in excess of 45%	15
High-lead yarding on slopes less than 45%	10

Activity	Points
Balloon or helicopter yarding	5
Road construction within 100 feet of stream	20
Road construction between 100 feet an 150 feet of waterway	15
Road construction between 150 feet and 200 feet of waterway	10
Road construction on slopes greater than 60%	20
Road construction on slopes between 45% and 60%	15
Road construction on slopes between 30% and 45%	10
Miscellaneous activities requiring substantial alteration of cover or landform within minimum CDA	20
Land conversion within minimum CDA	20

The proposed activity is examined and rated according to its potential for causing damage to the stream's water quality. The rating having the highest point value is included in the tally. The data needed to rate the type of activity should be available from the Notice of Timber Operations or could be obtained by contacting the applicant. Revision of the Notice of Timber Operations should be requested by the RWQCB to provide a more descriptive indication of the proposed activity.

After all five categories have been examined, summation of the highest assigned points in each category will determine if the Detailed Risk Analysis is needed. The point totals for requiring the Detailed Analysis are 40 for permanent streams and 60 for intermittent streams.

Critical Requirements. Regardless of point total, however, a Detailed Analysis will automatically be required if the operation is to be conducted within the minimum CDA, and any of the following criteria are met:

Direct municipal water withdrawal within 1 mile downstream.

Critical anadromous fish spawning, rearing or holding area within the zone of influence of the project as defined by the Department of Fish and Game.

Very highly erosive soils with more than 50% dominant cover removal on slopes 45% or greater.

Classification as a State or Federal Wild, Scenic or Recreational River.

Tractor yarding on slopes greater than 45%

Road construction on slopes greater than 60%

Land conversion in the minimum CDA

Miscellaneous activities requiring substantial alteration of cover or land form in the minimum CDA.

In cases where a Detailed Risk Analysis is indicated, the operator will be notified by the RWQCB and be requested to submit a "Report of Waste Discharge for Logging and Road Construction Activities" within 10 calendar days. An additional ten calendar days may be granted upon the operator's request.

Detailed Analysis (Stage IV)

After the general nature of the proposed operation has been determined through the Initial Risk Analysis, those operations that threaten to cause a deleterious waste discharge would be selected for the Detailed Risk Analysis. Thereafter, a Report of Waste Discharge for Logging and Road Construction Activities (RWD) (see Appendix G) would be requested from the prospective operator. Upon return of the RWD the operation would be subjected to an office investigation and, if necessary, a field investigation of both the environmental conditions and the nature of the proposed activity. Six broad categories containing a total of 29 parameters are examined: 1) physical characteristics of the watercourse, 2) physical characteristics of the watershed, 3) existing water quality, 4) aesthetic and recreational considerations, 5) environmental features requiring protection, and 6) the proposed activity. Each parameter would be examined and rated according to its potential association with a waste discharge. For example, the closer an operation approaches a watercourse, the greater the potential for waste discharge to occur. Consequently, in the rating system a greater point score would be given to an operation within 50 feet of a creek than one 100 feet away. A score of zero to 10 is developed for each parameter.

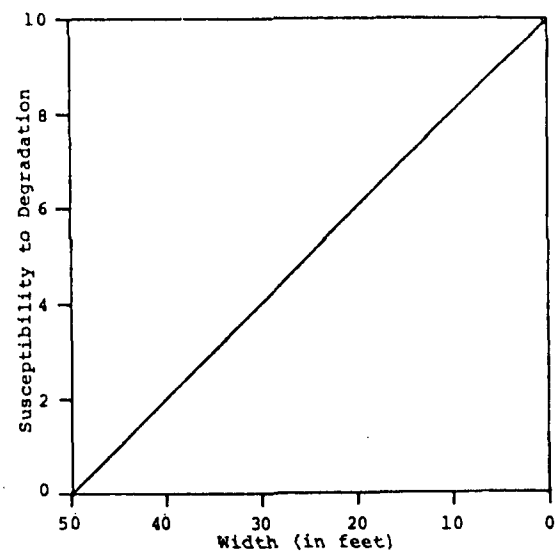
The 29 watershed variables are included so that a clear impression can be obtained of the proposed operation. Subsequent testing by the RWQCB may reduce the number of parameters and may result in weighting the remaining parameters in addition to the strictly one to ten scale of risk now used.

The total of all parameters provides a number which indicates the probability that a waste discharge will occur. From this risk evaluation, Risk Classes would be assigned and the Minimum Critical Discharge Area expanded.

A graph relating magnitude of action to risk probability has been developed for each parameter. These graphs are arbitrary in nature but they reflect the general state of knowledge in these cause and effect situations. For a particular parameter, it will be necessary for the investigator to determine the position on the horizontal axis which is applicable to the site, thence proceed perpendicularly to the intersection with the curve thence horizontally to the perpendicular or risk level axis which indicates the relative value of degradation expected for that particular parameter. The value on the horizontal axis should be obtainable from the RWD filed by the operator, state agencies, or RWQCB files. If data is lacking or incomplete, the operator should be contacted. It may be necessary for the Board's staff to make an on-site inspection or otherwise obtain necessary data. Remember, the values appearing on each graph are arbitrary and are only an approximation of the relationship between a particular parameter and an estimated level of risk. These values were employed satisfactorily in office and field testing of the system and seem to project, in a pragmatic sense, the level of risk or the degree of threatened waste discharge from proposed logging and road construction activities.

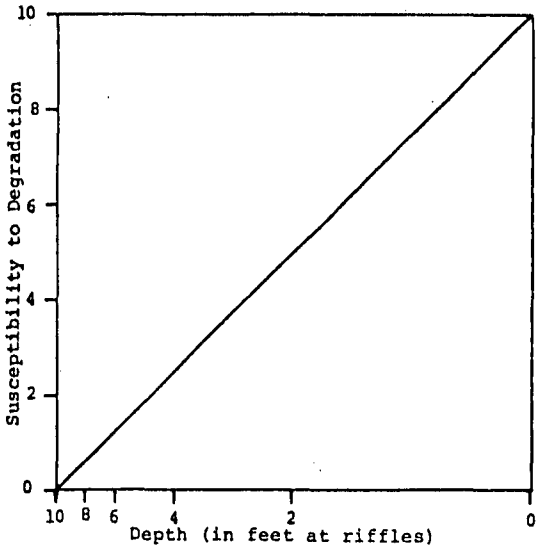
Physical Characteristics of the Stream. The actual morphology of the stream and its flow characteristics are examined in this category. Those parameters most subject to alteration by adjacent land use are rated as are characteristics of flow which might compound the effect. The criteria measured are: stream width, depth, gradient, and flooding behavior, stream bed material, percent of fines in gravels and pool-riffle relationships.

Stream Width



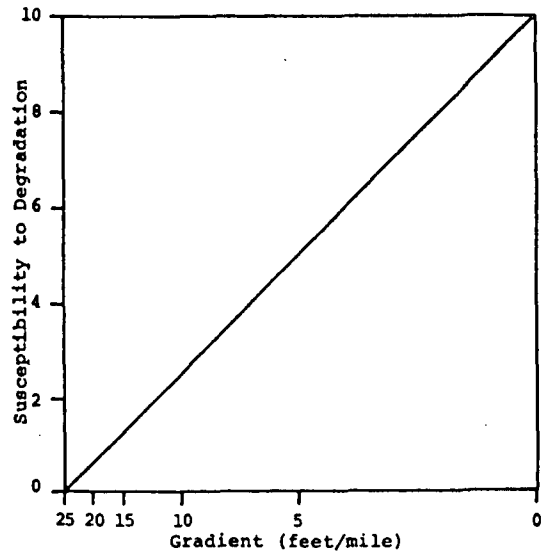
The narrower the stream channel (measured as the unvegetated channel), the higher its susceptibility to damage from waste discharge. Width is proportionally of greater importance to smaller streams. A wider channel is indicative of flood flows of sufficient volume to move sediment or debris downstream. Like many watershed and stream values, it interacts with other values particularly stream depth and gradient. Examined by itself however, progressively greater damage could be expected to occur as the unvegetated stream channel narrows. However, the importance of the degradation may be noticeably less in very small streams.

Stream Depth



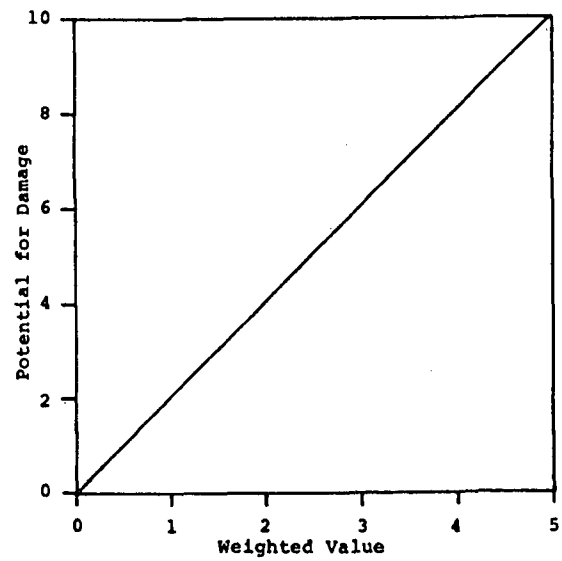
The shallower a stream (measured at riffles), the more susceptible it is to degradation from earthen and debris waste discharge. Shallow channels, like narrow channels, have less ability to cleanse themselves by removal or accommodation by debris and sediment deposited in them. Channels over ten feet deep indicate sufficient annual flooding volume to annually move all sediment, except in extreme cases (landslides) from the site. This ability progressively lessens as the depth becomes shallower.

Stream Gradient



A steep gradient permits faster water movement hence removal of material deposited as a result of poor land use. More material and larger material can move downstream faster because the steeper gradient encourages higher water velocities. Below 25 feet/mile however, streams become increasingly more sluggish, deposition of suspended solid wastes occurs and material entering the stream remains for long periods of time moving out only during intense floods.

Flooding Behavior

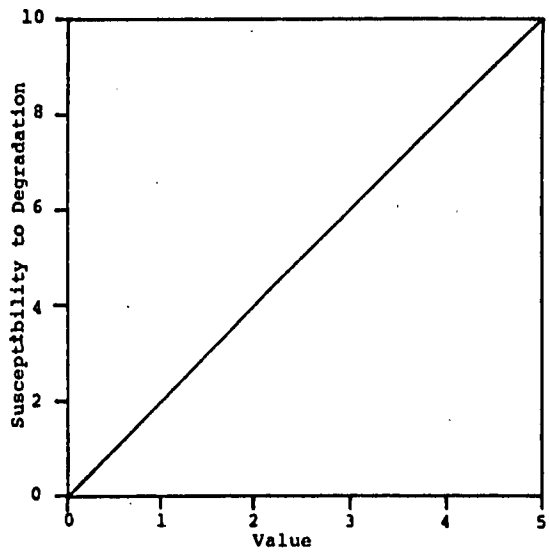


A weighted value is derived from totalling the number from each of the following columns which rate the stream's flood volume with its frequency and damage. The value is based on records or judgement as ascertained by inspection of the stream.

Frequency	Volume	Damage
Frequent 1	high 2	high 3
Infrequent 0	moderate 1	moderate 2
	low 0	low 1
		none 0

Flooding behavior is measured because altering the land surface or vegetative cover adjacent to a frequently flooding, high volume, normally destructive stream increases its potential for erosion damage. Poor land use practices adjacent to a stream with a high weighted value may increase the frequency or magnitude of flooding.

Stream Bed Material

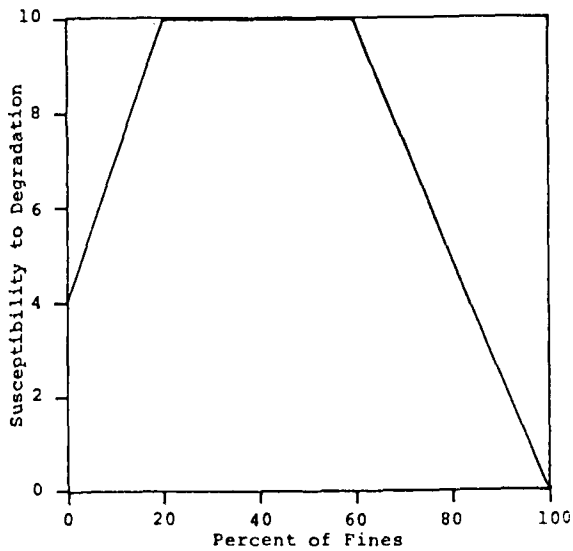


Streams having rubble or gravel bottoms are subject to greater degradation for salmonids than those with muddy bottoms. A weighted value is obtained from the following column.

Fine gravels - less than 2"	5
Medium gravels - 2 to 4"	4
Coarse gravels - 4 to 6"	3
Boulders - greater than 6"	2
Sand	1
Mud	0

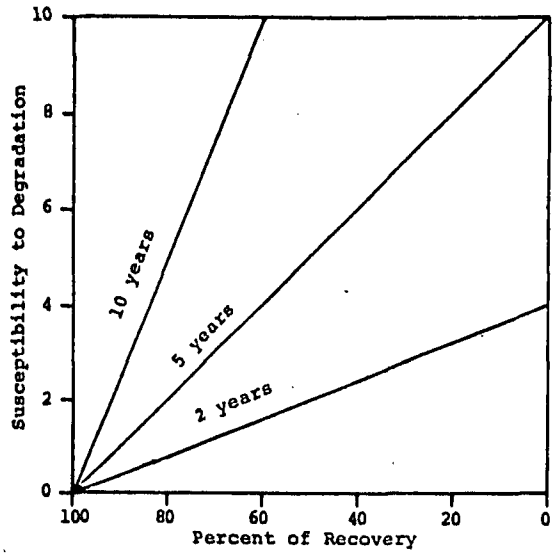
The composition of the stream bed is critical for spawning salmonids. Therefore, protection of gravel substrates from fine sediments and oxygen consuming debris is very important. This criterion interacts with others, such as gradient, in determining whether deposited material will render the gravels less valuable for spawning or whether the material will rapidly disperse with normal winter flows. Measured in itself however, it does provide an indication of the magnitude of susceptibility to degradation.

Percent of Fines in Gravels



Fines are described as sediments passing through a 1mm mesh screen opening. This is used as a measure of the stream's ability to cleanse its gravels and of its value as a salmonid spawning stream. Susceptibility to degradation of gravels can be estimated in that those streams having low percentages indicate cleansing ability while those with high percentages indicate a poorer ability. The curve breaks at 40 to 50 percent because streams normally possessing such high percentages of fines in the gravels are naturally of almost no value as spawning grounds. Salmon spawning streams with low percentages of fines in the gravels can absorb a small volume of fine sediment before the intergravel spaces become clogged thereby severely restricting spawning success. Spawning beds noramlly having 20 to 40 percent fines are particularly sensitive. Streams that normally have 60 percent or more fines are valueless as spawning gravel, consequently, addition of fine sediment has a decreasing degradatory effect.

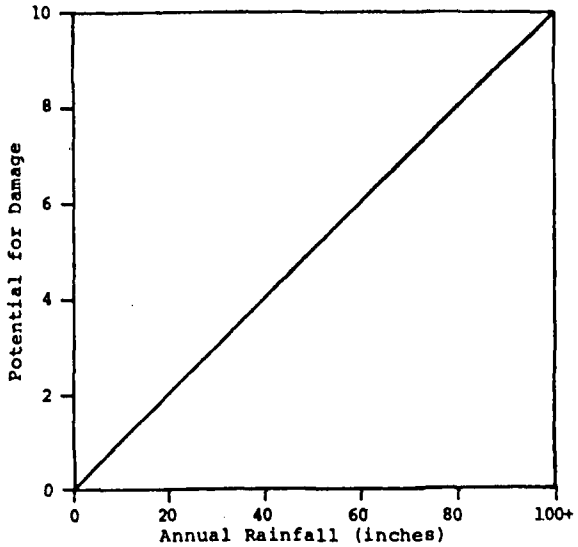
Riffle-pool Relationship



This is an estimate of the stream's ability to maintain a satisfactory relationship of pools to riffles despite past land use. Pool and riffle length should be about five times stream width. Some land use results in deposition of sedimentary material in the pools and conversion of miles of streams into riffles without occasional interspersion of pools. Fish use of the waterway is curtailed when pool-riffle relationship does not return to normal. Time since past activity must be considered hence the three slopes on the graph. This is a difficult relationship to judge as knowledge of prior conditions is needed. If the pool-riffle situation seems inadequate, and this inadequacy is judged to be caused by recent sedimentation, then additional sedimentation can only further impair the stream.

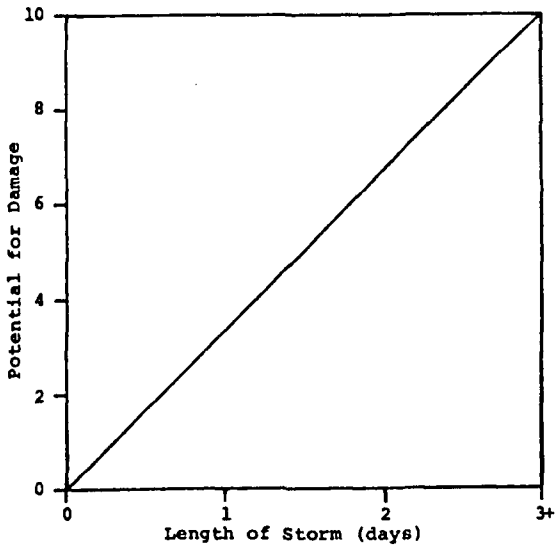
Physical Characteristics of the Watershed. The morphology of the watershed and its rainfall characteristics are examined in this category. Each parameter is evaluated to rate the magnitude of its effect upon water quality. The criteria examined are: rainfall amount, duration and intensity, erosive hazard of soils, hydrologic soil group, slope, vegetative cover, evidence of mass soil movement and recovery from past use.

Rainfall Amount (Annual)



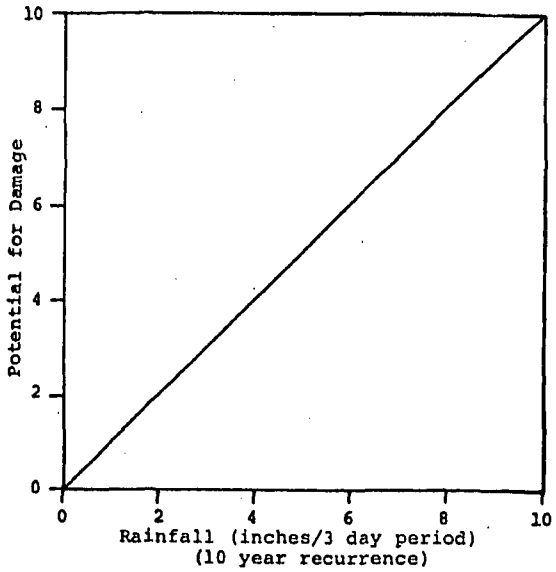
The greater the annual average rainfall, the greater the possibility that the soils will be saturated a longer period of time and the higher the possibility of flooding and mass soil movement. Annual totals less than fifty inches can generally be absorbed by the soil profile without adverse consequences. Above fifty inches however, the potential for creating danger rapidly increases. This characteristic interacts with rainfall intensity and duration but must be measured separately.

Rainfall Duration



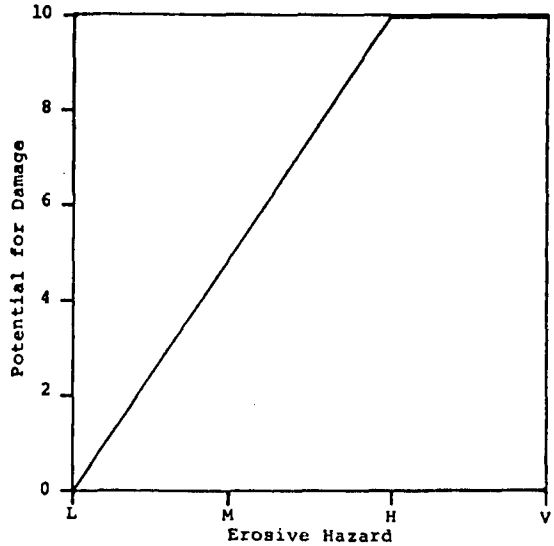
Although most North Coastal soils have good water transmissivity a prolonged series of storms rapidly saturates the soil and increases the potential for mass soil movement. Severe flooding and extensive erosion commonly occurs when an intense storm cell moves in after several days of moderate rainfall. This is one of the three rainfall parameters which interact to initiate soil movement.

Rainfall Intensity



Intense rainfalls do not allow much transmissivity through soils, hence more surface runoff occurs accelerating the rate of sheet and gully as well as stream bank erosion. Since raindrop impact velocity is 19 mph, many and large raindrops will rapidly compact the soil surface thereby increasing overland surface flow. Also soil pores can only move so much water through the soil profile and if the precipitation is arriving faster than it can percolate through the profile, surface runoff will ensue. Rainfall intensity can cause erosion in itself but it does interact with rainfall amount and duration.

Erosive Hazard of Soils

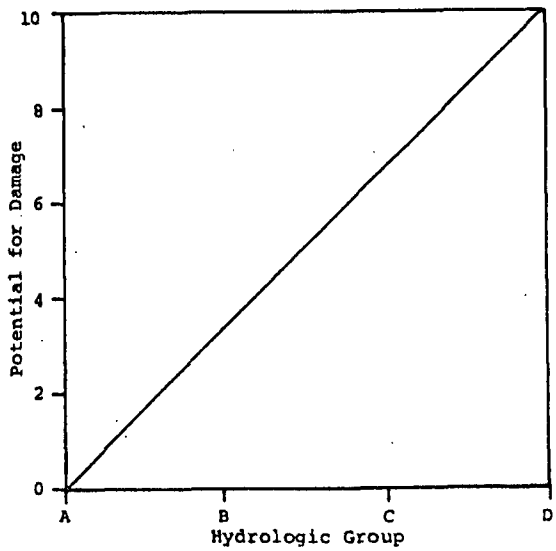


The erosive hazard of soils for most of Basins 1A and 1B appear on large scale maps and in indexed charts in Department of Agriculture appendices (USDA, 1970 and 1972). For more accuracy, however, smaller scale soil vegetation maps should be examined. Erosive hazard is rated as follows:

L = low
M = moderate
H = high
V = very high

Erosion hazard is determined by the Department of Agriculture by evaluating slope, texture and structure of soil, amount and type of vegetative cover and amount of runoff with slope being the dominant factor. The potential for damage rapidly increases as the erosive potential increases. The erosive hazard of soil is perhaps the most indicative parameter to be measured when evaluating potential for stream damage from adjacent land use.

Hydrologic Soil Group

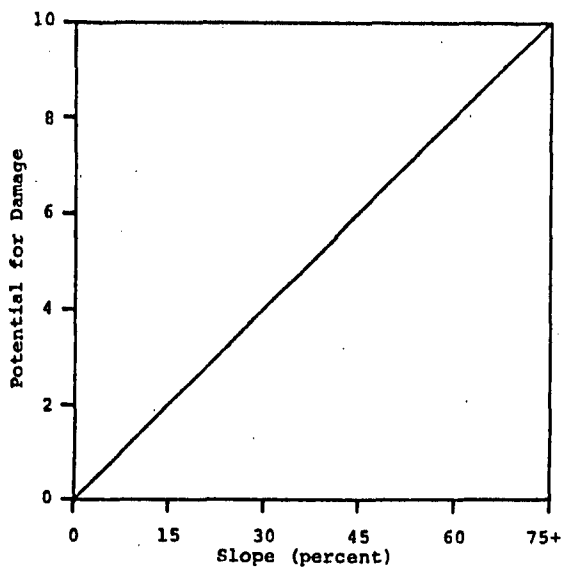


The Department of Agriculture (USDA, 1970 and 1972) has indicated on large scale maps and by soil types the hydrologic soil groups for most of Basins 1A and 1B. These groups are used to estimate runoff potential of soils. Considered in determining the grouping are water transmissivity through the profile, soil texture, drainage and infiltration rates. The following grouping is used:

Group A = Low runoff potential
Group B = Moderately low runoff potential
Group C = Moderately high runoff potential
Group D = High runoff potential

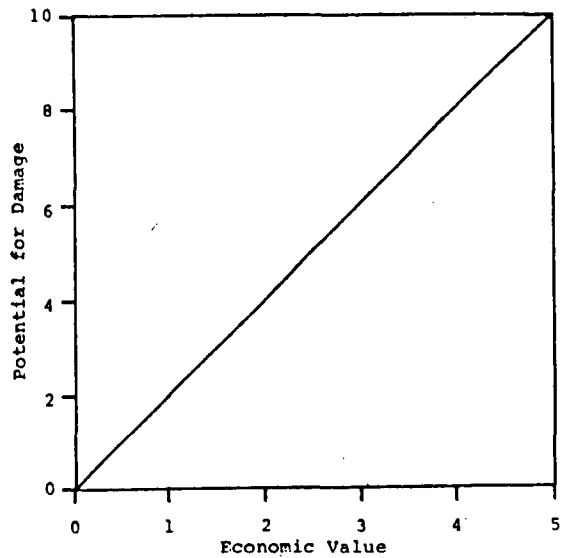
As the runoff potential increases, the potential for waste discharges to the water likewise increases.

Slope



Slope is included in the erosion hazard classification but because of its relationship to soil and debris movement and thus waste discharges, it is considered separately as well. The steeper the slope, the greater the risk that waste discharges will occur regardless of soil type and erosion hazard. Slope percentages will vary throughout the site so an average or typical value should be determined.

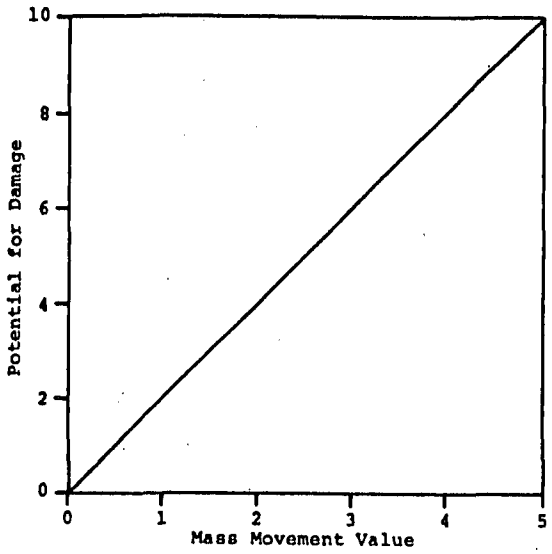
Vegetative Cover



Filtering strips of vegetation retained between stream channels and soil disturbing activities provide a measure of protection against waste discharge. Its principal purposes are to keep heavy equipment away from the sensitive streamside zone and to act as a filter for materials originating upslope. If non-economic tree species occupy the streamside zone (within 100 feet), there is a greater probability that the zone will be left undisturbed. The greater the economic utility of the vegetation within the zone, the greater the potential for surface disruption according to the following schedule:

Even-aged conifers	5
Multi-aged conifers	4
Mixed stand (conifers and hardwoods)	3
Grassland	2
Hardwoods	1
Riparian	0

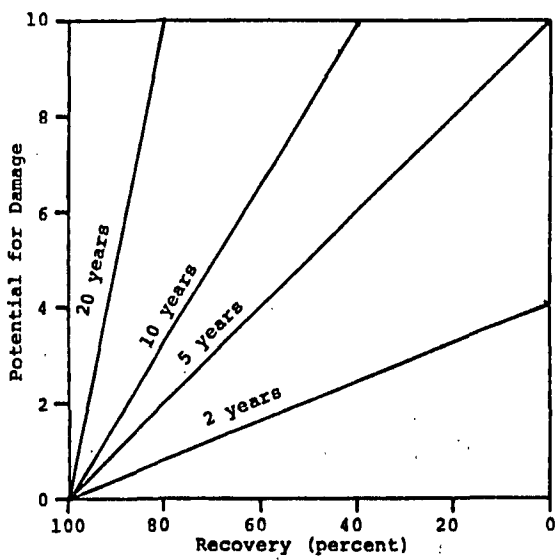
Evidence of Mass Soil Movement



Readily visible indications of active or arrested mass soil movements provide evidence that future movements can be expected.

Landslide	5
Slump	4
Gully extensive	3
Gully moderate	2
Gully light	1
None	0

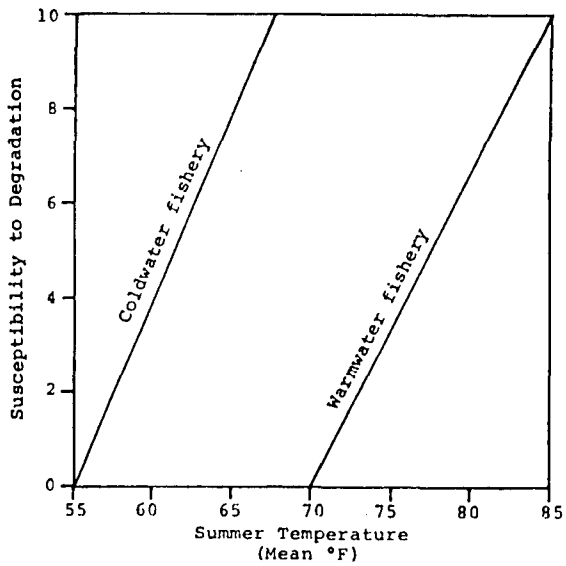
Land Recovery



Recovery is an estimate of the ability of the land to recover from land uses based on its observable condition since past uses. The parcel of land to be logged or constructed upon, or an adjacent site, should be examined to determine the rate and degree of recovery since the last activity. Time since the previous activity is a very important consideration with those lands requiring long periods of time for recovery having correspondingly greater potential for damage. Waste discharges from such lands likewise extend over longer periods of time.

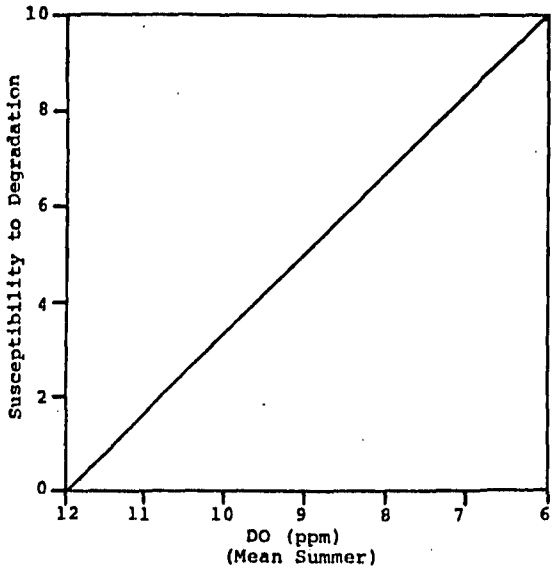
Water Quality Characteristics. Some easily measured water quality parameters can provide an indication of sensitivity to degradation. Maintenance of water quality is the major goal of this entire study but only three parameters are measured in this Detailed Analysis because adjacent land use such as logging or roadbuilding can easily cause the acceptable limits of these parameters to be exceeded. The characteristics measured are: temperature, dissolved oxygen and background turbidity.

Temperature



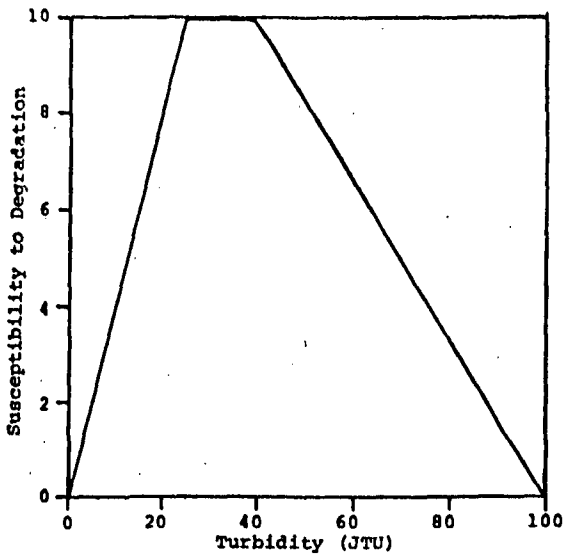
Aquatic organisms particularly fishes are sensitive to levels of water temperature. Removal of streamside vegetation increases the amount of solar energy reaching the stream thus increasing its temperature. These organisms have optimum ranges of temperature for their well being and the difference between optimum and lethal is often small. A greater temperature range is permissible before unsuitable temperatures are attained when existing mean summer stream temperatures are colder. On a warmer stream much less temperature latitude is available before degradation occurs. Two functions are presented depending upon the nature of the fishery.

Dissolved Oxygen



The dissolved oxygen content of streams is critical to aquatic organisms. Fishes are at a physiological disadvantage when DO levels drop below 5 ppm and may die when levels go below 2 ppm. Therefore, the higher the dissolved oxygen level (mean summer), the more degradation a stream can withstand before the DO level becomes critical for fishes.

Background Turbidity

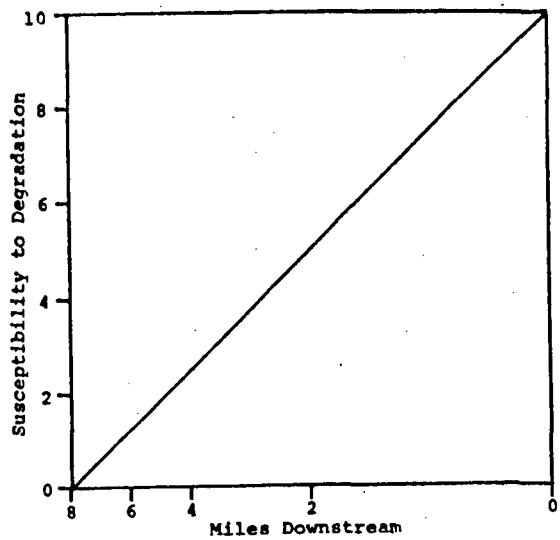


When streams are subjected to high levels of turbidity angling success decreases and salmonid egg and fry mortality increases. Streams having naturally low mean summer background turbidities are more susceptible to degradation than

those streams with high background levels. Particularly critical are streams with natural background levels less than 25 JTU's (Jackson Turbidity Unit). Impairment of angling success and damage to the fishery rapidly increases at 25 to 30 JTU. The addition of turbidity to a stream with naturally high values is expected to have a lower level of effect on a relative scale of values.

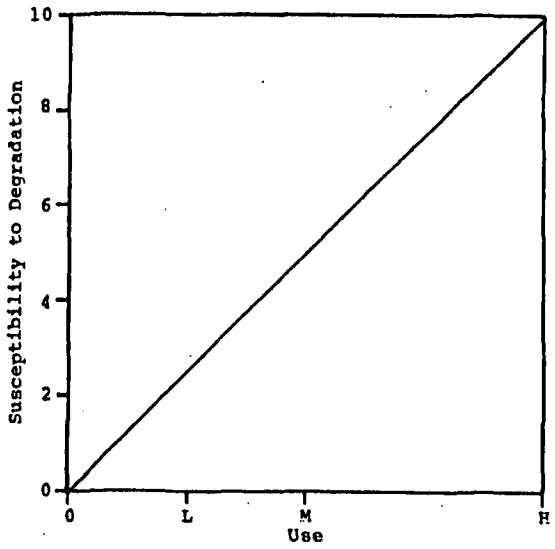
Aesthetic and Recreational Characteristics. The only contact many individuals have with waterways is aesthetically or recreationally. Hence the value of a waterway for these purposes must be considered. If a stream has high recreational or aesthetic value, any land use operation has the potential to diminish this value. The closer the proposed project is to established recreational areas or the more intense the recreational use, the greater the potential for damage. Characteristics to be examined are: utilization for body contact sport, general recreational use of waterway, angling use, and general recreational use of land adjacent to waterway.

Utilization for Body Contact Sports



The closer the operation is to areas utilized for body contact sports, the greater the potential for health hazards and aesthetic degradation. The susceptibility to degradation rapidly decreases the farther the operation is upstream from the use areas.

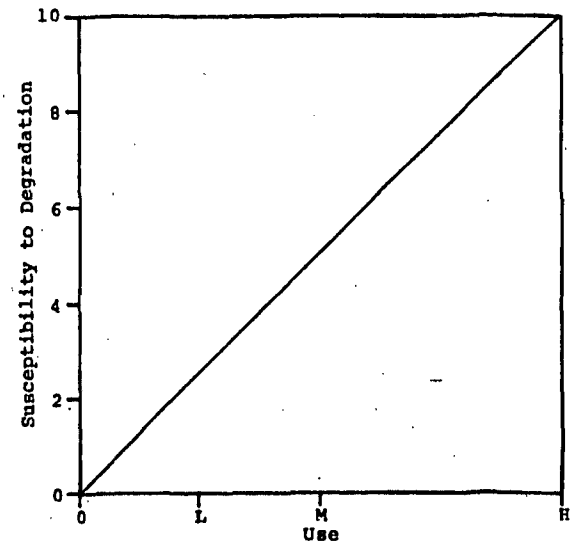
General Recreational Use of Waterway



This is a measure of the extent of recreational use. Impairment of recreational values by waste discharges occurs in heavier utilized areas. Lightly used areas could withstand more degradation of water quality from sedimentation than could heavier utilized areas before extensive personal recreation values are affected. Recreation use of the waterway adjacent to the project and for five miles downstream must be considered on the following schedule:

O = None
L = Light
M = Moderate
H = Heavy

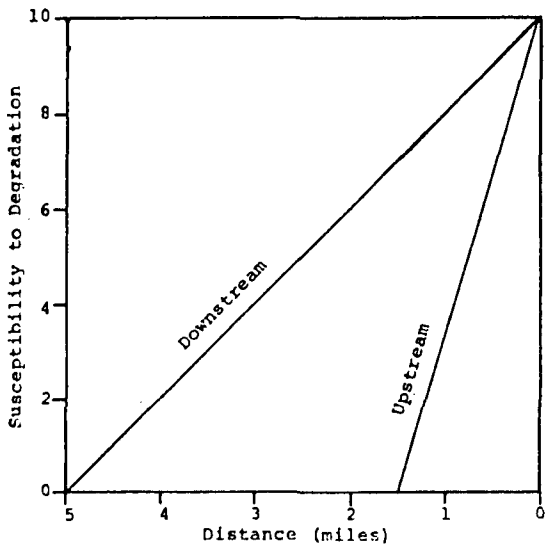
Angling Use



This category is an estimate of magnitude of angling use of the waterway. A heavier utilization would result in greater potential losses if water quality is impaired. The following schedule is used to judge level of use.

O = None
L = Light
M = Moderate
H = Heavy

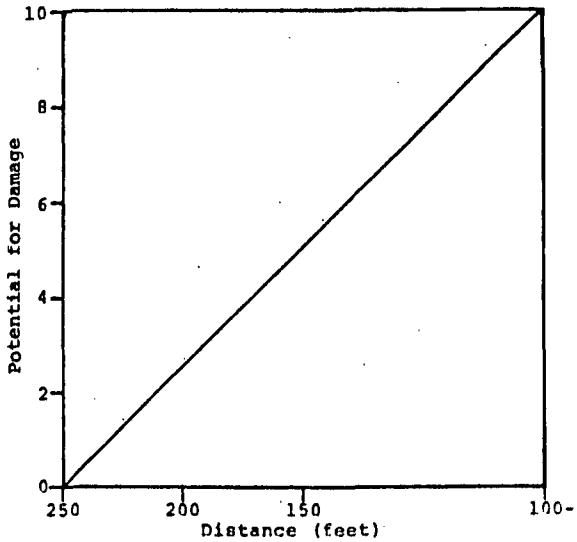
General Recreational Use of Land Adjacent to Waterway



This is an estimate of the proximity of a proposed operation to an established or proposed recreational facility both up and down stream. Consideration should be given to such facilities as, campgrounds, picnic grounds, and scenic areas and trails. The value of the individual's recreation experience would be affected by incompatible land use activities adjacent to the recreation area. Two values are shown because a recreation site upstream is quickly out of sight and sound of an operation and would be seen only by hikers from the recreation area. Downstream recreation sites are affected by any water quality degradation as well as by sight and sound.

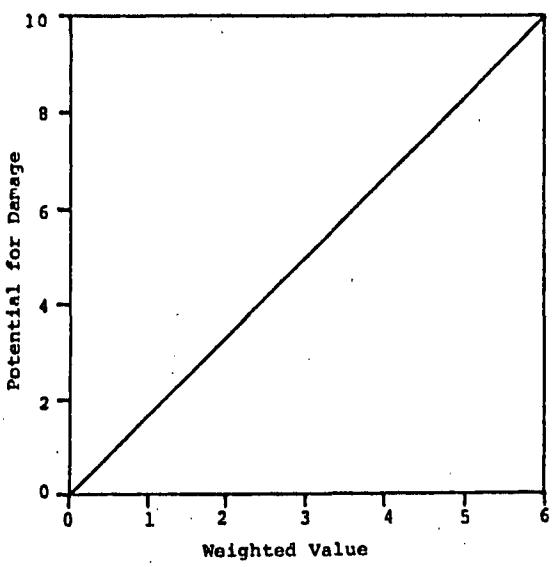
Proposed Activity. The potential for water quality degradation resulting from construction or land use activities varies according to the type of activity and its proximity to the waterway. When examining a proposed project the activity and amount of soil surface exposed must be considered. Rated in this category are: distance to waterway from nearest road, extent of road cuts and fills, and amount of surface exposure expected.

Distance to Waterway from Nearest Road



Roads and road construction are a primary source of sedimentary material. Particular attention should be paid to the nearness of new roads to streams because several years are required before any degree of soil stabilization and revegetation occur. The potential for damage rapidly increases as the road nears the stream.

Road Cuts and Fills

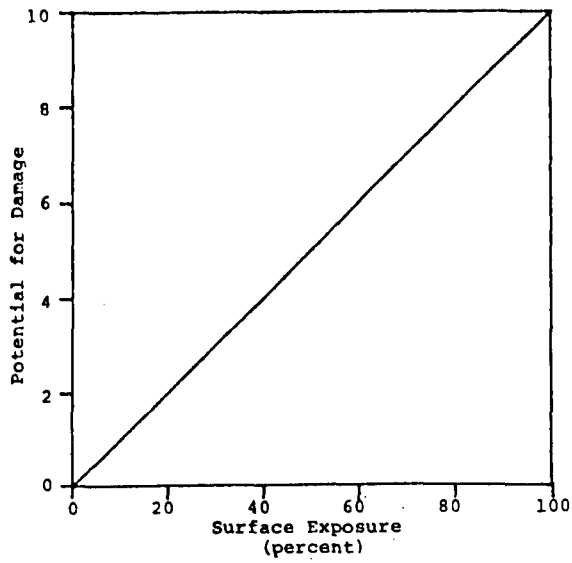


Road cuts and fills are frequent producers of erosional material which may be promptly discharged into waterways. This risk evaluation characteristic relates to the type of cuts and fills on the operation and provides no direct

indication of how many. The number is broadly covered under the surface exposure category. The weighted value is determined from totalling the appropriate number from each of the following columns.

Cut & Fill Slope Height	Soil Erosibility	Slope
26' + = 2	Very high = 2	>30% = 2
11' - 25' = 1	High = 1	15-30%= 1
0' - 10' = 0	Moderate = 0	<15% = 0

Surface Exposure Expected



This is an estimate of the amount of surface to be exposed through removal of vegetation or by construction. Potential for a waste discharge is directly proportional to the amount of raw, unvegetated surface exposed by the operation.

Considerations Requiring Protection. The Detailed Analysis must take into consideration various extra-ordinary concerns requiring special attention or additional protection. If any of the following apply to the proposed project the stated point value is added to the total.

Anadromous fish spawning or rearing area	10
Existing or proposed State or Federal Wild River	10
Classified I in California Protected Waterway Plan	10
Classified II in California Protected Waterway Plan	5

Risk Class for Threatened Discharge. The total of all risk units estimated in the Detailed Analysis provides an index of the probable risk for a waste discharge to occur in violation of Board policy. There is a possible total of 290 points in the Detailed Analysis, but in practice an operation would have a much lesser number. It is unlikely that all 29 evaluation factors are pertinent to a particular project. It is also possible that some factors may be able to be estimated even though pertinent. Consequently, fewer than 29 parameters would be considered. Therefore, the total risk value, in all cases, is divided by the number of parameters considered in order to establish a Risk Class. For example, the Alex Creek case study provided a total of 123 points and a Risk Class value of 4.2 (123÷29), and the South Fork Caspar Creek field test provided a total of 82 points and a Risk Class value of 3.2 (82÷26). The Risk Class value is applied to Table 3 according to stream flow character to ascertain the Risk Class for the threatened discharge anticipated from the proposed activity.

Width of Critical Discharge Area. In lieu of setting Waste Discharge Requirements at this point, the Board may expand the minimum Critical Discharge Area bordering the stream (Table 4). Expansion distance coincides with the Risk Class. This area presumably has a very high risk for waste discharge as a result of soil disturbances. If the applicant chooses not to operate in the Critical Discharge Area, then there is no need for further examination by the Board. On the other hand, to operate in the CDA, an operator must satisfy the Board through specific operational plans which are included in his RWD, that his operation will not result in violation of the Board's prohibitions. The submitted plan should be carefully examined and arbitrated for change if necessary in order to prevent waste discharges in violation of Board policies. After determination of the Risk Class for a proposed project, Waste Discharge Requirements could be established utilizing data derived from the Report of Waste Discharge for Logging and Road Construction Activities and the Initial and Detailed Risk Analysis. Setting Waste Discharge Requirements is a judgement prerogative of the Regional Board and can be accomplished on the basis of overriding site variables or past performance of the applicant. Information gathered in the Risk Classification System would assist in the establishment of waste discharge requirements.

The Risk Evaluation System as a Tool. At the beginning of this chapter it was indicated that the contractor was presenting a risk evaluation concept. An attempt was made to judge and evaluate stream and watershed

Table 3

Risk Class for Threatened Waste Discharge

	Stream Flow	
Risk Class	Permanent	Intermittent
I	4.0+	5.0+
II	3.0-3.9	4.0-4.9
III	2.0-2.9	3.0-3.9
IV	1/	1/

1/ Values lower than 2.0 on Permanent Streams and 3.0 on intermittent streams and all operations not requiring a Stage IV analysis.

Table 4

Critical Discharge Area Additional Width in Feet[1/]

Risk Class	Stream Flow	
	Permanent	Intermittent
I[2/]	100	75
II[2/]	75	50
III	50	25
IV	[3/]	[3/]

[1/] Measured as slope distance from the edge of the 100-year flood plain or the discernible flood channel.

[2/] If slopes adjacent to the stream are in excess of 50 percent the width of the CDA may be increased to the point where the topography breaks into a lesser slope.

[3/] Critical Discharge Area as wide as 100-year flood plain or the discernible flood channel.

characteristics which would have an effect or be affected by logging or construction activities. In practice the use of all 29 parameters may be unsuitable. For example, a parameter may not apply or the slope of a function or the manner of estimating a variable may not be realistic. The system was designed to be flexible; Risk Evaluation parameters may be added or subtracted in order to enhance the usefulness of the system. It was also designed as a tool for the logging and road construction industry so that they could evaluate their activities adjacent to watercourses in the same manner as the Regional Water Quality Control Board.

Testing the Risk Evaluation System

Office and field tests were made of the Initial and Detailed Risk Evaluation systems. A 1972 logging operation on Alex Creek was tested to determine its probable Risk Class and the width of the Critical Discharge Area which should have been designated. Also tested was a proposed timber sale on South Fork Caspar Creek to determine its Risk Class and CDA. These two sites are dissimilar in that Alex Creek is an interior, permanent stream in a pine-fir association while South Fork Caspar Creek is a coastal, intermittent stream in a redwood-fir association. The Initial analysis of these operations is summarized in Table 5 and the Detailed analysis in Table 6.

These tests were utilized to refine and modify the original concepts of the Risk Evaluation System. In the two tests, members of the North Coast RWQCB staff were readily able to apply the systems and to determine Risk Classes and Critical Discharge Areas. Further testing will refine both the Initial and Detailed analysis but the contractor believes that the basic tenets of the described Risk Classification System will readily assess the potential for water quality degradation from logging and construction activities. Therefore, it is recommended that the Risk Evaluation System proposed in this report and tested in this section be adopted for testing and refinement by the State Water Resources Control Board. Detailed explanation of the reasoning behind each individual value for each test case follows.

Alex Creek Test Case. On December 14 and 15, 1972, members of the North Coast Regional Water Quality Control Board staff and a representative of Jones & Stokes met and tested the Risk Evaluation System. Selected for the test was an actual logging operation adjacent to Alex Creek in northern Siskiyou County. Alex Creek drains northward into the State

Table 5

Initial Analysis - Test Results - Summary

	Alex Creek	South Fork Caspar Creek
Beneficial Use of Water		
Exclusive of fishery	5	5
Fishery	10	15
Erosive Hazard of Soil	22	18
Existing Classification	0	0
Type of Activity	20	20
Total	57	58

Table 6

Detailed Analysis - Test Results - Summary

	Alex Creek		South Fork Caspar Creek	
Physical Characteristics of the Stream				
Stream width	9		9	
Stream depth	10		5	
Stream gradient	0		0	
Flooding behavior	2		0	
Streambed material	1		-	
Percent of fines in gravels	0		-	
Pool-riffle relationship	0		-	
Subtotal		22		14
Physical Characteristics of the Watershed				
Rainfall amount (annual)	6		5	
Rainfall duration	7		7	
Rainfall intensity	4		1	
Erosive hazard of soils	10		10	
Hydrologic soil group	7		3	
Slope	6		7	
Vegetative cover	10		10	
Evidence of mass soil movement	10		0	
Land recovery	8		1	
Subtotal		68		44
Water Quality Characteristics				
Temperature	3		0	
Dissolved oxygen	0		0	
Background turbidity	0		0	
Subtotal		3		0

Table 6 (continued)

Aesthetic and Recreational Characteristics				
Utilization for body contact sports	1		0	
General recreational use of waterway	0		0	
Angling use	0		0	
General recreational use of land adjacent	2		4	
Subtotal		3		4
Proposed Activity				
Distance to waterway from nearest road	10		10	
Extent of road cuts and fills	10		6	
Surface exposure expected	7		4	
Subtotal		27		20
Special Considerations				
Anadromous fish habitat	0		0	
Existing or proposed federal wild river	0		0	
Classified in Protected Waterway Plan	0		0	
Subtotal		0		0
TOTAL		123		82
Total divided by number of parameters (T ÷ n)		123÷29		82÷26
Risk value = T ÷ n		4.2		3.2
Risk Class (from Table 3)		I		III
Increases in width of Critical Discharge Area (from Table 4)		100'		25'

of Oregon and is tributary to the Applegate River as shown in Figure 9. Although the logging operation had been completed, it was examined as if it were a proposed operation.

Alex Creek is a permanent stream. Since the Initial Analysis resulted in a point total of 57, a Report of Waste Discharge for Logging and Road Construction Activities would have been required and a Detailed Analysis undertaken. However, soils on the watershed are very highly erosive and clearcutting with tractor yarding on slopes over 45 percent was indicated so a Report and Detailed Analysis would have been required regardless of the Initial Analysis total.

Initial Analysis

Category	Score	Reasoning
Beneficial use of water (exclusive of fishery)	5	Forest Service campground located on Elliott Creek 5 miles downstream from Alex Creek
Beneficial use of water (fishery)	10	No anadromous habitat but game fish habitat exists in lower Alex and in Elliott Creeks within 2 miles of the site
Erosive hazard of soil	22	Soils are in the Windy Rockland Association which is very highly erosive. The operator intends to clearcut the stand.
Existing classifications	0	No classifications
Type of activity	20	The operator intends to tractor yard on slopes greater than 45 percent and to construct roads on these slopes.
TOTAL	57	Value exceeds 40 on this permanent stream therefore a Report of Waste Discharge for Logging or Road Construct Activities and a Detailed Analysis is needed.

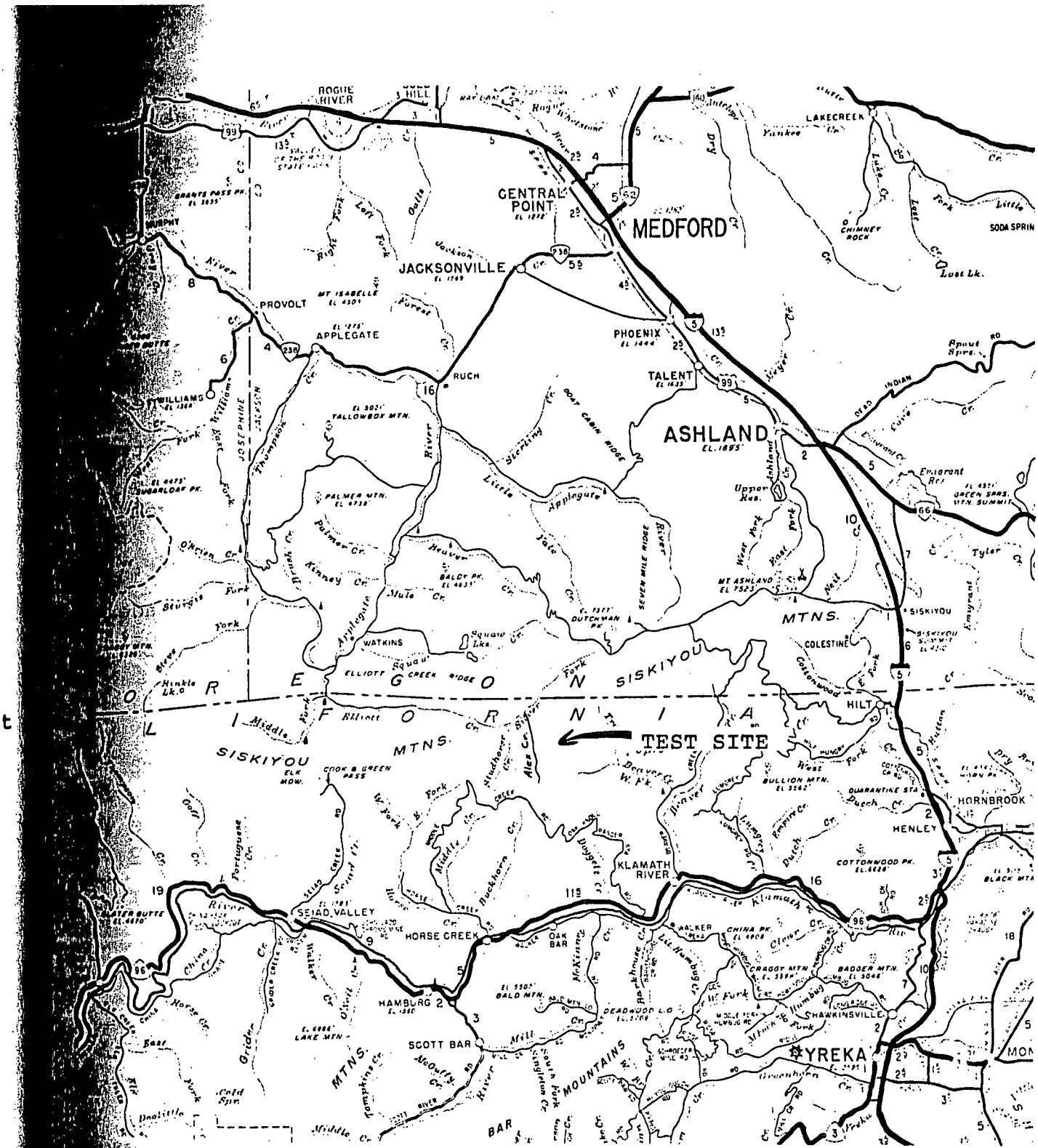


Figure 9. Alex Creek Test Case Location Map.

Detailed Analysis

Category	Score	Reasoning
Physical characteristics of the stream		
Stream width	9	Alex Creek averages 5 feet in width in the proposed logging site.
Stream depth	10	Average summer depth of the creek is less than one foot, deeper in pools but averaging less than a foot.
Stream gradient	0	Alex Creek drops faster than 200 feet per mile.
Flooding behavior	2	Flooding is frequent, of moderate volume, but no physical damage to man-made facilities.
Stream bed material	1	Alex Creek has mainly a sandy bottom.
Percent of fines in gravel	0	Not applicable - no game fish habitat adjacent to site.
Riffle-pool Relationship	0	Relationship completely restored soon after prior operations along the creek.
Subtotal	22	
Physical characteristics of the watershed		
Annual rainfall	6	Annual rainfall at this location is about 60 inches.
Rainfall duration	7	Several storms each year last for at least two days without significant let up.
Rainfall intensity	4	Rains of at least 4 inches during a three day period can be expected to reoccur once in ten years.

Erosive hazard of soils	10	Erosive hazard is very high.
Hydrologic soil group	7	The Windy-Rockland soil association has slow transmissivity for water and is in Hydrologic Group C.
Slope	6	Average slopes throughout the site are about 45 percent.
Vegetative cover	10	Most of the vegetation adjacent to the creek is even aged conifers - a mixed stand of douglas fir and ponderosa pine.
Evidence of mass soil movement	10	Many landslides have occurred on a previous logging operation just upstream from the proposed site.
Land recovery	8	The neighboring operation has only had a 20 percent recovery in the 5 years since logging.
Subtotal	68	
<u>Water quality characteristics</u>		
Temperature	3	Summer temperature seldom exceeds 60°F.
Dissolved oxygen	0	Dissolved oxygen is in excess of 12 ppm.
Background turbidity	0	Stream is normally clear with no turbidity except during flooding situations.
Subtotal	3	
<u>Aesthetic and recreational characteristics</u>		
Utilization for body contact sports	1	Swimming is an activity in Elliott Creek adjacent to the Forest Service Campground 5 miles downstream.

General recreational use of waterway	0	No use.
Angling use	0	No use - no game fish resident to the portion of Alex Creek adjacent to site.
General recreational use of land adjacent	2	Occasional hunter and hiker use but presence of downstream campground results in this value.
Subtotal	3	

Proposed Activity

Distance to waterway from nearest road	10	Roads are planned to be located immediately adjacent to the creek.
Road cuts and fills	10	Cut and fill slopes would be greater than 1:1 on very highly erosive soils on slopes in excess of 30 percent.
Surface exposure expected	7	An estimated 70 to 75 percent of the surface would be disturbed either through vegetation removed or by road and skid trail construction.
Subtotal	27	

Special Considerations

Anadromous fish habitat	0	None
Existing or proposed state or federal wild river	0	None

Classified in Protected Waterway Plan	0	None
Subtotal	0	
TOTAL	123	

Parameters examined = 30

Detailed Analysis value = 123 ÷ 29 = 4.2

Since Alex Creek is a permanently flowing waterway the 4.2 value places the proposed operation into Risk Class I and results in a widening of the minimum Critical Discharge Area by an additional 100 feet.

South Fork Caspar Creek Test Case. A field test of the level of Risk Evaluation Classification System was performed on January 11, 1973 at the offices of the California Division of Forestry in Fort Bragg and at the Jackson State Forest. Representatives of the North Coast Regional Water Quality Control Board Staff, the California Division of Forestry and Jones & Stokes participated. Selected for testing was a proposed 551 acre timber sale on Watershed #3 of South Fork Caspar Creek in western Mendocino County. South Fork Caspar Creek located on the Jackson State Forest flows into Caspar Creek about four miles from the Pacific Ocean. Logging was expected to be accomplished during 1973. The Notice of Timber Operations would provide the following location data needed to initiate Stage II:

S 1/2 section 11 T 12 N R 17 W 240 acres
W 1/2 NW 1/4 SW 1/4 section 12 T 17 N R 17 W 26 acres
N 1/2 NE 1/4 and NW 1/4 section 14 T 17 N R 17 W 220 acres
E 1/2 E 1/2 NE 1/4 section 15 T 17 N R 17 W 55 acres

This information would be sufficient for the Regional Board staff to examine reference material available in their office and, with one exception, complete the Initial Analysis. It would be necessary to inquire of the operator as to the nature of his activity and the extent of cover removal. General location, topographic and soil/vegetation maps appear as Figures 10, 11 and 12.

Since South Fork Caspar Creek is an intermittent stream and since the Initial Analysis resulted in a point total of 58 a Report of Waste Discharge for Logging and Road Construction Activities would not have been required. However, a Detailed Analysis would have automatically been required because the timber sale contract required tractor yarding on slopes in excess of 50 percent.

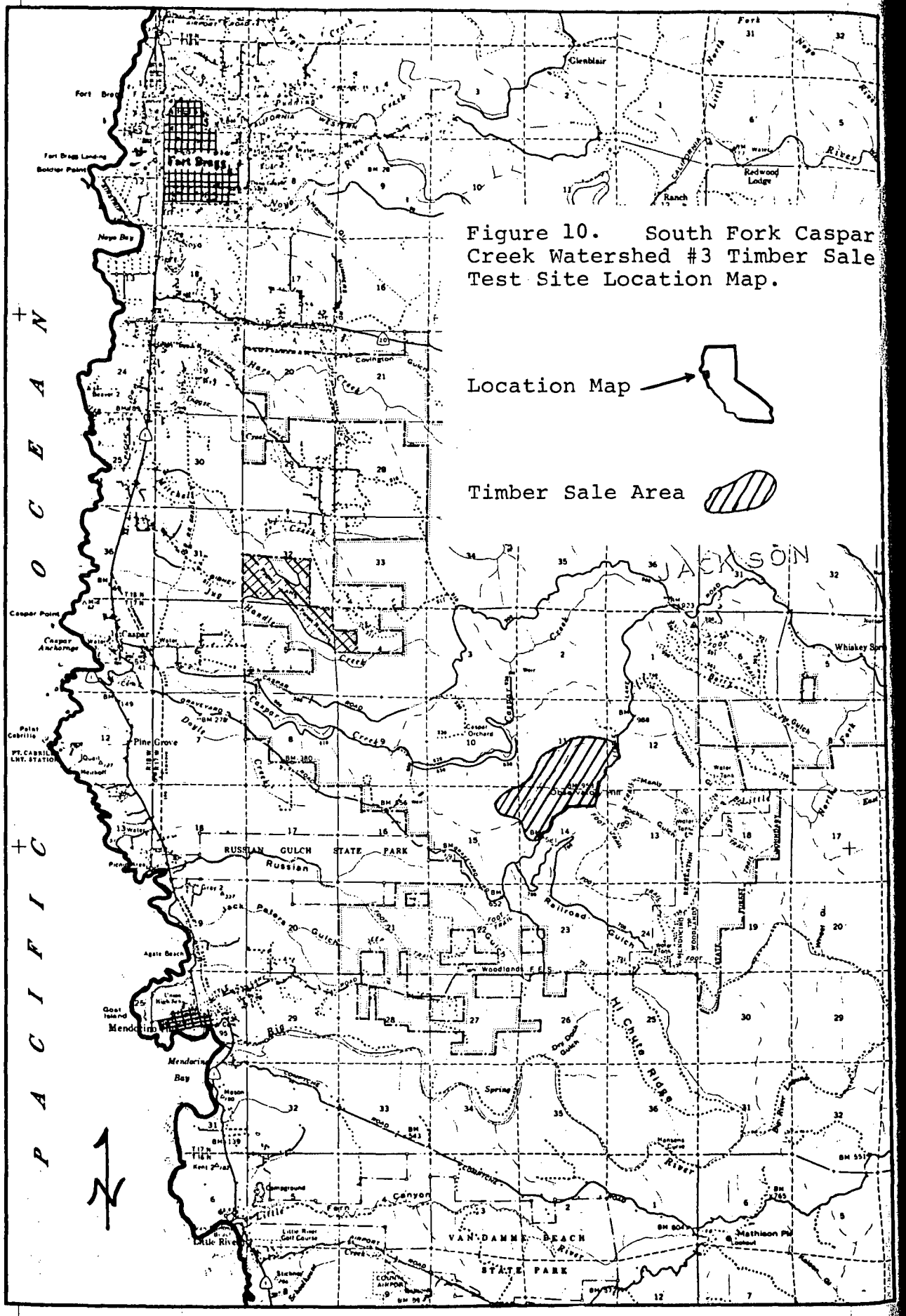


Figure 10. South Fork Caspar Creek Watershed #3 Timber Sale Test Site Location Map.

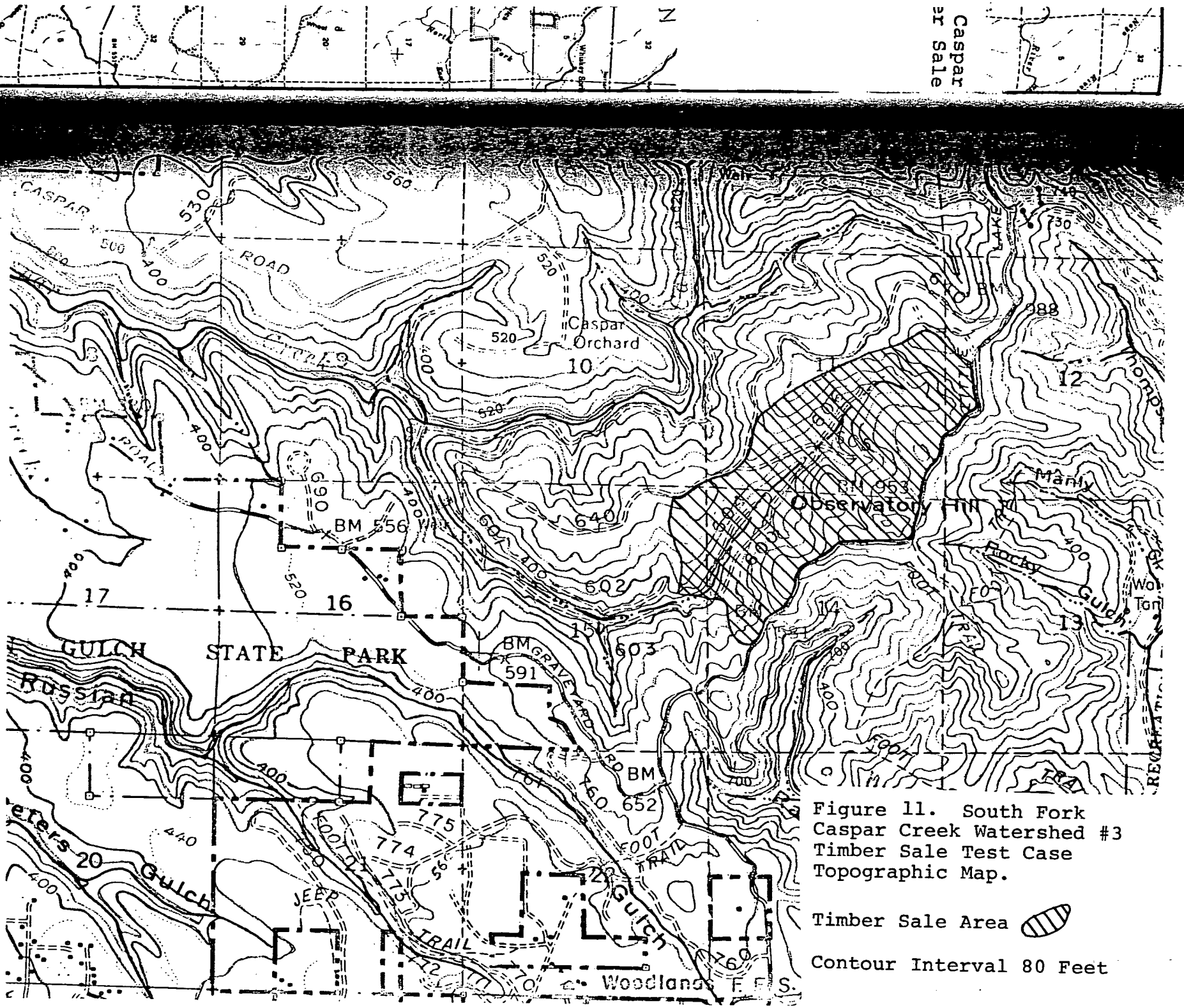


Figure 11. South Fork Caspar Creek Watershed #3 Timber Sale Test Case Topographic Map.

Timber Sale Area

Contour Interval 80 Feet

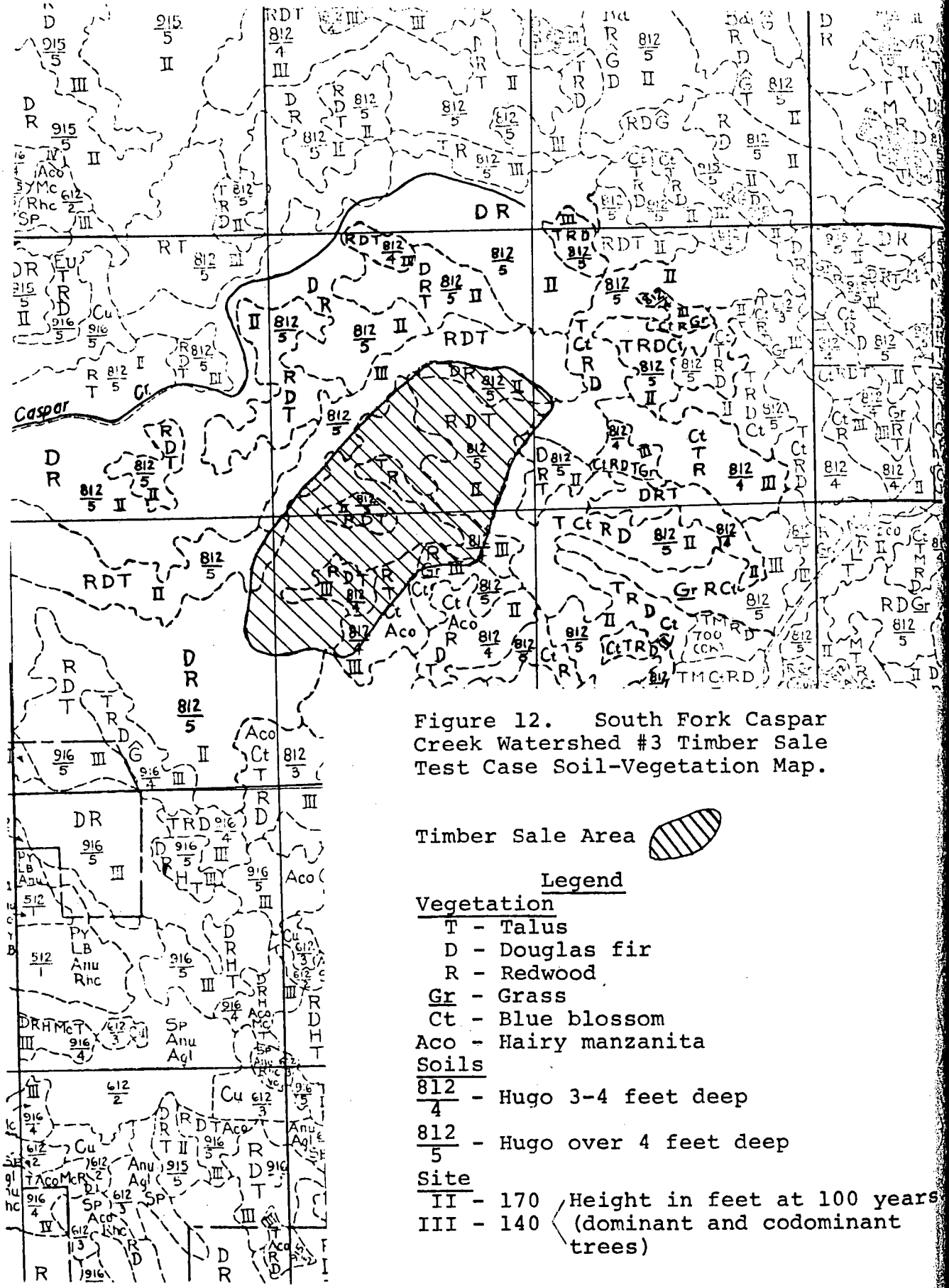


Figure 12. South Fork Caspar Creek Watershed #3 Timber Sale Test Case Soil-Vegetation Map.

Initial Analysis

Category	Score	Reasoning
Beneficial use of water (exclusive of fishery)	5	There is non-body contact recreational use of Caspar Creek three to four miles downstream near its confluence with the Pacific Ocean.
Beneficial use of water (fishery)	15	Silver salmon spawn in Caspar Creek, one mile below the timber sale.
Erosive hazard of soil	18	Soils are in the Hugo-Josephine Association with 30 to 50 percent slopes which is highly erosive. Seventy percent of the dominant trees would be removed.
Existing classifications	0	None.
Type of activity	20	The timber sale contract specifi tractor yarding. Inspection of USGS Comptche 15 minute quad rev slopes generally in excess of 30 throughout the timber sale.
Total	58	Value does not exceed 60 on this intermittent stream; therefore a Detailed Analysis would not ordi arily be needed. However, tract yarding on slopes in excess of 4 automatically requires a Detaile Analysis. A Report of Waste Discharge for Logging and Road Construction Activities is also required.

Detailed Analysis

Physical characteristics of the stream		
Stream width	9	South Fork Caspar Creek averages 5 feet in width within the sale.

Surface exposure expected	4	Fifty percent of the trees and 70% of the volume are to be re using tractor yarding. An est 40% of the soil surface will pr bably be exposed.
Subtotal	20	

Special considerations

Anadromous fish habitat	0	None.
Existing or proposed state or federal wild river	0	None.
Classified in Protected Waterway Plan	0	None.
Subtotal	0	
TOTAL	82	

Parameters examined = 26

Detailed Analysis value = 82 ÷ 26 = 3.2

Since South Fork Caspar Creek is an intermittent stream, the 3.2 places the proposed timber sale in Risk Class III and results in a widening of the minimum Critical Discharge Area by 25 feet.

Alternative Calculation of Additional CDA Based on Slope and Soil Analysis. The slope of the adjacent land surface is an important factor in determining erosion potential. Slope determines the shear stress of water flowing over the soil and the stability of the soil mass. The U. S. Department of Agriculture (1970 and 1972) study of the North Coast region recognized the importance of slope to erosion potential and devised four erosion hazard classifications based primarily on slope. If the strategy is to maintain at least the existing stability of slopes near the streams by retaining the vegetation, the relevant factors for determining the width of the CDA are the slope, depth, drainage, and shear strength of the soil.

Subsurface drainage is perhaps the greatest variable determining failure of soil masses by sliding or sloughing. Soils overlying relatively impervious material are particularly susceptible because accumulation of moisture immediately above the relatively impermeable material reduces the shear strength of the soil. Massive slides can occur on such slopes when surface or subsurface drainage is altered or when stabilization by plant roots that extend into the relatively less permeable material is reduced by denudation or decay. Slides that do not extend to a surface stream should not cause precipitous increases in water turbidity, but such disturbed soil would increase surface erosion rates.

Failure of banks undercut by stream erosion during flood flows and massive bank failure due to seepage from runoff or to lowering of the river water surface after floods, however, cause sudden increases in stream water turbidity. Further, such failures often cause progressive failure upslope or the formation of gullies in deeper soils with a resulting deterioration of land and an increase in turbidity. The surface of failure of banks depends on the uniformity of permeability and shear strength of the soil and on its stabilization by roots.

Slopes, soils, and types of vegetation in an area vary, and a single widely applicable formula is not available for calculating the minimum CDA. Methods for calculating the stability of slopes against failure due to sliding and against failure by cylindrical rotation are presented by Wu (1966) and Taylor (1948) for various slope, subsoil, and submergence configurations. It is possible to survey a slope, take soil samples, determine or estimate probable seepage conditions, make laboratory tests on the samples, and calculate with reasonable certainty whether the slope would be stable if roots decayed or if altering surface drainage would cause massive failure. Such calculations may be justified in the neighborhood of a structure on a stream bank or for strongly contested cases.

It is useful, however, to consider two greatly simplified cases of massive failure to learn whether the CDA that should be left undisturbed is tens, hundreds, or thousands of feet wide. The first simplified case for the condition of a relatively impervious layer parallel to the soil surface on a long slope is shown in Figure 13. It consists of a cylindrical failure surface tangent to the impervious layer with the intersection of the upper failure surface and the soil surface vertical. This represents the shortest massive slide with cylindrical terminal failure surfaces. Tangency to the relatively impervious layer is selected because the moisture will be greatest there, and the soil weaker, and a vertical upper edge to the failure surface

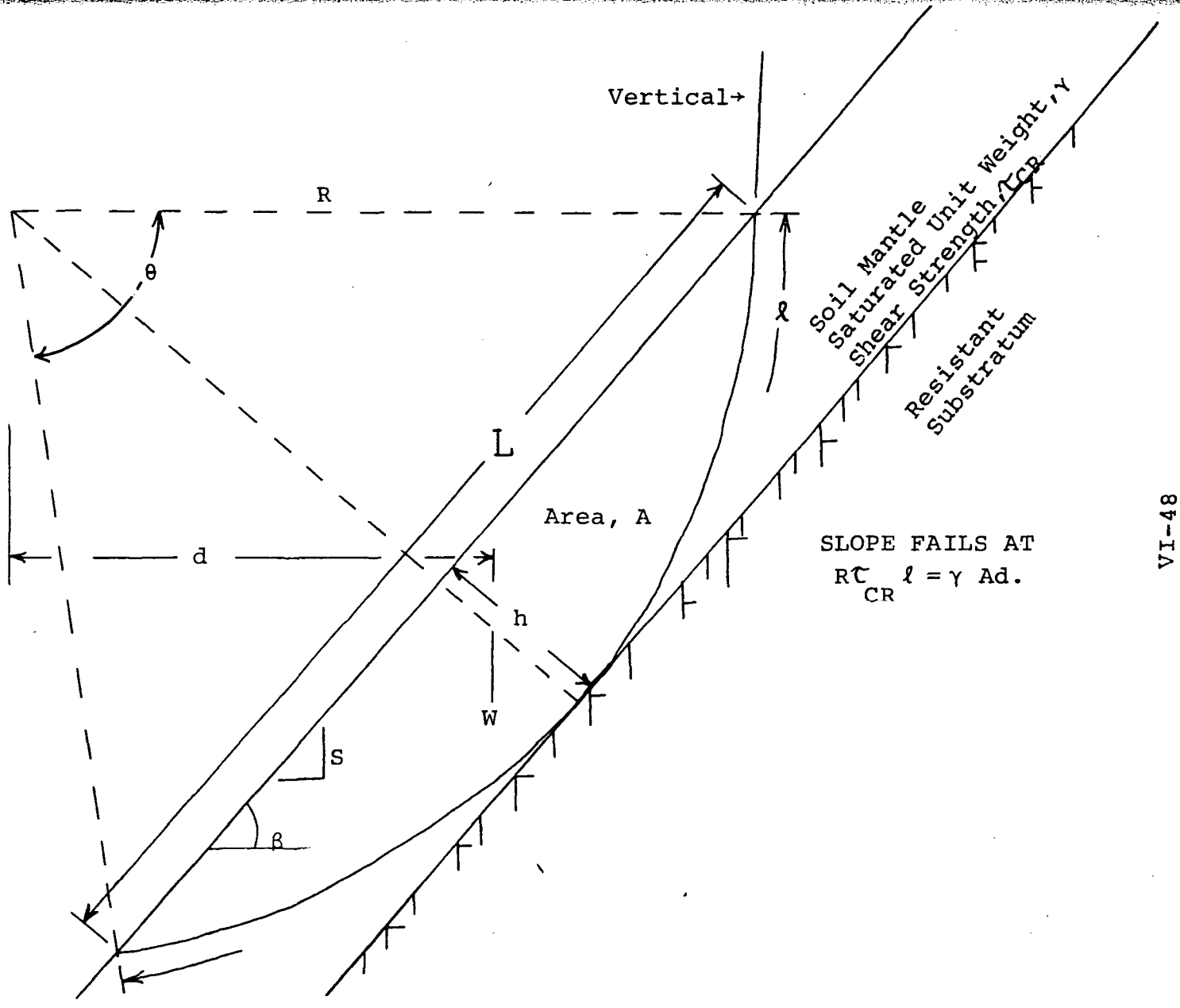


Figure 13. Model for Calculating Slope Failure.

because the lack of a normal force on a vertical surface would minimize the soil shear strength in that direction near the surface. From the geometry and symbols shown in the figure the length of the slope as a function of depth and slope can be described as

$$\frac{L}{h} = \frac{2 \cos \beta}{1 - \sin \beta}$$

Values of $\frac{L}{h}$ as a function of slope are shown in the following table.

Table 7.
Values of $\frac{L}{h}$ as a function of slope

Slope	β Degrees	$\frac{L}{h}$	Slope	β Degrees	$\frac{L}{h}$
0.0	0.0	2.00	0.6	31.0	3.53
0.1	5.7	2.21	0.8	38.7	4.16
0.2	11.3	2.44	1.0	45.0	4.83
0.3	16.7	2.69	1.4	54.5	6.24
0.4	21.8	2.95	1.8	60.9	7.72
0.5	26.6	3.23	2.0	63.4	8.47

The calculation shows that even for steep slopes the width of such a failure would be on the order of tens of feet.

The second simplified case consists of failure over a cylindrical surface where the depth cannot be determined by a relatively impermeable layer. Assuming uniform shear strength throughout, and the symbols shown in Figure 13, the length of slope failure is

$$L = \frac{6 \tau_{CR}}{\gamma} \quad \frac{\pi/2 - \beta}{\sin \beta \cos^2 \beta}$$

For an example, consider $\tau_{CR} = 500$ psf $\gamma = 150$ pcf so that $\frac{6\tau_{CR}}{\gamma} = 20$. The following values of L are found.

Table 8.
Values of L as a function of slope

Slope	$(\pi/2 - \beta)/\sin\beta \cos^2\beta$	L, ft.
0.1	14.9	298
0.2	7.28	146
0.4	3.71	74
0.6	2.72	54
0.8	2.35	47
1.0	2.22	44
1.2	2.20	44
1.4	2.26	45
1.6	2.34	49
1.8	2.46	49
2.0	2.59	52

For very deep soils the length of slope where failure occurs is only on the order of a hundred feet. It appears, therefore that requirement of a hundred foot width above high water should be satisfactory, with provision that increased widths be required if demonstrable massive failure is imminent, and that lesser widths be allowed if determined by a competent soils engineer.

The width of a protective CDA strip along streams appears to be determined largely by the distance upslope from the stream bank over which sloughing will cause large contributions of soil to the stream. As shown, this distance depends on the soil shear strength and depth, on the permeability of the material on which the soil rests, and on the slope. A blanket requirement might consider the worst cases, most of which would be protected by a 100 foot width of vegetation. It should be noted that protection of the upper portion of this zone is especially important. If a crack develops there from incipient sloughing, the increased penetration of water along the failure plane is facilitated and eventual failure is then certain.

CHAPTER VII

SURVEILLANCE AND MONITORING

To effectively enforce the prohibition against discharge of earthen materials and organic debris into streams, the California Regional Water Quality Control Board, North Coast Region will have to institute surveillance and monitoring procedures. Violations of prohibitions, clandestine operations and information necessary for legal actions can be determined through a combination of aerial and ground surveillance and on-site monitoring.

Surveillance

Surveillance of logging and construction activities in the North Coastal and Klamath River Basins could be done visually or by remote sensing. Visual surveillance of operations, either before, during or after activity could be accomplished on the ground by Board staff or by Division of Forestry and Department of Fish and Game field personnel. On-the-ground surveillance of this nature would be incidental to other duties being performed by the personnel. More systematic data would be obtained through a regular aerial staff patrol of the Region from light aircraft. More area could be covered on such a routine patrol than could be covered on the ground with the Board's limited staff. The pilot and observer, particularly if they are the same on each flight, would quickly become familiar with the Region and would be valuable in detecting changes from flight to flight. Two 35mm cameras, one with normal color, the other with color-infared film, could document conditions and violations. Areas discovered from the air and determined to be causing degradation or be a threat to water quality could then be examined thoroughly on the ground by the Regional Board's staff.

Various methods of remote sensing are applicable to detection of sedimentation and potential sedimentation. These include conventional aerial photography, high altitude (U-2) photography, space photography (satellite), and orthophotography. Of these, high altitude photography appears to offer the Board the best opportunity. The National Aeronautics and Space Administration could be contracted to routinely provide photography which could be compared by the Board's staff with previous photography to indicate areas needing more detailed investigation. Ground resolution is fine enough in this high level photography to detect individual tree crowns. The other methods have serious drawbacks which limit their usefulness in

surveillance of this nature. Conventional aerial photography is too bulky and costly for routine surveillance, space photography (Earth Resources Technology Satellite) has insufficient resolution (only down to 300 feet) (Latham and McCarty, 1972), and orthophotography is more applicable to detailed engineering work.

Monitoring

On particularly sensitive sites the Board may desire to establish water quality monitoring stations upstream and downstream from the logging or construction area to measure the contribution of the operation to degraded water quality. This also would safeguard the operator from getting blamed for naturally occurring degraded water quality or that not attributable to his operation. A continuously operating turbidometer, temperature probe and dissolved oxygen probe attached to chart recorders may be useful. Suspended sediment samplers may also be desired in some cases.

Field Inspection Criteria

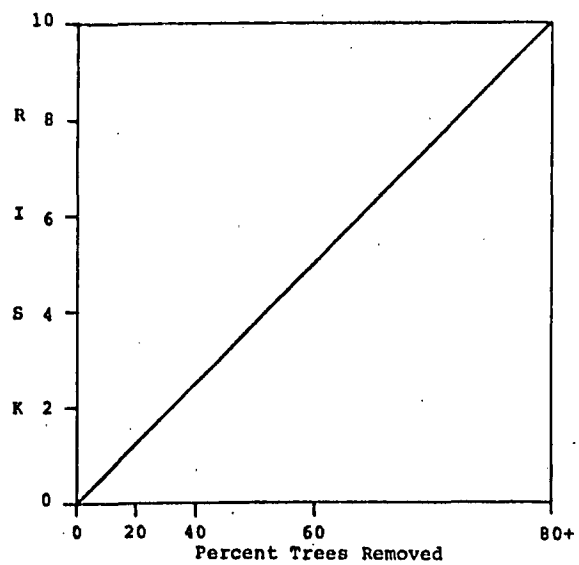
A watershed practices assessment system, similar in concept to the Risk Evaluation System, has been devised. This assessment system is designed to assist the RWQCB in distinguishing between good and poor land use practices and thereby determine the potential for damage from various logging and construction activities. Each facet of on-going or completed operations which have potentials for adversely affecting water quality is examined and rated as to its potential risk for causing waste discharge. This system is more an assessment of actual watershed practices and their effect on water quality than it is an estimate of the magnitude of degradation. Point totals may be accumulated to ascertain the level of risk to water quality in terms of proposed or on going watershed practices.

Utilization of this watershed practices assessment system provides the Board staff with a checklist of logging and road construction practices which are particularly likely to produce waste discharges. Those practices having high risk values are readily discernible from the checklist and can be designated for correction or alteration to reduce any unreasonable potential for waste discharges. The decisions in this system are judgmental and individual values will vary according to the evaluator's training and experience. Experience will minimize the arbitrary nature of the watershed practices assessment system.

Various federal, state and university references (Packer, 1967; FWPCA, 1970; California Division of Forestry, 1972; and Packer and Christensen, n.d.) were drawn upon to both identify watershed practices and to determine their effects. Review of these manuals is essential to use of the risk system. The assessment system is segregated into the following categories: logging, roads, drainage and rehabilitation.

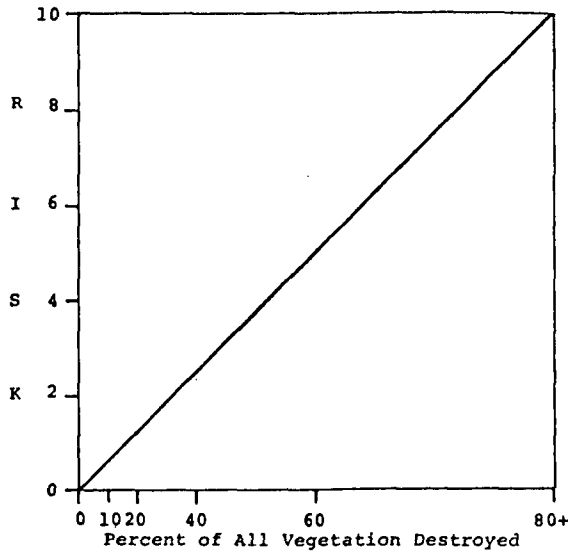
Logging. Timber harvesting disrupts an oftentimes delicate balance between soil and vegetation and a potential for water quality degradation is created. The risk of degradation varies with differing logging practices and is compounded by site variables. In this section the risk factor of the logging activity is examined independent of site factors to develop the relationship between the actual practice and its risk. A somewhat arbitrary correlation has been developed for those logging practices clearly lending themselves to such analysis. Those practices not applicable to correlation analysis are listed separately and assigned suitable risk factors. If, in the evaluator's judgment, the particular practice falls between the extremes, the practice could be rated wherever on the 0 to 10 scale that most accurately describes the situation. Beside each correlated or separately listed practice is a brief explanation of the relation of the practice to its potential for water quality degradations.

Extent of Harvesting



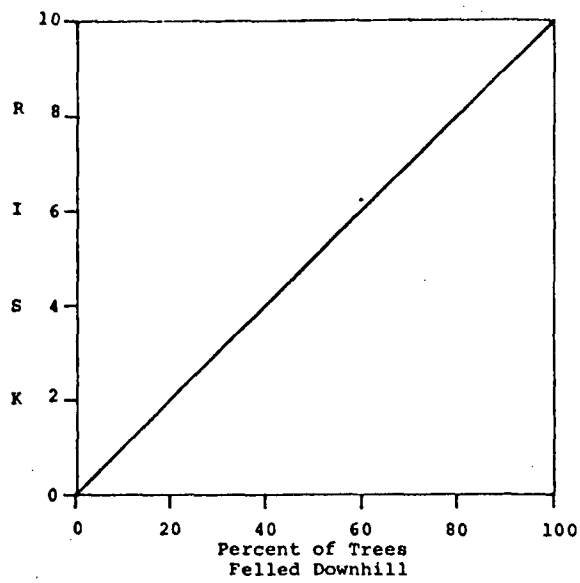
As more and more of the basal area is removed from an area, the more the soils are disturbed and the greater the erosion potential becomes. The closer to a clearcut situation, the higher the risk.

Vegetative Disturbance



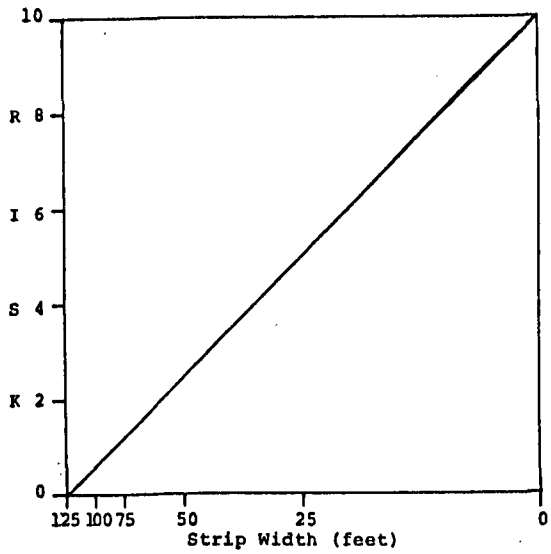
The greater the extent of vegetative disturbance through land use practices the greater the potential for waste discharge. If understory is retained undamaged, potential for erosional damage is reduced. Above 60 percent destruction, the risk potential rapidly increases.

Felling



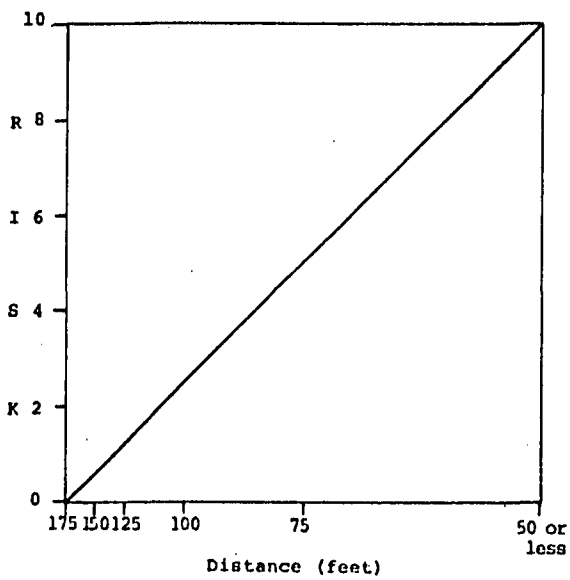
Trees have to be felled wherever convenient to avoid striking other trees or shattering upon contact with the ground. However the greater the percentage of trees felled downhill, the greater the probability of debris entering a stream. Uphill felling also permits shorter yarding distance, hence less surface disturbance.

Critical Discharge Area (CDA)



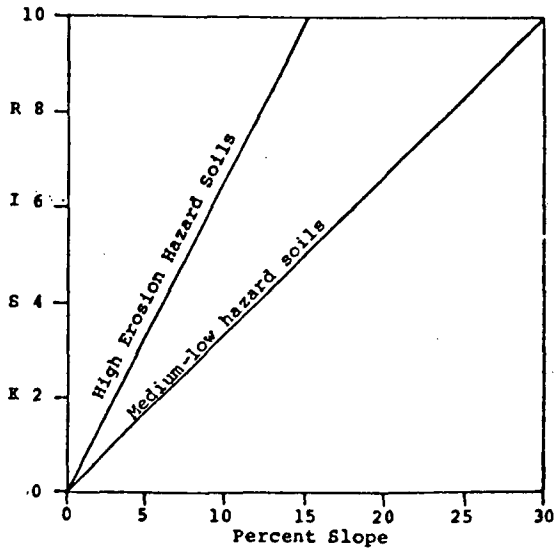
The closer any phase of the logging operation comes to a stream, the higher the risk of water quality degradation. Besides separating machinery and activity from the stream bank, the CDA serves as a filter for erosional material and debris generated on the upper slopes.

Landing Proximity to Stream



Landings are the focal point of the logging operation. Logs are yarded to them and haul roads connect them. All this activity produces extensive vegetative disruption and soil compaction. The farther a landing can be located from a stream, the less the risk for degraded water quality from this source.

Tractor Yarding



Tractor yarding in itself causes excessive soil disturbance, but when compounded with steep slopes and erosive soils even greater disturbance results. On steep slopes tractors have to maneuver more to perform their tasks thereby disturbing even more surface.

Method of Yarding

		Risk 10
A.	Tractor	
B.	High lead	7
C.	Sky crane	2
D.	Balloon-helicopter	0

The more the logs or the machinery yarding the logs comes in contact with the ground, the greater the soil disturbance and the higher the risk for subsequent erosion.

Extent of Planning

		Risk 10
A.	None	
B.	Written	0

To reduce the risk to water quality each area must be logged using a specific plan tailored for that area. Method of harvest and yarding should be prescribed as should site repair measures to prevent undue erosion

Saturated Areas

		Risk
A.	Yes	10
B.	No	0

Logging in saturated areas causes excessive surface disturbance and accelerates erosion.

Limbing before Yarding

		Risk
A.	No	10
B.	Yes	0

To minimize disturbance to soil and damage to reproduction and water quality, logs should be limbed before yarding.

Yarding across Stream

		Risk
A.	Yes	10
B.	No	0

Yarding across streams immediately alters the water quality. It also provides a path for erosional material to enter the stream.

Operating During Rains

		Risk
A.	Yes	10
B.	Day after	8
C.	Two days after	0

Operating on wet soils causes a greater amount of site deterioration than logging on dry soils. Suspension of operations during and after heavy rains reduces the magnitude of surface degradation.

Yarding Direction

		Risk
A.	Downhill	10
B.	Across hill	5
C.	Uphill	0

Downhill and across hill yarding gouge the surface more than uphill yarding.

Landing Fill

		Risk
A.	No stabilization	10
B.	Cribbed or planted	0

Landing fill, like road fill, is an accumulation of unstable, loose soil highly susceptible to erosion. Cribbing, using cull logs or seeding and mulching can impart a degree of stability to the fill.

Provision for Miscellaneous Contaminants

		Risk
A.	No provision	10
B.	Adequate provision	0

Oil and gas storage and service areas and toilets and garbage pits, should be properly located so that the refuse or accidental spills will not contaminate the stream.

Skid Road Rehabilitation

		Risk
A.	None	10
B.	Adequate	0

Replanting skid trails and scattering slash on them will reduce the erosion hazard created by exposure of mineral soil.

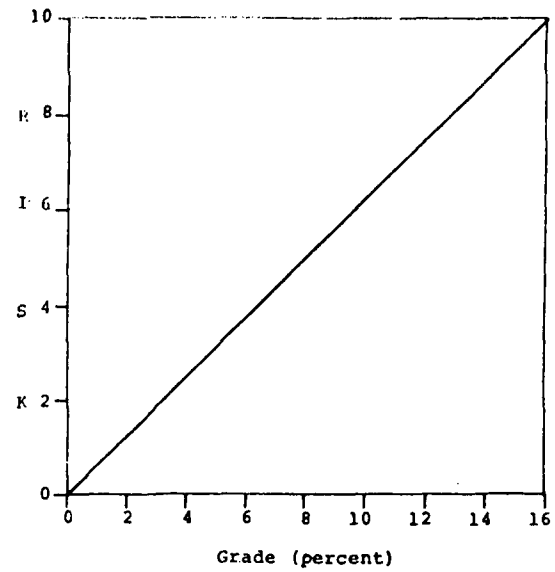
Skid Road Drainage

Spacing (feet)	Slope % 10	25	50	
		R I S K		
25	0	0	0	0
50	0	0	0	1
75	0	0	1	2
100	0	0	2	5
125	0	1	3	10
150	0	2	4	10
175	1	3	6	10
200	2	4	8	10
225	3	5	10	10
250	4	6	10	10

Waterbars and crossdrains must be installed on all skid trails after completion of use or before the fall rains whichever comes first. Waterbars and crossdrains interrupt the flow of water down the skid trail and diverts it upon the forest floor diffusing its erosional effect.

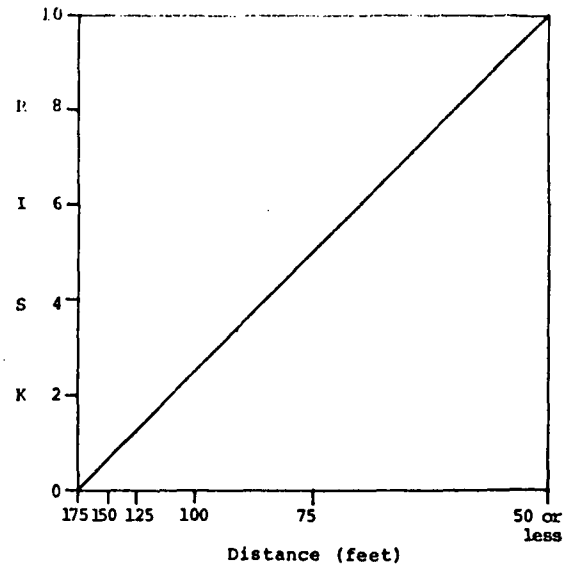
Roads. Poor location, design, construction and maintanence of roads, from logging spurs to superhighways, causes severe erosion and water quality degradation. Even when the greatest care is taken, roads are a key source of sediment production either obviously through removal of vegetation and exposure of raw soil on cuts and fills or less obviously by interception drainage patterns. Like logging, the risk factors related to roads are examined independent of site factors to develop the relationship between the particular factor and its risk for causing waste discharge. Somewhat arbitrary correlation has been developed for those road practices lending themselves to such an analysis. Those practices suitable for yes/no, either/or analysis are listed separately and assigned suitable risk factors. If a particular practice falls between the extremes, the practice could be rated wherever on the 0 to 10 scale that most accurately describes the situation. The relationship of each practice to potential water quality degradation is explained. Three broad categories are examined: design and construction, drainage, and rehabilitation.

Design and Construction



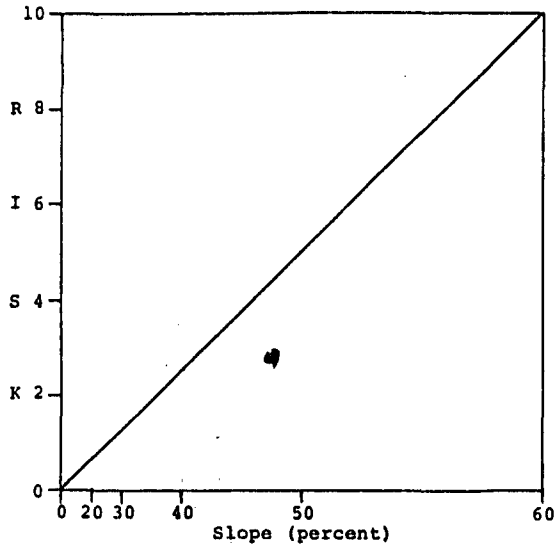
Flat graded roads produce little sediment from their surfaces. As grades increase, more crossdrains are needed because erosion from the surface of the road increases.

Proximity to Stream



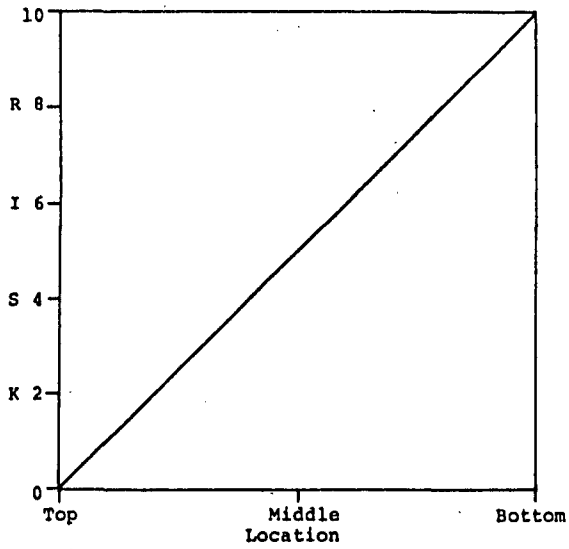
The closer a road comes to a stream, the greater the potential for material eroding from its surface or its cuts and fills entering the waterway. Studies have shown that the potential for sediment entering the stream is 2-1/2 times greater if a road comes within 100 feet of a stream than if it is located beyond 100 feet from the stream.

Slope



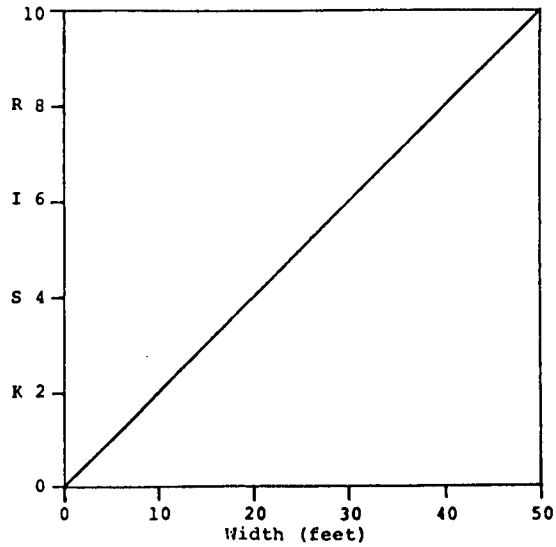
The steeper the side slope that the road is constructed upon, the greater the cut and fill area. Large volumes of material will need to be disposed and the possibility of intercepting subsurface flow patterns increases.

Location on Hill



A road located near a ridge top has a low potential for causing water quality degradation as there is a long slope distance between the road and the stream and material generated from the road can be absorbed by the slope before the stream is reached. Roads low on the slope however, do not have this absorption zone, hence the potential for degradation is higher.

Right-of-way Clearance



As more and more vegetation is removed to accommodate road construction activities, more and more surface is exposed to erosional effects. Clearance should be kept as narrow as possible to minimize this effect.

Saturated Areas

		Risk
A.	Marshes, seeps	10
B.	None	0

Saturated areas are indicative of high water tables. Road construction through areas such as these causes problems with road stability and drainage. Soils in saturated areas are easily compacted and churned creating potential degradation situations.

Unstable Soils

		Risk
A.	Slides and slumps	10
B.	Highly erosive soils	8
C.	Stable	0

Roads constructed on unstable soils or across existing slides or slumps generally will setoff mass soil movement. Any activity which disturbs the equilibrium that may have been reached by the slope creates a potential water quality problem.

Direction of Exposure

		Risk
A.	South	10
B.	North	0

Roads on north-facing slopes are less likely to erode than those on south-facing slopes. Fewer crossdrains are generally required.

Extent of Planning

		Risk
A.	None	10
B.	Written	0

Planned, when compared to unplanned road location and design, can fit the roads to natural topography, can reduce acres needed for roads, and reduce cut and fill volumes and subsequent surface exposure.

Operation in Stream Bed

		Risk
A.	Yes	10
B.	No	0

In road construction it may be necessary to operate heavy equipment in the stream bed to install culverts or bridge abutments. Such activity, although necessary, is discouraged as immediate degradation of water quality occurs whenever equipment is operated in the stream.

Road Cross-Section

		Risk
A.	Fill	10
B.	Balanced cut and fill	5
C.	Cut	0

Assuming end-hauling of waste material, full bench cuts produce the most stable road surfaces but a problem with waste disposal occurs. Fills, because of their unconsolidated nature, are the most unstable and have a greater possibility of eroding.

Angle of Repose

		Risk
A.	Fill greater	10
B.	Fill Less	0

If road fill is at a steeper angle than the normal angle of repose of the slope, the fill will continually seek to attain that angle of repose; therefore erosional potential is increased.

Cutbanks Backsloped

		Risk
A.	No	10
B.	Yes	0

Backslope sloughing can be reduced by rounding the tops of cutslopes.

Sidecasting

		Risk
A.	Yes	10
B.	No	0

Sidecasting cut material deposits it far down the slope, smothering vegetation and leaving large expanses of unconsolidated material which will continue its downhill movement with each rain. Waste material from road cuts should be end-hauled and deposited on benches or used in fill areas.

Fill Material Compacted

		Risk
A.	No	10
B.	Yes	0

The more compacted the fill material, the less likely is massive failure. Compacted fill has a greater tendency to resist erosional forces.

Slash in Fill

		Risk
A.	Yes	10
B.	No	0

Slash and other large organic debris should not be included in fills as it will decay and in time cause instability and increased possibility of failure.

Road Surface Outsloped

		Risk
A.	No	10
B.	Yes	0

Outsloping temporary road surfaces from the toe of the road cut to the road shoulder, if there is no outside berm, prevents concentration of road surface generated water and disperses it randomly downslope. Undercutting of stabilized cut slopes is minimized.

Berms

		Risk
A.	Yes (except on fills)	10
B.	No	0

Berms (earthen dikes) permit concentration of water on the road surface increasing the potential for undercutting stabilized cut slopes and eroding the road surface. Berms occur from road usage and from grading. Except on fills, where berms protect the fill slope, they should be removed.

Surfacing Material

		Risk
A.	Dirt	10
B.	Oil	8
C.	Gravel	4
D.	Paved	0

The harder and more durable the road surfacing material, the lesser the erosive action upon its surface and the greater protection provided for use during wet weather.

Kinds of Obstructions

		Risk
A.	None	10
B.	Grass, weeds, and shrubs	8
C.	Slash and brush	6
D.	Trees and stumps	4
E.	Rocks 4"	2
F.	Logs 4"	1
G.	Depressions	0

Obstructions on fills and on slopes below fills reduce downslope flow of sediments. Some types of obstructions are more effective than others. All lose their effectiveness in time as they become filled with sediment.

Spacing of Obstructions

Type of Obstruction	Distance (feet) 5	10	15	20	25
	RISK				
Herbaceous	8	10	10	10	10
Slash and brush	6	8	10	10	10
Trees and stumps	4	6	8	10	10
Rocks	2	4	6	8	10
Logs	1	3	5	7	9
Depressions	0	2	4	6	8

The spacing of obstructions on the slopes below fills is also important in reducing downslope movement of sediments.

Drainage.

Type of Stream Crossing

		Risk
A.	Fords	10
B.	Concrete fords	6
C.	Culverts	2
D.	Bridges	0

Bridges or culverts adequate to convey normal flood flows (25 year frequency) should be constructed across all natural watercourses. Fords disrupt channel integrity and their approaches funnel sediment into the stream.

Channel Alteration

		Risk
A.	Channel moved	10
B.	No alteration	0

Alteration of the natural stream channel by road construction including bridge and culvert approaches should be avoided. Streams moved from their established channel will produce high volumes of sediment from bank cutting as they seek their new course.

Culvert and Bridge Riprap

		Risk
A.	No ditch	10
B.	Adequate	3
C.	Adequate and lined	0

Concrete or heavy rock riprap on culvert and bridge wingwalls and abutments will assist in stabilization of the fill material and help direct passage of debris. Inadequate protection of the fill material can result in erosion of the fill and subsequent failure of the bridge or culvert approach.

Road Crossings

		Risk
A.	Greater than 20' spacing above required	10
B.	Between 15 and 20'	8
C.	Between 10 and 14'	6
D.	Between 5 and 9'	4
E.	Between 0 and 4'	2
F.	More frequent than required or as required	0

Sediment from road crossdrains or waterbars flows farther downslope when the drains are farther apart. Hence wide spacing on crossdrains increases the potential for deposition of sediment in streams. Spacing of crossdrains requires consideration of soil, road grade, exposure, topographic position and steepness of side slope above the road.

	Soils			
Road Grade	L	M	H	V
2	170	155	135	105
4	150	140	120	90
6	145	130	110	80
8	135	125	105	75
10	130	115	95	65
12	120	105	85	55
14	110	95	75	45

Spacing for slopes of 80%, north facing, upper 1/3 of slope

Space 5' closer for each 10% decrease.

Space 10' closer for east and west facing and 15' closer for south facing.

Space 20' closer if in middle 1/3
35' closer if in lower 1/3

Dips and Fills

		Risk
A.	None	10
B.	Dip on approach	0

A dip should be placed at the downgrade approach to fills with culverts so that in case the culvert becomes plugged the back up water may flow over the road at that point rather than across the fill.

Drainage on Cuts, Fills, Borrow Areas and Spoil Areas

		Risk
A.	No provisions	10
B.	Adequate drainage	0

Drainage should be diverted or otherwise disposed so that it does not pass over or collect in cuts, fills, borrow areas or spoil areas. These areas are usually raw soil and easily subject to accelerated erosion.

Drainages Cleared of Woody Debris

		Risk
A.	Not cleared	10
B.	Cleared	0

All drainage ways should be cleared of woody debris generated during road construction. Clearance should be to the discernible high water mark. Uncleared debris has a tendency to clog culverts and thereby increase the possibility of fill washouts.

Energy Dispersal

		Risk
A.	None	10
B.	Adequate	0

The energy created by concentrating water in crossdrains or culverts should be dispersed soon after the water leaves the drain or culvert. Downspouts or riprap are effective in reducing water force and thereby erosion particularly on fills.

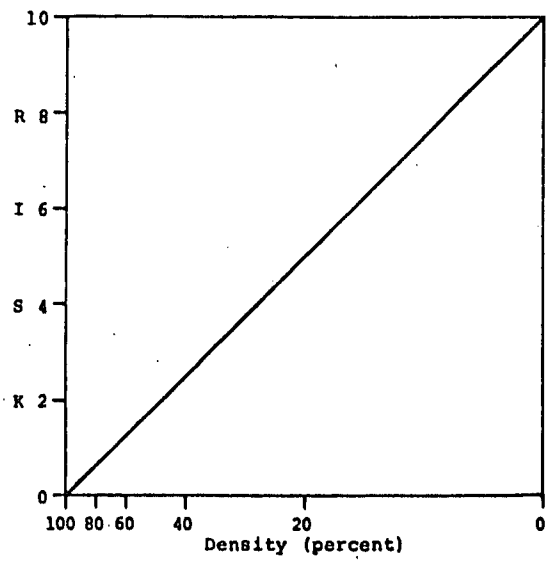
Drain Pipes In Slumps

		Risk
A.	No	10
B.	Yes	0

Horizontal soil drain pipes with well points should be used in critical slump areas. This assists in removing excess moisture thereby lowering somewhat the tendency for mass soil movement.

Rehabilitation.

Density of Revegetation



Revegetation of road cuts and fills before the winter rainy season is necessary to reduce surface and gully erosion from the exposed slopes. The extent or density of revegetation is a measure of the risk for causing erosion.

Temporary Roads Put to Bed

		Risk
A.	Nothing done	10
B.	Surface replanted	0

All non-permanent roads should be scarified and replanted with grasses or other vegetation to protect the exposed surface and to discourage use.

Rehabilitation of Borrow and Spoil Areas

		Risk
A.	None	10
B.	Rehabilitated	0

Borrow and spoil areas should be reshaped and revegetated following construction to reduce their potential for generating sediment.

CHAPTER VIII

RECOMMENDATIONS

It is recommended that:

1. The relative Risk Evaluation System described in this report be accepted by the State Water Resources Control Board (SRWCB) as a pilot method for determining the level of threat to water quality from non-point source waste discharges from logging and road construction activities.

2. The project be continued for one year through the North Coast RWQCB offices in order to test, evaluate, and adjust the proposed methods. In-service testing is required to give the systems validity in terms of practical and reasonable application.

3. A minimum Critical Discharge Area (CDA) be adopted encompassed by the projected 100 year flood plain or the highest discernible water mark on the bank.

4. Additional Critical Discharge Area increments be set according to the described methods and that specific and satisfactory operation or logging plans be required for activities undertaken in any CDA.

5. The Regional Water Quality Control Board (RWQCB) set waste discharge requirements in cases which appear likely to violate prohibitions against discharge of sediment and debris into waterways.

6. Interagency agreements be entered into between the Board and California Division of Forestry and Department of Fish and Game for transmittal of copies of report of timber operations, timberland conversion plan, and Section 1601 and 1602 applications to the RWQCB.

7. The Division of Forestry be requested to revise the form, "Notice of Timber Operation", to include information concerning amount of cover removal and the intended method of logging.

8. The RWQCB compile and reduce information useful to initial and detailed analysis and that this information be entered in the STORET or other suitable information retrieval system.

9. The Division of Forestry be encouraged to continue their soil-vegetation mapping of the region.

10. Watershed areas which historically produce non-point source discharges of sediment and debris be delineated on 7.5 minute quads. Conversely, quarter section areas should be defined where there is a low risk for discharge. Through this effort many CDA can be identified beforehand.

11. An aerial surveillance plan be prepared and used to monitor on-going logging and road construction activities using both high level vertical and low level oblique photography. The results of monitoring should be interpreted using the described risk analysis system and parameters listed in the surveillance section of this report.

12. The systems proposed in this report be revised to reflect changes which may be needed when a new Forest Practice Act becomes law.

CHAPTER IX

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APPENDIX A

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD

In the Matter of the Review of the Failure of the California Regional Water Quality Control Board, North Coast Region, to Adopt Amendments to Water Quality Control Plans	Order No. 72-21

On August 23, 1972, the California Regional Water Qua Control Board, North Coast Region (hereinafter Regional Board) failed to adopt proposed amendments to the Interim Water Quality Control Plans for the Klamath River and North Coastal Basins relating to the prohibition of waste discharges from logging, construction and associated activities. The proposed amendments tc the basin plans had been the subject of a public hearing on July 1972, in the City of Eureka, California. The draft amendments t the basin plans considered at the public hearing are attached an incorporated herein as Exhibit A.

Testimony at the public hearing and additional informa tion received while the hearing record remained open was reviewe by the staff of the Regional Board and a subcommittee of Board Members appointed by the Chairman of the Regional Board. The st and subcommittee recommended certain changes in the amendments a considering the evidence at the hearing. The Chairman of the su committee presented the proposed amendments to the Regional Boar as an item of business at the regular meeting of the Regional Bo on August 23, 1972. The amendments proposed for adoption by the Regional Board on August 23 are attached and incorporated herein as Exhibit B. The Board postponed action on the amendments as presented until the next regular meeting in October 1972.

The Regional Board had been informed of the need to regulate the waste discharge from logging, construction and associated activities since the regular meeting of the Board in February 1972 but had failed to set an early date for a public hearing on proposed basin plan amendments, and then further delayed adoption of the waste discharge prohibitions after the public hearing where further evidence of the need for such regulation was presented.

On September 7, 1972, the State Water Resources Control Board (hereinafter State Board) on its own motion adopted Resolution 72-64 to undertake a review of the failure of the Regional Board to adopt the amendments to the basin plans prohibiting the discharge of waste from logging, construction and associated activities. The State Board has reviewed the record of the Regional Board relating to the proposed amendments to the Interim Basin Plans for the Klamath River and North Coastal Basins, and concludes that the record supports the following findings:

1. The discharge of waste from logging, construction and associated activities has caused and threatens to cause pollution of waters of the Klamath River and North Coastal Basins.

2. Existing regulations of state, federal and local agencies are inadequate or lack implementation for controlling water quality, and the primary authority for the control of factors relating to the quality of the waters of the State is with the regional water quality control boards.

3. The discharge of waste in quantities deleterious to the beneficial uses of the waters of the State by any activity of industry, government or individuals must be controlled to protect the health, welfare and safety of the people of the State.

4. The proposed amendments to the basin plans are necessary and appropriate for the protection of the waters of the North Coast Region.

The State Board therefore makes the following findings:

1. The Regional Board had sufficient evidence and other information at the time of the regular meeting on August 23, 1972, to take action adopting the proposed amendments to the Interim Basin Plans for the Klamath River and North Coastal Basins.

2. The further postponement of the adoption of the amendments prohibiting the waste discharge from logging, construction and associated activities was not consistent with the evidence presented to the Regional Board, which clearly indicated a need for regulation of this type of waste discharge.

3. The Klamath River and North Coastal Interim Water Quality Control Plans contain water quality objectives which define water quality conditions to be maintained which will protect all beneficial uses of the waters of these basins.

4. The failure of the Regional Board to act on the proposed amendments to the Interim Water Quality Control Plans was inappropriate.

THEREFORE, the State Board takes the following action as authorized under Water Code Section 13320(c)(3):

1. The amendments to Chapters VI and VII of the Klamath River and North Coastal Interim Water Quality Control Plans which are attached to this order are hereby adopted.

2. The California Regional Water Quality Control Board, North Coast Region, is directed to adopt guidelines at the earlies possible date and submit them to the State Board for review and approval as to adequacy and reasonableness before they become effe tive. Such guidelines shall consist of at least the following elements:

a. Instructions to the Executive Officer of the Regional Board for the issuance of a cleanup or abatement order to any waste discharger whose activities have resulted in a violation or a threatened violation of the discharge prohibitions.

b. Instructions to the Executive Officer of the Regional Board to bring before the Regional Board, for consideration of a cease and desist order, evidence of waste discharges which violate or threaten to violate the discharge prohibitions.

c. Instructions to the Executive Officer of the Regional Board to investigate any violations of the Water Quality Objectives contained in the Interim Water Quality Control Plans which threaten to result in or interfere with the beneficial uses of the waters of the Region.

d. Instructions and directions to the Executive Officer to use all means of cooperation and communication with the other state and federal agencies involved with the regulation of logging, construction and associated activities, including

the use of necessary reports and files required by these agencies to eliminate duplication of effort by the individuals and agencies involved. The guidelines should take into consideration all relevant statutory and administrative regulations of the Department of Fish and Game, the Division of Forestry, State Department of Conservation, the Division of Highways and the United States Forest Service, Department of Agriculture.

Adopted as the order of the State Water Resources Control Board at a meeting duly called and held at Sacramento, California.

Dated: September 21, 1972

W. W. ADAMS
W. W. Adams, Chairman

E. F. DIBBLE
E. F. Dibble, Vice Chairman

RONALD B. ROBIE
Ronald B. Robie, Member

ROY E. DODSON
Roy E. Dodson, Member

MRS. CARL AUER
Mrs. Carl H. (Jean) Auer, Member

AMENDMENTS TO CHAPTERS VI AND VII,
INTERIM WATER QUALITY CONTROL PLANS FOR THE
KLAMATH RIVER AND NORTH COASTAL BASINS

Chapter VI

a. The discharge of soil, silt, bark, slash, sawdust or other organic and earthen material from any logging, construction or associated activity of whatever nature into any stream or watercourse in the Basin in quantities deleterious to fish, wildlife or other beneficial uses is prohibited.

b. The placing or disposal of soil, silt, bark, slash, sawdust or other organic and earthen material from any logging, construction or associated activity of whatever nature at location where such materials could pass into any stream or watercourse in the Basin in quantities which would be deleterious to fish, wildlife or other beneficial uses is prohibited.

Chapter VII

Discharge prohibitions for logging, construction and associated activities shall be implemented by (1) requiring submission of technical and monitoring program reports pursuant to Water Code Section 13267(b), and (2) issuance and enforcement of cleanup or abatement orders, cease and desist orders or other remedies as provided in Section 13350, where appropriate.

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APPENDIX B

GUIDELINES FOR IMPLEMENTATION AND ENFORCEMENT OF DISCHARGE PROHIBITIONS RELATING TO LOGGING, CONSTRUCTION OR ASSOCIATED ACTIVITIES

The California Regional Water Quality Control Board
North Coast Region

On September 21, 1972, the State Water Resources Control Board adopted Order 72-21 which (1) established prohibitions of waste discharge from logging, construction and associated activities; (2) incorporated those prohibitions as amendments to the Interim Basin Plans for the Klamath River and North Coastal Basins; and (3) directed the California Regional Water Quality Control Board, North Coast Region, to adopt guidelines under which the Regional Board will implement and carry out the terms of the prohibitions in an effective and reasonable manner.

These guidelines, which are hereby transmitted to the State Water Resources Control Board for approval, have been developed with the objective of (1) defining the criteria by which the Board will consider that violation of the prohibitions has occurred or threatens to occur; (2) instructing the Regional Board staff of procedures and actions they will take in implementing the prohibitions; (3) advising all potential dischargers of the scope and intent of the prohibitions and; (4) advising all interested parties that it is the intent of this Regional Board to carry out its responsibilities in this matter in a reasonable, and effective manner.

I. CRITERIA

A. Chapter VI of the Interim Water Quality Control Plans for the Klamath River and North Coastal Basins contains Water Quality Objectives, which specify limitations on certain water quality parameters that are not to be exceeded as a result of waste discharges. Accordingly, the Executive Officer of the Regional Board is directed to investigate and report to the Board evidence of violations of the water quality objectives contained in the Interim Water Quality Control Plans for the Klamath River and North Coastal Basins which result or threaten to result in unreasonable effects on the beneficial uses of the waters of the Region. When such investigation reveals that such violations are occurring or are threatened due to the discharge or threatened

discharge of waste, the Executive Officer shall take all appropriate actions as directed by the Enforcement section of these guidelines.

The following water quality objectives, quoted directly from Chapter VI of the Interim Basin Plans, are considered of particular importance in protecting beneficial uses from unreasonable effect due to discharges from logging, construction or associated activities:

1. The turbidity of the waters of the North Coast Region shall not be increased more than 20 percent above naturally occurring background levels.

2. There shall be no bottom deposits other than of natural causes in the waters of the North Coast Region.

3. There shall be no visible evidence of any floatable material or oil and grease other than of natural causes in the waters of the North Coast Region.

4. No substance which promotes aquatic growths in the receiving waters, to the extent such growths cause nuisance or damage any beneficial use, shall be discharged to the waters of the North Coast Region.

5. No toxic substance which will produce deleterious effects upon the aquatic biota or which would render aquatic life undesirable for human consumption shall be discharged to the waters of the North Coast Region.

B. DEFINITIONS

1. Definitions for the following terms, used in these guidelines, are provided in Section 13050 of the Porter-Cologne Act:

   a. "Waste", includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation of whatever nature, including such waste placed within containers of whatever nature prior to, and for purposes of, disposal.

b. "Beneficial uses" of the waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; esthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

c. "Water quality objectives" means the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or prevention of nuisance within a specific area.

d. "Water quality control" means the regulation of any activity or factor which may affect the quality of the waters of the state and includes the prevention and correction of water pollution and nuisance.

e. "Water quality control plan" consists of a designation or establishment for the waters within a specified area of (1) beneficial uses to be protected, (2) water quality objectives, and (3) a program of implementation needed for achieving water quality objectives.

f. "Pollution" means an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects: (1) such waters for beneficial uses, or (2) facilities which serve such beneficial uses. "Pollution" may include "contamination".

2. The definition for "stream or watercourse" as those terms are used in the waste discharge prohibitions relative to logging and construction activities shall be interpreted by the Regional Board to mean the following: Natural watercourse as designated by a solid line or dash and three dots symbol shown in blue on the largest scale United States Geological Survey Topographic Map most recently published.

C. The Board acknowledges that it does not have jurisdiction for direct enforcement of the rules and regulations of other local, State or Federal Agencies. However, the Board directs the Executive Officer to to investigate the violation or threatened violation of those rules and regulations of other agencies which have been adopted to protect the quality of the waters in the Region. The violation of the following rules, regulations, or provisions may be considered a threatened violation of the waste discharge prohibitions accordingly and the Executive Officer shall take appropriate action as directed by the Enforcement section of these guidelines.

1. A violation of current rules for forest practices relating to erosion control in any logging or related activity being conducted pursuant to regulations administered by the Division of Forestry, California Department of Conservation.

2. A violation of current rules for forest practices, relating to water quality management or erosion control in any logging or related activity being conducted pursuant to current contracts, permits and regulations administered by the Forest Service, U. S. Department of Agriculture, the Bureau of Land Management, U. S. Department of Interior, or other Federal Agency.

3. A violation of the water pollution control provisions of the current California Standard Specifications in any highway project being constructed under contract entered into by the Division of Highways, State Department of Public Works.

4. A violation of Sections 1601, 1602, 5650 and 5948 of the California Fish and Game Code when such violation involves activities or discharges enumerated in the aforesaid prohibitions.

II. INVESTIGATION & COORDINATING ACTIVITIES

A. To avoid delay in meeting its responsibility for the protection of Water Quality, the Board will undertake an implementation program at once. This program should be recognized as interim, pending completion of current studies which may result in revised or

modified prodecures. The interim procedures outlined below are intended to avoid an additional administrative burden on the discharger by utilizing existing State reporting requirements.

1. The staff of the Regional Board is directed investigate and review, on a continuing basis, logging operations, road building, and related construction activities within the region to determine the effect, or potential effect, of such activities on water quality.

2. The staff shall consult with any individual associated with logging operations, road building or construction activities having an effect on the quality of waters in the region, and shall investigate such activities when requested to do so.

3. The staff shall obtain from the Division of Forestry and the Department of Fish and Game copies of all notices received for timber operations and stream alteration activities within the Region.

4. The staff shall obtain from the Division of Highways the names of all contractors performing work that could result in violation of the discharge prohibitions. The Forest Service, USDA and other Federal agencies, will be requested to furnish the Board, as early as feasible, with the names, addresses, and location of anticipated operations of all private contractors who will be engaged in logging, construction or related activities on lands in the Region which are under their control. In connection with these contracts, regulations for the control of erosion or protection of water quality.

5. Upon receipt and review of such information, the staff will transmit to the permittee or contractor copies of the discharge prohibition and provisions as contained in the Regional Basin Plans and copies of this or subsequent implementation statements on this subject issued by the Board.

6. The staff will request that the State Division of Forestry notify the Board's office of citations or of other notices issued by Forestry personnel for violation of erosion control sections of the Forest Practice Rules. The staff will request that the Department of Fish and Game advise the Board's office of all violations of its code Sections 5650, 1601, 1602, and 5948 resulting from logging, road building or associated construction activities. The staff will request that the Division of Highways notify the Board's office of all violations of the water pollution control provisions of the California Standard Specifications and will request that the Forest Service, USDA, and other Federal agencies, notify the Board's office of all violations of rules and regulations for the control of erosion or protection of water quality.

7. The staff will notify the State Department of Fish and Game, the State Department of Conservation, Division of Forestry, the State Division of Highways and the Forest Service, USDA of all violations of the discharge prohibitions and of all actions taken by this Board with regard to such violations or threatened violations.

8. The staff may request additional information from any individual or firm engaged in timber operations, road building, or related construction activity in accordance with Water Code Section 13267(b) as may be necessary to implement their investigations and carry out the policy of this Board.

B. The regional Board considers that implementation of the discharge prohibitions relating to logging, construction or associated activities can provide appropriate protection to waters of the region from these sources of waste. Accordingly, the Board considers that it is in the public interest to waive the need for reports of waste discharge and waste discharge requirements unless, in the determination of the Regional Board certain activities may, because of special circumstances, require the adoption of waste discharge requirements.

III. ENFORCEMENT ACTIVITIES

When investigation by the Executive Officer reveals that violations as described in the Criteria section of these guidelines are occurring or are threatened due to the discharge or threatened discharge of waste, the actions to be taken by the Executive Officer are as follows:

A. Cleanup or Abatement Order

1. If the discharge of waste can be cleaned up or its adverse effects abated, a cleanup or abatement order shall be issued to the discharger or responsible person.

2. The Order and all relevant information shall be transmitted to the discharger as provided in the Manual of Administrative Procedures. Copies of these materials shall be transmitted concurrently to all Regional Board members and all other interested agencies.

3. The Regional Board may hold a public hearing for purposes of making the necessary findings under Water Code Section 13350(a)(2) with respect to a cleanup or abatement order or violation of waste discharge prohibition at any regular meeting of the Regional Board, or at a special meeting of the Board called by the Chairman, on his own motion or at the request of the Executive Officer, or when called by any two Regional Board members as provided in Water Code Section 13204.

B. Cease and Desist Order

If a cleanup or abatement order would not be the most expeditious means of achieving compliance with the prohibitions, the Executive Officer shall notify the the Regional Board Chairman of his intention to bring the matter before the Regional Board, at either a regular or a special meeting, for consideration of evidence and recommendation that a cease and desist order be issued. The decision by the Executive Officer to recommend a cease and desist order hearing shall be made after consideration of the following factors:

1. The nature of the activity of the discharger.

2. The anticipated length of time the discharger will be carrying on the activity which results or threatens to result in a waste discharge

3. The potential deleterious and unreasonable effect on beneficial uses of the waters during the time before the Board will be able to take action on the violation of the prohibitions.

4. Other relevant factors considered applicable by the Executive Officer as necessary to bring before the Board for their consideration and deliberation.

October 25, 1972.

APPENDIX C

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION
DIVISION OF FORESTRY

NOTICE OF TIMBER OPERATIONS

FOR ADM. USE ONLY

To: STATE FORESTER

See instructions on reverse side for completing and filing form.
This form must be *printed in ink* or *typewritten.*

Pursuant to Sections 4585 and 4592 of the Public Resources Code and Section 1110 of Title 14 of the Califor Administrative Code,

1. I (We), as ..... (Enter as appropriate one or more of the following: *Timber owner, Timberland owner, Timber operator*)

hereby give notice of proposed timber operations:

Name ..... (Individual, firm, corporation or partnership submitting this notice.)

2. Mail address ....., ..., ..., ... Street, City, State, Zip

3. The type of operation to be conducted is ..... (Type of forest product to be removed: e.g., *sawlogs, veneer logs, piling, poles, split products, pulp, posts, fuelwood, Christmas trees, greens, burls.*)

4. The location of proposed timber operation is (by legal subdivision description or such description as v enable the State Forester to locate the operations on the ground):

	SUB-SEC.	SECTION	TOWNSHIP	RANGE	COUNTY	APPROX. ACREAG
(1)						
(2)						
(3)						

(List locations for the current calendar year. Attach additional sheet, map or metes-and-bounds description if necessary)

5. The owner(s) of the timber on lands herein described, is (are):

Name ..... Address .....

Name ..... Address .....

Name ..... Address .....

6. Consent is hereby given to the State Forester, his agents and employees, to enter the premises to inspect timl operations and to determine compliance with forest practice rules.

If you are the timber owner, complete this box:

7. The dates within which timber operations are to take place: From ....., 19.... to ....., 19.....

8. Person(s) who will conduct the timber operations. (By number cross reference persons with locations item 4 above, if more than one person.)

Name ..... Address .....

Name ..... Address .....
(Attach additional sheet if necessary)

If you are the timber operator, complete this box:

9. Timber operator permit No. .....

10. Proposed date of commencement of timber operations: ....., 19.....

11. Approximate date of completion of timber operations: ....., 19.....

12. Do you have a contract for this operation? (Yes) (No) (Written) (Verbal)
(Strike out where inappropriate)

I declare under penalty of perjury that the foregoing is true and correct.

Executed this ..... day of ....., 19..... at ....., Californ

Original for State Forester
Duplicate for District Deputy
Triplicate for State Forest Ranger
Quadruplicate for Timber Owner or Operator

C-1

..... (Signature) (Title)

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION
DIVISION OF FORESTRY
SACRAMENTO 95814

INFORMATION AND INSTRUCTIONS FOR TIMBER OPERATORS AND TIMBER OWNERS

IN MAKING APPLICATION FOR TIMBER OPERATOR'S PERMIT AND FOR SERVING OF REQUIRED NOTICES

(Required by Articles 6-8, Chapter 8, Sections 4585-4594 and 4601-4603, Public Resources Code)

Timber Operator's Permit

Upon receipt by the State Forester of a properly executed application, with fee of $50.00 he will issue an original timber operator's permit. He may, however, deny a permit for certain reasons prescribed by law. A permit other than a temporary permit once issued is good indefinitely if renewed annually, or until suspended, revoked, or otherwise expired in accordance with law. It is subject to future legislation and is not transferable. The permit or a copy must be available for inspection at the location of timber operations. A permit held by one not the true operator is subject to revocation. Any person who engages in timber operations or conspires with another to engage in timber operations without a valid permit is guilty of a misdemeanor.

Application for Permit (Form FM-3 rev. 10-71)

A timber operator's permit is needed by all operators who for commercial purposes cut or remove from timberlands saw and veneer logs, timbers, pulpwood, poles, piling, posts, fuelwood, split products, greenery, Christmas trees, and other forest products. A permit is not required of a person who engages in timber operations as an employee with wages as his sole compensation. Persons cutting exclusively on their own property for personal use do not need a timber operator's permit. Sawmills and other processing plants which buy all their logs or raw products delivered at the plant do not need a permit.

Every timber operator must apply to the State Forester for a permit to engage in timber operations. The application must be submitted on the prescribed form, "Application for Timber Operator's Permit" (Form FM-3). The application form should be completed, signed and returned to the State Forester accompanied by the proper fee. Fees are as follows: Original Permit - $50.00, Renewal Permit - $25.00 ($35.00 if renewed after December 31), Temporary Permit - $15.00. The Temporary Permit is nonrenewable, valid only for harvesting minor forest products such as Christmas trees, greenery, firewood, posts, and split products, and good only for a consecutive 3 month period designated by the applicant. Another temporary permit cannot be issued to the same party until nine months after expiration of a previously held temporary permit. Payment for all permit fees must be in the form of personal check, postal money order, or bank draft. Cash or postage stamps are not acceptable.

Annual Renewal

The holder of a permit other than a nonrenewable Temporary Permit must within the month of December in each year file with the State Forester an application for renewal of his permit. This application must be submitted on the prescribed form, "Application for Timber Operator's Permit" (Form FM-3), accompanied by a fee of $25.00. If an application for renewal is postmarked later than January 1, a penalty fee of $10.00 is required (add this to the $25.00 filing fee).

The original permit will become invalid if it is not renewed by January 1 of any year after its issuance or previous renewal. An application for an original permit (Form FM-3) may then be necessary to obtain a new permit.

Notice of Timber Operations (Form FM-6 rev. 10-71)

Timber owners where applicable, upon whose holdings timber operations are proposed and timber operators are required by Sections 4585 and 4592 of the Public Resources Code and Section 1110 of Title 14 of the California Administrative Code to notify the State Forester of proposed timber operations for the calendar year giving certain information required by law prior to the date of commencement of such timber operations. Form FM-6, "Notice of Timber Operations," must be used for filing such notices. Failure of a timber owner where applicable, and of a timber operator to file such notice is a misdemeanor, and failure of a timber operator to do so is also grounds for suspension or revocation of a timber operator's permit.

Timber Production Report (Form FM-31)

The State Forester's office annually compiles timber production data submitted by timber operators when applying for timber operator permits. Individual production figures are treated as confidential. They are grouped with other data so that the identity of individual operations are not disclosed. The statewide report is sent to each timber operator of record and other interested parties.

Your voluntary cooperation in supplying these figures is appreciated and makes available factual information that would not otherwise be available. Form FM-31, "Timber Operator's Report of Timber Production for Previous Year," though not required, was designed for your convenience in reporting your production.

Change of Address

Permittees are required by law to notify the State Forester at his Sacramento office in writing within 15 days of any change of address. Timber owners are required to notify the State Forester of any change in address in writing within 30 days until one year after completion of such timber operations. Notice can be made by letter or card forms provided for this purpose by Post Offices.

GENERAL INFORMATION

The State Forester, acting in accordance with policies adopted by the State Board of Forestry and under the supervision and direction of the Director of Conservation administers the Forest Practice Act (Sections 4521-4618, Public Resources Code), and exercise all powers necessary to accomplish its purposes and intent, including entering and inspecting lands subject to the Act.

Under the Act the State is divided into four forest districts: The Redwood, North Sierra Pine, South Sierra Pine, and Coast Range Pine and Fir.

Copies of the Forest Practice Act, and forms described in these instructions are available on request from the State Forester, Sacramento, California 95814, or from principal offices of the California Division of Forestry throughout the State.

If you have any questions regarding these matters, we are ready to assist in any way possible.

L. A. MORAN
State Forester

...epartment has 30 days ... of receipt in which to make ... recommendations.

Notification No._____ Received_____
(Not to be filled in by applicant)

STATE OF CALIFORNIA

RESOURCES AGENCY

DEPARTMENT OF FISH AND GAME

NOTIFICATION OF REMOVAL OF MATERIALS AND/OR ALTERATION OF LAKE, RIVER, OR STREAMBED BOTTOM, OR MARGIN

APPLICANT

Pursuant to Section 1601 or 1602 of the California Fish and Game Code

I, _____ of _____,
Name of applicant — Mailing address

Representing _____
(Name of agency, company, etc.)

hereby notify the California Department of Fish and Game of operations to be carried out by me, or the organization I represent,

From _____ to _____.
Date — Date

_____ of _____ County
Name of stream, river, or lake

in the _____ ¼, Section _____, Township _____, Range _____.
NE, NW, SE, or SW

(Complete site description on reverse side of the second sheet)

The owner of the property is _____

whose address is _____

_____ is responsible for operations at the site.
(Name of person to be contacted at site during operations)

He can be reached at _____
Mailing address

Telephone No._____.

DESCRIPTION OF OPERATION

1. The nature of said operations will be as follows: (Check all squares which apply)

A. ☐ Soil, sand, gravel, and/or boulder removal or displacement. (If checked, complete items 1, 2, and 3 below as applicable.)

B. ☐ Water diversion or impoundment. (If checked, complete items 1, 2, 3, and 4 below as applicable.

C. ☐ Mining — other than aggregate removal. (If checked, complete items 2, 3, and 5 below as applicable.)

D. ☐ Road or bridge construction. (If checked, complete items 1, 2, and 3 below as applicable.)

E. ☐ Logging. (If checked, complete items 3 and 5 below as applicable.)

F. ☐ Temporary, recreational or irrigation dam.

G. ☐ Levee or channel construction.

H. ☐ Other — Describe on reverse side

Item No. 1. — Volume of sand, gravel, and/or boulders to be removed, displaced or added during time period covered in this notification. 20.

Describe: _____

_____

Item No. 2. — Type of material removed or displaced

☐ Soil 21.

☐ Sand 22.

☐ Gravel 23.

☐ Boulders 24.

Item No. 3. — Equipment to be used in the described site

☐ Bulldozer, cat, logging arch, etc. 25.

☐ Dragline 26.

☐ Bucket dredge or suction dredge 27.

☐ Other (Describe)_____ 28.

Item No. 4. — Use of water (i.e., domestic, irrigation, gravel, washing, etc.) 29.

Describe: _____

_____

Item No. 5. — Material not covered in Item No. 1

A. Describe type of solid material which will enter or be deposited in the stream or lake as a result of this operation: 30.

_____

_____

_____

B. Estimate quantity of material which will enter or be deposited in the body of water as a result of this operation: 31.

_____

_____

_____

Item No. 6. — Describe type and density of vegetation to be affected, and estimate area involved. If no vegetation involved, write "None."

2. Briefly describe proposed construction methods.

C. SKETCH MAP

Diagram or sketch below the location of your operation to clearly indicate the stream or other water and access from named public road. Indicate locked gates with an X. Show compass direction.

Signature of Applicant

Date:

of California
Resources Agency
rtment of Conservation
VISION OF FORESTRY

TIMBERLAND CONVERSION PLAN

NSTRUCTIONS. Applicants must complete General section for plan submitted and such additional sectio as may be appropriate for the specific future use to which the timberlands are to be converte ou may attach supplemental pages to provide complete answers, or explain a use not covered. Key supplement continued answers by using the appropriate question number, such as General—7, Grazing—5, etc. Addition formation may be required as appropriate.

GENERAL

1. Plan of _____ (Name of timberland owner(s)) (Address)

for conversion of timberland for _____ (new use)

on realty shown on Timberland Conversion Plat or map accompanying application dated _____

for exemption from Forest Practice Rules, covering _____ acres of timberland.

2. Do you or a representative reside on or near the property? _____ (yes/no)

_____ (Name of resident)

3. Have you received any professional advice or assistance in planning this conversion? _____ (yes/no) List

name and address people professionally trained in land management who are advising you on this conversio

_____ (Indiv. Name) (Firm or Agency Name) (Address)

_____ (Profession or occupation)

4. Do you have or can you obtain sufficient financial resources to carry out this conversion? _____ (yes/no) Shou

the conversion fail or be abandoned do you have or can you obtain sufficient financial resources to return tl

land to timber production? _____ (yes/no)

5. How will the timber be logged? (Will all or only some trees be cut, will area be tractor logged or cab

logged, etc.) Describe: _____

6. Timbered slopes generally are from _____ % to _____ % and face _____ (direction)

_____ (direction), _____ (direction), _____ (direction)

7. What special measures will be taken during logging including road and skid road construction and use t

prevent erosion, protect soil, and to protect local streams, ponds or lakes on or near the conversion area

Describe: _____

_____ (use an attached sheet if necessary)

B (REV. 6-69)

8. How will the area be prepared for new use after logging? (Describe methods of slash disposal and woody vegetation treatment, and any additional land treatment measures that will be taken.)

9. If conversion fails, or is abandoned for any reason, how will area be returned to timber growing use to meet the purposes of the Forest Practice Act? Describe land preparation, and seeding or planting measures:

10. Amount of timberland on which you plan to have conversion completed 5 years hence, will be _____ acres.

11. When do you expect to complete the following: Logging _____ (mo./year) Final Conversion to new use _____ (mo./year)

12. What assurance can you give that this conversion is feasible?

13. What are the specific plans for development of the new use?

14. Sketches for development, and other documents illustrating or showing proposed new use attached? _____ (check)

15. List attached sketches or documents:

a.

b.

c.

d.

e.

(COMPLETE AND ATTACH APPROPRIATE SECTIONS COVERING INTENDED USE.)

sal and woody

ng use to meet
ing measures:

acres.

version to new

hed? (check)

2

AGRICULTURE—GRAZING—GAME MANAGEMENT

The following additional information is needed for lands to be devoted to agricultural purposes incl
razing and game management.

1. Has the soil been examined to determine its suitability for the intended agricultural use?_____ (yes/n
(Consultation with farm advisors, soil conservation district specialists, or other qualified professionals.

2. Describe the soils now supporting timber or other woody vegetation:_____

(clay, clay loam, sandy loam, sand, decomposed granite, other)

Give soil series if known_____

3. What soil treatments will be necessary or desirable for the new use? (lime, fertilizers, mulch, etc., and
of application)_____

4. What steps are going to be taken to eliminate other woody vegetation left following logging? (check b
Mechanical clearing_____ Chemical eradication_____ Burn_____ Other (specify)_____

5. What steps are going to be taken to keep natural woody growth from revegetating the area? (check b
Mechanical removal_____ Reburn_____ Chemical eradication_____ Other_____

6. What kind and rate of application of seed or planting stock will be made?_____

7. If for grazing, what kind and number of livestock are being grazed now on this property?_____

What kind and number of livestock will be grazed after conversion is completed?_____

8. What water developments exist now on the property?_____

What additional water developments are planned for conversion?_____

9. What length of fence exists now in connection with the conversion area?_____

Additional length to be added in connection with conversion_____

10. Describe buildings or improvements now on property where conversion is planned

(Residence, barn, other farm structures)

What buildings or improvements will be added in connection with conversion?

11. Specify Agricultural Conservation Program practices that will be applied for in connection with this conversion

12. *If conversion is for game management*

a. Specify species of birds or animals for which management is intended

b. What are your specific plans for treatment of the area including vegetation treatment, water development, seeding or planting of food and cover plants, access, etc., not covered in items 1 to 4 above. (Use additional pages if necessary)

WATER DEVELOPMENT PROJECTS

The following additional information is needed for lands to be devoted to reservoirs or other water dev projects:

1. Is the reservoir to be built and operated for a government *agency* or for *private* use?_____

   If for a public agency show name of agency_____

2. If privately owned and operated do you have a permit, certificate or similar documents from the S (California) Department of Water Resources?_____

3. Is a reservoir to be built under Agricultural Conservation Program?_____ (yes/no) If so, have you application?_____ (yes/no) Please attach copy of application, document of approval, or copy of evidenc professional planning and design. Document attached_____ (check)

4. Provide a map showing the high water line in relation to your property.

RECREATION

The following additional information is needed for lands to be devoted to recreational development:

1. What evidence of county or district zoning and approval are you giving with this plan?_____

   _____ Attached_____ (chec

2. Does your plan comply with local health and sanitation requirements, and have approval?_____ (yes/no)

   By what local governing authority?_____

3. Will your plan meet county road standards, and have county approval of the roads?_____ (yes/no)

4. Development plan attached?_____ (check)

SUBDIVISION

The following additional information is needed for lands to be devoted to real estate subdivisions:

1. Has "Combined Notice of Intention" per Section 11010, Business and Professions Code been filed with State Division of Real Estate?_____ (yes/no) _____ (date)
2. Is area approved for subdivision?_____ (yes/no) By what local governing authority?_____

Proposed general development plan is attached_____ (check)

MINING

The following additional information is needed for lands to be devoted to mining purposes:

1. What kind of material will be mined or removed?_____
2. Has an assay or feasibility report been made to determine the quality and the economics of the venture?

_____ (yes/no) _____ (summary of findings)

3. Describe nature and extent of necessary surface disturbance:

Sketch or map attached?_____ (check)

FM-55 (REV. 6-69)

33207-356 6-69 10M

with State

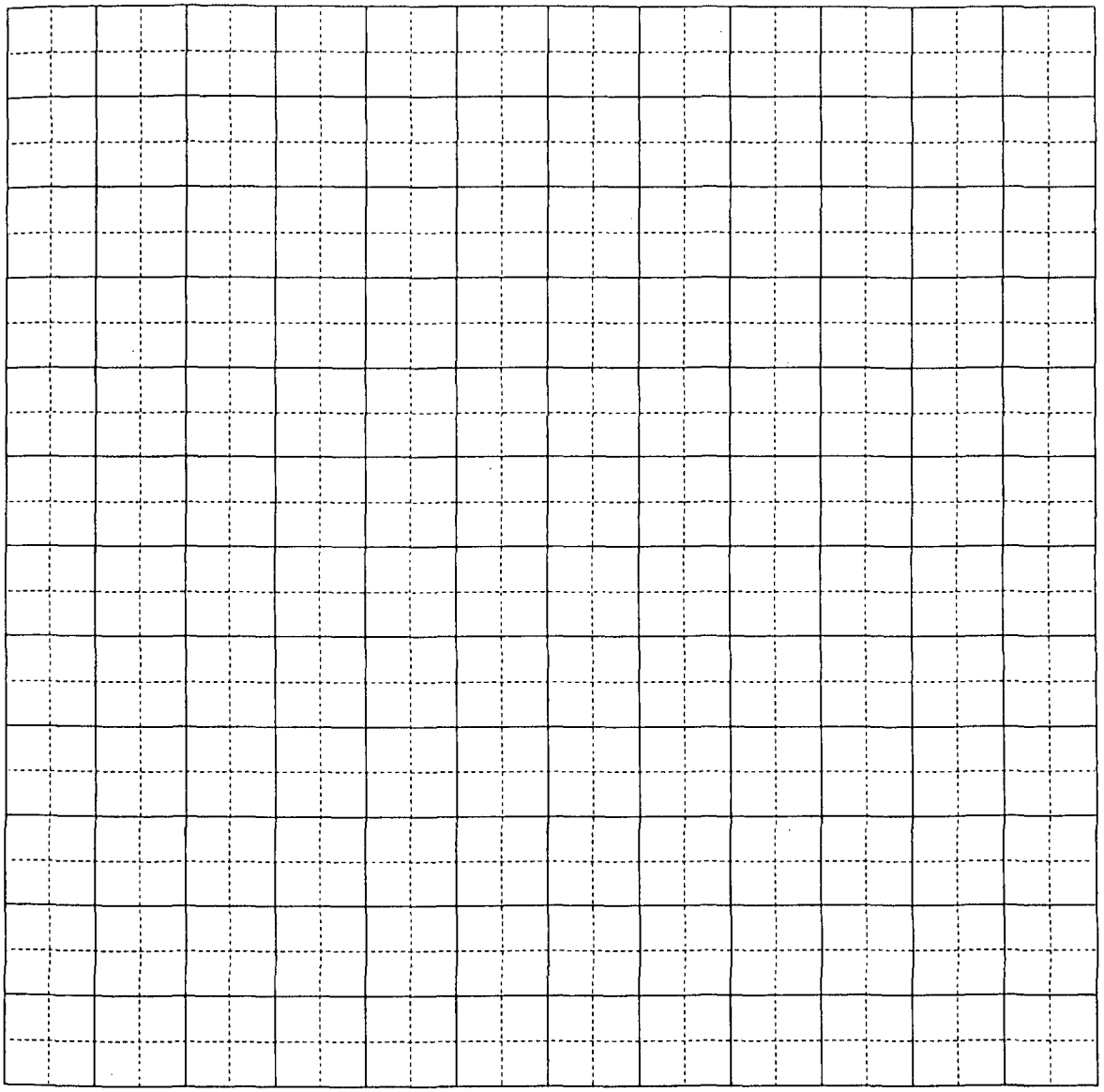
...e venture?

...tate of California
...he Resources Agency
...epartment of Conservation
DIVISION OF FORESTRY

Applicant's Name_____

TIMBERLAND CONVERSION PLAT

Township_____ Range_____ _____B & M



Scale_____inch(es) = 1 mile

Show section numbers in center of section on plat. Entire plat may be used as one section or as halves of adjoining secti if needed for large scale detail.

Show clearly the timbered area only to be cut for conversion to other use by: ////// (Show to the nearest pract boundaries such as regular 40 acre land subdivision, main roads, streams, or ridges within your property.)

...9 10M ① △ OSP

FM-54 (REV. 6-69)

33205-356 6-69 10M △

State of California
The Resources Agency
Department of Conservation
DIVISION OF FORESTRY

TIMBERLAND CONVERSION CERTIFICATE NO. .....

Forest District.....
Administrative Unit.....

The State Forester hereby grants to:

.....
(Name(s))

.....
(Address(es))

This Timberland Conversion Certificate which exempts the holder thereof from complying with the provisions of Sections....., Title 14 of the California Administrative Code regulating timber cutting practices within the.....forest district. All other forest practice rules shall be complied with during conversion. Said exemption shall be valid from.....to..... and be applicable only to lands located in

Sections.....Twp.....Range..... .....B&M

_____	_____	_____	_____
_____	_____	_____	_____

as shown in detail in Plat attached hereto, being.....acres of timbered lands subject to the Forest Practice Act.

Exemption from the timber cutting practices prescribed in the applicable forest practice rules is granted pursuant to the provisions of Section 4577 of the Public Resources Code upon a satisfactory showing of proof that the timberland described above and shown on the attached Plat are to be devoted, in a bona fide manner, to other than a timber growing use as evidenced by the conversion plan submitted by the applicant, verification of facts by inspection of records and field examination of said timberlands and the applicant's affidavit attesting to the truthfulness of statements made in his application and conversion plan.

This certificate may be voluntarily terminated by the holder(s) by completing and signing the reverse side hereof and sending it to the State Forester at Sacramento, California.

The State Forester may suspend or revoke this certificate upon misrepresentation of the facts in the application or conversion plan or if significant work toward completion of the proposed timberland conversion has not been accomplished in accordance with the conversion plan during any eighteen-month period.

The privilege granted herein to the holder of this certificate is non-transferable for any purpose.

.....
State Forester

Dated.....

Sacramento, California

FM-56 (REV. 6-69)

VOLUNTARY TERMINATION OF TIMBERLAND CONVERSION CERTIFICATE

State Forester
California Division of Forestry
1416 Ninth Street
Sacramento, California 95814

Sir:

_____, a holder of
Timberland Conversion Certificate No._____voluntarily desire to terminate the exemption from
compliance with cutting provisions of the applicable Forest Practice Rules specified under this certificate because

(Line out all reasons not applicable)

(1) Timberland Conversion has been completed before termination date of the certificate.

(2) Timber subject to the exemption provisions of this certificate has not been cut.

(3) Timber subject to the exemption provisions of this certificate was cut on only a portion of the timberlan
covered by this certificate, and conversion for_____has been complete
(purpose)

(4) Timber subject to the exemption provisions of this certificate has been cut on a portion or all of the timbe
land covered by this certificate, but I am unable to complete the planned land use conversion. I understan
that the said cut portion of timberland must be promptly restocked with commercial conifer seedlings, o
the State Forester may enter upon said cut portion of timberland and perform such work as may b
necessary to restock said cut portion of timberland for timber production, and that the cost of such wo
performed by the State Forester may not exceed $40.00 per acre, for which I am liable.

(5) Other—(Use attached sheets if needed)_____

_____

_____

_____

Please terminate this certificate upon receipt.

*I declare under penalty of perjury that the statements and declarations made above are true and correct to th
best of my knowledge.*

Executed on_____at_____, California.
(date)

Signed:_____
Declarant

_____
Address

Voluntary Termination approved by the State Forester

_____
State Forester

Dated_____

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C
O
P
Y

TIMBERLAND TO BE DEVOTED TO OTHER THAN TIMBER GROWING USE

The State Board of Forestry in Sacramento on June 30, 1972 adopted as emergency regulations Sections 1100-1105, Subchapter 4.1, Chapter 2, Division 2, Title 14, California Administrative Code, to become effective June 30, 1972. These regulations listed below implement, interpret or make specific Section 4577.1 of the Public Resources Code.

TITLE 14, CALIF. ADM. CODE, SUBCHAP. 4.1, CHAPTER 2, DIV. 2

Section 1100. Proof that Timberland is to be Devoted To a Use Other Than the Growing of Timber. Any person, firm, corporation, company, or partnership owning timberland that is to be devoted to use other than the growing of timber, pursuant to the provisions of Section 4577.1 of the Public Resources Code, shall file an application, a plan for the conversion of said timberland and an affidavit with the State Forester at his office in Sacramento, California, in order to provide proof of the future use to be made of said land.

When the State Forester finds that proof as submitted is satisfactory, he shall issue a Timberland Conversion Certificate pursuant to these regulations.

Section 1100.3. Issuance of Certificate Denied. The State Forester may deny issuance of a Timberland Conversion Certificate for any of the following reasons:

(a) Failure of the applicant to comply with these regulations.

(b) Material misrepresentation or false statement in the Application, Affidavit, Conversion Plan or any other material submitted for the purpose of constituting proof that the timberlands in question are to be devoted in the bona fide manner to other than a timber growing use.

(c) Failure of the applicant to give satisfactory proof that the timberlands being cut or to be cut are to be devoted, in a bona fide manner, to other than a timber growing use.

Section 1100.4. Certificate Suspension or Revocation. A Timberland Conversion Certificate may be suspended or revoked by the State Forester for any reason for which he may deny a Timberland Conversion Certificate.

Section 1100.6. Proceedings. All proceedings pursuant to Sections 1100.3 and 1100.4 shall be conducted in accordance with Chapter 5 (commences with Section 11500), Part 1, Division 3, Title 2 of the Government Code.

Section 1101. Application. The form of application shall be prescribed by the State Forester and shall include the name of the timberland owner as officially recorded, bona fide address of said owner, the legal description of the timberland to be converted, the approximate number of acres to be converted and information concerning the record interest.

Section 1101.5. Additional Proof. An applicant for a Timberland Conversion Certificate may submit to the State Forester any further or additional proof other than is specifically required by these regulations as proof that the timberlands being cut or to be cut are to be devoted in a bona fide manner to other than a timber growing use.

Section 1102. Conversion Plan. The Conversion Plan shall be in a format prescribed by the State Forester and the plan shall become a part of the application. The plan shall set forth in detail information pertaining to present and future use, soils, topography, conversion techniques, conversion time schedule, and such other information as may be required and is applicable to the particular future use to which the land will be devoted.

Section 1103. Affidavit. The form of affidavit shall be prescribed by the State Forester and shall include the name of the applicant, the nature of the future use to which said timberland is to be devoted, the dates when conversion is to commence and be completed, signature of the applicant.

Section 1104. Certificate. When satisfied that proof as submitted by the timberland owner and verified by records and field examination is satisfactory, the State Forester shall issue a Timberland Conversion Certificate. The Certificate shall include the name of the certificatee, and identification by code section of the cutting practices of the forest practice rules from which the certificatee is exempt from complying with, the description of the lands to which the certificate is applicable and the period of time during which the certificate is valid.

The privilege granted to the certificatee is nontransferable and nonassignable for any purpose; however, it may be renewed upon a proper showing of cause and necessity to the State Forester.

The timberland owner shall provide each timber operator harvesting forest products on timberland for which a Timberland Conversion Certificate has been issued a copy of said certificate prior to permitting any cutting of trees required to be left standing by the applicable forest practice rules.

Section 1105. Prohibited Activity. No timber operator shall cut or remove from any timberland trees required to be left by the applicable forest practice rules or valid alternate plan or forest management plan without first having received from the timberland owner a copy of a Timberland Conversion Certificate issued by the State Forester. Said copy of the certificate shall be available for inspection at the principal office of the timber operator at all times while he is conducting timber operations under provisions of the certificate.

Any timber operator cutting in violation of this section is subject to the same penalties as provided by the Forest Practice Act for violation of the forest practice rules.

State of California
The Resources Agency
Department of Conservation
DIVISION OF FORESTRY

APPLICATION FOR TIMBERLAND CONVERSION CERTIFICATE

WHEREAS, the forest practice rules in the respective Forest Districts regulate the cutting of trees within each district and Section 4577 of the Public Resources Code of California provides that where satisfactory proof is given that timberlands are to be devoted, in a bona fide manner, to other than timber growing use, owners and persons operating thereon may cut and remove any and all trees regardless of diameter but shall otherwise comply with the forest practice rules:

Therefore, pursuant to Section 4577, Public Resources Code, and regulations contained in Title 14, California Administrative Code, I (we) _____,

_____, _____
(Mail address) (Zip)

do hereby make application to the State Forester for a Timberland Conversion Certificate for the purpose of converting _____ acres of timberland as defined by Section 4531 of the Public Resources Code to a use other than the growing of timber. Conversion of this timberland will require the cutting of timber, otherwise required to be left standing under the Forest Practice Rules of the _____

Forest District by Section(s) _____, Title 14, California Administrative Code, located within the following parcels of land as shown in the shaded areas on the attached plat or map.

Subdivision(s)	Section	Twp.	Rng.	B&M

The record interest in said lands is held under deed dated _____, recorded in Vol. _____ at page _____ of Official Records in the County of _____ and the owner(s) of record is (are) _____.

These lands are assessed to _____.

Information on any more recent unrecorded transfer of ownership title is set forth as part of Item 1—General of the "Timberland Conversion Plan" attached to this application. **All owners must sign this application, or attach power of attorney for signer.**

I certify that any special use permits or license required by statute, ordinance or regulation for the proposed new land use have been applied for and granted by the responsible government agency. The type of permit or license required and issuing agency is listed in each appropriate section of the attached Timberland Conversion Plan.

Submitted herewith and thereby made a part of this application is the plan that will be followed to accomplish the orderly and safe conversion of these timberlands.

AFFIDAVIT

I, _____

_____, say: I own, or am one of the owners, of the property
(show all property owners)

described above and intend to use this land for _____.
(describe uses intended)

Conversion of this land will commence about _____, 19____, and will be completed on or before _____, 19____.

I have fully read the above application; to the best of my knowledge and belief the statements and declarations made therein and the attachments thereto are true.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, 19____, at _____, California.

_____

_____
(Signature(s) of property owner(s))

(If a signatory is in a state other than California, he must sign this affidavit before a Notary Public.)

NOTE: CUTTING OF TIMBER REQUIRED TO BE LEFT STANDING BY THE FOREST PRACTICE RULES IS PROHIBITED UNTIL A TIMBERLAND CONVERSION CERTIFICATE HAS BEEN ISSUED BY THE STATE FORESTER AND A COPY THEREOF DELIVERED BY THE CERTIFICATEE TO EACH TIMBER OPERATOR CUTTING TREES ON THE ABOVE DESCRIBED TIMBERLAND.

(TIMBERLAND CONVERSION CERTIFICATES MAY BE RECORDED WITH THE COUNTY RECORDER BY THE STATE FORESTER.)

APPENDIX F

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT *n* (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The n value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100

From: Chow, 1959.

APPENDIX G

Suggested Reporting Form

STATE OF CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

REPORT OF WASTE DISCHARGE FOR LOGGING AND

ROAD CONSTRUCTION ACTIVITIES

Pursuant to Division 7 of the State Water Code

Instructions: Applicants must complete entire form. Sufficient detail must be provided so that the Regional Board can assess the potential for non-point source waste discharges, including sediment. Briefly explain all non-applicable entries. Use additional paper if necessary.

1. Plan of _____ (name of landowner) _____ (address) and _____ (name of operator if different) _____ (address) for logging or construction activities within a potential critical discharge area.

2. The area is located in _____ (subsection, section, township, range, county) _____ and borders _____ (streams) _____

3. Principal representatives are _____

_____

4. Have you received any professional advice or assistance in planning this operation? _____ (Yes/No). List by names and addresses people professionally trained in land management who are advising you on this operation. _____ (name,

_____
firm or agency, address, profession or occupation)

_____

5. Type of proposed activities: (check appropriate boxes)

tractor yarding	☐	road construction	☐
high-lead yarding	☐	building construction	☐
ballon yarding	☐	mining	☐
helicopter yarding	☐	timber harvest	☐
land conversion	☐	other	☐

6. The season of operation is from _____ (month-year) to _____ (month-year).

7. The total acreage involved in entire operation is _____.

8. Roads will be constructed _____ (feet) away from stream channel.

9. Road cut slopes are _____:1 and fill slopes are _____:1.

10. Greatest road cut dimensions will be _____ (feet) by _____ (feet), fill height _____ (feet) by _____ (feet).

11. Amount of surface exposure expected from operation _____ %.

12. Watershed characteristics:

Slope from (%) to (%), (%) average

Percent of vegetative cover to be disturbed or removed _____ (%)

Type of vegetative cover

(% composition by species within 100 feet of streams)

Evidence of mass soil movement
(type and extent)

13. What special measures will be taken during the conduct of your activity to prevent subsequent erosion to protect the soil, and to protect streams, ponds, or lakes on or near the area of activity? (Describe)

14. What type of material will enter or be deposited in waterway as a result of this operation? (Describe)

15. Estimate quantity of material which will enter or be deposited in waterway as a result of this operation.

(amount by type)

16. If a Critical Discharge Area is designated for your activity, do you intend to operate in the CDA? _____ yes/no

All of the statements contained herein are true and correct to the best of my knowledge and belief and are submitted under penalty of perjury.

_____
(signed)

_____
(title)

_____
(date)

You will be notified of the completeness and adequacy of your Report pursuant to Division 7, Section 13260 of the State Water Code. The Board may establish a critical discharge area adjacent to your watercourses and require you to show how your operation will not violate the Board's prohibition on discharge of earthen or vegetative material into the watercourse.

APPENDIX H

SUGGESTED DETAILED RISK ANALYSIS WORK SHEET

Points				
	Name of Stream(s)			
	Storet Number			
	Flow (permanent, intermittent)			
	Width			
	Depth			
	Gradient			
	Flooding Behavior			
	Streambed material			
	Percent of Fines			
	Riffle/Pool			
	Rainfall Amount			
	Rainfall Duration			
	Rainfall - 3-Day Total			
	Name of Soil(s)			
	Erosion Hazard			
	Hydrologic Group			
	Slope (most prevalent - %)			
	Cover (in streamside zone)			
	Mass Movement (type, extent)			
	Land Recovery (extent)			
	Water Temperature			
	Water Dissolved Oxygen			
	Water Turbidity (background)			
	Name of Recreation Area(s)			
	Type of Activities			
	Proximity of Body Contact Sports			
	Amount of General Use			
	Amount of Angling Use			
	Proximity of Non-Body Contact Sports			
	Nearness of Road(s) to Stream(s)			
	Size of Road Cuts and Fills			
	Slope of Road Cuts and Fills			
	Amount of Surface Exposure			
	Anadromous Fishery Importance			
	Anadromous Fishery Proximity			
	Wild River (state or federal)			
	State Protected Waterway			

APPENDIX I

GLOSSARY OF TERMS

ACCELERATED EROSION - the wearing away of the soil at a rate faster than it is being created.

ANADROMOUS - pertaining to fishes which ascend rivers to spawn.

CAVITATION - a process of erosion carried on by rivers which occurs under very high velocities only.

CORRASION - the mechanical wearing away of land generally by the impact or grinding action of particles carried by the stream.

CORROSION - the chemical process which results from the reaction of water on the surface of the land.

CRITICAL DISCHARGE AREA - the land area adjacent to waterways. The discharge of waste from this area is particularly liable to cause waste discharges.

DEBRIS - material of organic origin such as slash, slabs or sawdust.

EPHEMERAL STREAM - a waterway which flows during and shortly after storms but which is normally dry.

EROSION - the wearing away of the surface of the land by water, wind or ice.

INTERMITTENT STREAM - a waterway which flows during moist periods of the year but which is seasonally dry.

JACKSON TURBIDITY UNIT - a standard unit of measurement for determining turbidity.

NON-POINT SOURCE DISCHARGE - release of material such as sediment or debris at transitory or undeterminable locations.

ONE-HUNDRED YEAR FLOOD PLAIN - the land adjacent to a waterway which becomes inundated by floods recurring on a frequency of once in 100 years.

ORTHOPHOTOGRAPHY - differentially rectified photography which places ground objects in their true plane position.

PERMANENT STREAM - a waterway which contains flowing water year long except perhaps in periods of extreme drought.

PERMEABLE - the capability of soil to be penetrated by moisture.

REMOTE SENSING - the use of aerial photography in resource management.

REPORT OF WASTE DISCHARGE - required of any person discharging wastes that could affect the quality of water.

SALMONID - any fish of the family Salmonidae, especially the anadromous salmon, but also including trout.

SEDIMENT - visible fine organic or earthen particles suspended in waterways.

SEDIMENTATION - the action or process of depositing sediment.

SOLID WASTE - in this report, limited to any flow or seepage containing debris or eroded earth from logging operations.

SPAWNING ESCAPEMENT - that portion of the anadromous fish run that eludes anglers and fishermen and returns to ancestral gravels for spawning.

STORET - the storage and retrieval system of data for water quality control as devised by FWPCA in 1964.

WASTE DISCHARGE - in this report, limited to the deposition of debris or eroded earth into a waterway.