

# national program of inspection of dams

IN FIVE VOLUMES • Volume I

MAY 1975



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314



627.8  
Un32n  
V.1

NATIONAL PROGRAM OF  
INSPECTION OF DAMS

VOLUME INDEX

VOLUME

- I      Report of the Chief of Engineers on the National Program  
         of Inspection of Dams  
         Appendix A, Responses to Questionnaire on Supervision of  
         Dams by State Authorities  
         Appendix B, Responses to Questionnaire on Supervision of  
         Dams by Federal Agencies  
         Appendix C, Model Law for State Supervision of Dams  
         and Reservoirs  
         Appendix D, Recommended Guidelines for Safety Inspection  
         of Dams  
         Appendix E, Resolutions of State Organizations and  
         National Conferences
- II     Appendix F, Inventory of Dams in the United States  
         Section I - Alabama, Alaska, Arizona, Arkansas, California,  
         Colorado, Connecticut, Delaware, District of Columbia,  
         Florida, Georgia, Hawaii, Idaho, Illinois, Indiana,  
         Iowa, Kansas and Kentucky
- III    Appendix F, Inventory of Dams in the United States  
         Section II - Louisiana, Maine, Maryland, Massachusetts,  
         Michigan, Minnesota, Mississippi, Missouri, Montana,  
         Nebraska, Nevada, New Hampshire, New Jersey, New Mexico,  
         New York, North Carolina, North Dakota and Ohio
- IV     Appendix F, Inventory of Dams in the United States  
         Section III - Oklahoma, Oregon, Pennsylvania, Rhode Island,  
         South Carolina, South Dakota, Tennessee, Texas, Utah,  
         Vermont, Virginia, Washington, West Virginia, Wisconsin,  
         Wyoming, American Samoa, Puerto Rico, Trust Territories,  
         Virgin Islands and Guam
- V      Appendix F, Inventory of Dams in the United States  
         Section IV - Index





# CONTENTS

## VOLUME I

|                                                         | <u>Page</u> |
|---------------------------------------------------------|-------------|
| Memorandum for Secretary of the Army _ _ _ _ _          | vi          |
| Comments of the Governor of Alabama _ _ _ _ _           | ix          |
| Comments of the Governor of Arizona _ _ _ _ _           | x           |
| Letter to the Governor of Arizona _ _ _ _ _             | xii         |
| Comments of the State of California _ _ _ _ _           | xiii        |
| Letter to the State of California _ _ _ _ _             | xv          |
| Comments of the Governor of Connecticut _ _ _ _ _       | xvi         |
| Letter to the Governor of Connecticut _ _ _ _ _         | xix         |
| Comments of the Governor of Florida _ _ _ _ _           | xxi         |
| Comments of the Governor of Hawaii _ _ _ _ _            | xxii        |
| Comments of the State of Idaho _ _ _ _ _                | xxiii       |
| Letter to the State of Idaho _ _ _ _ _                  | xxv         |
| Comments of the State of Illinois _ _ _ _ _             | xxviii      |
| Letter to the State of Illinois _ _ _ _ _               | xxix        |
| Comments of the Governor of Indiana _ _ _ _ _           | xxx         |
| Letter to the Governor of Indiana _ _ _ _ _             | xxxi        |
| Comments of the State of Iowa _ _ _ _ _                 | xxxii       |
| Comments of the Governor of Kentucky _ _ _ _ _          | xxxiv       |
| Comments of the Governor of Louisiana _ _ _ _ _         | xxxv        |
| Comments of the Governor of Maine _ _ _ _ _             | xxxvi       |
| Comments of the Governor of Maryland _ _ _ _ _          | xxxvii      |
| Comments of the Commonwealth of Massachusetts _ _ _ _ _ | xxxviii     |
| Comments of the Governor of Michigan _ _ _ _ _          | xL          |
| Comments of the State of Minnesota _ _ _ _ _            | xLi         |
| Letter to the State of Minnesota _ _ _ _ _              | xLiii       |
| Comments of the Governor of Missouri _ _ _ _ _          | xLiv        |
| Comments of the Governor of Montana _ _ _ _ _           | vLvi        |
| Comments of the Governor of Nebraska _ _ _ _ _          | xLvii       |
| Comments of the Governor of Nevada _ _ _ _ _            | xLix        |
| Letter to the Governor of Nevada _ _ _ _ _              | L           |
| Comments of the Governor of New Hampshire _ _ _ _ _     | Li          |
| Letter to the Governor of New Hampshire _ _ _ _ _       | Lii         |
| Comments of the Governor of New Mexico _ _ _ _ _        | Liii        |
| Letter to the Governor of New Mexico _ _ _ _ _          | Liv         |
| Comments of the Governor of New York _ _ _ _ _          | Lv          |
| Comments of the Governor of North Dakota _ _ _ _ _      | Lvi         |
| Comments of the State of Rhode Island _ _ _ _ _         | Lvii        |
| Letter to the State of Rhode Island _ _ _ _ _           | Lviii       |
| Comments of the State of Tennessee _ _ _ _ _            | Lix         |
| Comments of the Governor of Utah _ _ _ _ _              | Lx          |
| Comments of the Governor of Vermont _ _ _ _ _           | Lxi         |

|                                                                                   | <u>Page</u> |
|-----------------------------------------------------------------------------------|-------------|
| Comments of the Commonwealth of Virginia _ _ _ _ _                                | Lxii        |
| Comments of the Governor of Washington _ _ _ _ _                                  | Lxiii       |
| Comments of the Governor of Wisconsin _ _ _ _ _                                   | Lxiv        |
| Comments of the Governor of Wyoming _ _ _ _ _                                     | Lxv         |
| Letter to the Governor of Wyoming _ _ _ _ _                                       | Lxvii       |
| Comments of the Commonwealth of Puerto Rico _ _ _ _ _                             | Lxix        |
| Comments of the Governor of Guam _ _ _ _ _                                        | Lxxii       |
| Comments of the Trust Territory of the Pacific Islands _ _ _ _ _                  | Lxxiii      |
| Comments of the Department of Agriculture _ _ _ _ _                               | Lxxiv       |
| Letter to the Department of Agriculture _ _ _ _ _                                 | Lxxvii      |
| Comments of the Bureau of Indian Affairs _ _ _ _ _                                | Lxxix       |
| Letter to the Bureau of Indian Affairs _ _ _ _ _                                  | Lxxx        |
| Comments of the Bureau of Reclamation _ _ _ _ _                                   | Lxxxix      |
| Letter to the Bureau of Reclamation _ _ _ _ _                                     | Lxxxv       |
| Comments of the Fish and Wildlife Service _ _ _ _ _                               | Lxxxvii     |
| Comments of the Geological Survey _ _ _ _ _                                       | Lxxxviii    |
| Comments of the Federal Power Commission _ _ _ _ _                                | Lxxxix      |
| Letter to the Federal Power Commission _ _ _ _ _                                  | xci         |
| Comments of the International Boundary and Water Commission _ _ _                 | xciii       |
| Comments of the Tennessee Valley Authority _ _ _ _ _                              | xciv        |
| Letter to the Tennessee Valley Authority _ _ _ _ _                                | xcv         |
| Report of the Chief of Engineers on the<br>National Program of Inspection of Dams |             |
| 1. Authority _ _ _ _ _                                                            | 1           |
| 2. Interim Report _ _ _ _ _                                                       | 1           |
| 3. Scope _ _ _ _ _                                                                | 1           |
| 4. Background _ _ _ _ _                                                           | 2           |
| 5. Inspections _ _ _ _ _                                                          | 2           |
| 6. Inventory of Dams _ _ _ _ _                                                    | 3           |
| 7. Existing Regulatory Functions and Practices _ _ _ _ _                          | 4           |
| a. State Authorities _ _ _ _ _                                                    | 4           |
| b. Federal Agencies _ _ _ _ _                                                     | 5           |
| 8. Inspection Guidelines _ _ _ _ _                                                | 7           |
| 9. Need for National Program _ _ _ _ _                                            | 8           |
| 10. Elements of a National Program _ _ _ _ _                                      | 9           |
| a. Model Law _ _ _ _ _                                                            | 9           |
| b. Regulatory Functions _ _ _ _ _                                                 | 10          |
| c. Initial Inspections _ _ _ _ _                                                  | 11          |
| 11. Responsibility for Supervision of Program _ _ _ _ _                           | 11          |
| a. General _ _ _ _ _                                                              | 11          |
| b. Federal Dams _ _ _ _ _                                                         | 11          |
| c. Non-Federal Dams _ _ _ _ _                                                     | 13          |
| 12. Cost of Program _ _ _ _ _                                                     | 13          |
| 13. Cost-Effectiveness of Program _ _ _ _ _                                       | 14          |

|                                                                                       | <u>Page</u> |
|---------------------------------------------------------------------------------------|-------------|
| 14. Impact of Program _ _ _ _ _                                                       | 15          |
| a. Economic Resources _ _ _ _ _                                                       | 15          |
| b. Technical Capabilities _ _ _ _ _                                                   | 15          |
| 15. Financing of Program _ _ _ _ _                                                    | 16          |
| a. Federal Agencies _ _ _ _ _                                                         | 16          |
| b. State Activities _ _ _ _ _                                                         | 16          |
| 16. Conclusions _ _ _ _ _                                                             | 16          |
| a. General _ _ _ _ _                                                                  | 16          |
| b. Safety Program _ _ _ _ _                                                           | 17          |
| c. Supervision _ _ _ _ _                                                              | 18          |
| (1) States _ _ _ _ _                                                                  | 18          |
| (2) Federal _ _ _ _ _                                                                 | 18          |
| d. National Dam Inventory _ _ _ _ _                                                   | 18          |
| 17. Recommendations _ _ _ _ _                                                         | 19          |
| Appendix A, Responses to Questionnaire on Supervision<br>of Dams by State Authorities |             |
| Appendix B, Responses to Questionnaire on Supervision<br>of Dams by Federal Agencies  |             |
| Appendix C, Model Law for State Supervision of Dams<br>and Reservoirs                 |             |
| Appendix D, Recommended Guidelines for Safety Inspection<br>of Dams                   |             |
| Appendix E, Resolutions of State Organizations and<br>National Conferences            |             |



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

16 May 1975

MEMORANDUM FOR: SECRETARY OF THE ARMY

SUBJECT: National Program of Inspection of Dams

1. I submit for transmission to the Congress my Report on the National Program of Inspection of Dams in response to Section 5 of the National Dam Inspection Act (Public Law 92-367). As directed by that section, it reports on the activities performed under the Act. The report submits an inventory of dams in the United States and recommendations for a comprehensive national program for the inspection and regulation of dams of the Nation, including the respective responsibilities which should be assumed by Federal, State and local governments and by public and private interests.

2. The activities performed in this study consisted of compiling the data for an inventory of dams; conducting a survey of each State and Federal agency's capabilities, practices and regulations in regard to the design, construction, operation and maintenance of dams; developing guidelines for the safety inspection and evaluation of dams; and formulating recommendations for a comprehensive national program for the inspection and regulation of the dams of the Nation. No inspections authorized by Public Law 92-367 have been performed due to limited funding and the belief that such inspections of non-Federal dams should be accomplished by the concerned States as part of their normal responsibilities.

3. The National Dam inventory included in the report consists of data on 49,329 dams which are 25 feet or more in height or have a maximum impounding capacity of 50 acre-feet or more. The inventory data consist of the name of the dam or impoundment; the river or stream on which the dam is located; the type of dam; the year completed; purpose of the dam; the height and maximum storage capacity; the name, population and distance from the dam to the nearest downstream city, town or village; the downstream hazard potential; the owner of the dam; and the Congressional District in which the dam is located.

4. The report presents the first Federal study of the problems of the safety of dams on a nationwide scale. It reveals that approximately 20,000 of the 49,329 dams of the Nation are so located that failure or



16 May 1975

SUBJECT: National Program of Inspection of Dams

misoperation of the discharge facilities could result in loss of human life and appreciable or greater property damage. The report also finds that existing dam safety programs in most States and in some Federal agencies are either non-existent or inadequate to protect the public from the hazards created by dams.

5. The protection of human life and property from the hazards of dam failure or misoperation is deemed a governmental concern. Although the adequacy and safety of dams owned and operated by numerous governmental agencies, public and private organizations, and private individuals are the obligation of the owners, governmental inspection and regulation is considered necessary to insure the adequacy of design, construction and operation of dams. To further reduce the risk of failure or misoperation, continued surveillance of the dam and appurtenant works is necessary to detect conditions of structural distress or operational inadequacy and to provide a basis for timely initiation of restorative and remedial measures if necessary.

6. Regulatory agencies should be established to regulate all existing and future dams and reservoirs and such agencies should be provided with adequate personnel, financing and powers to enforce their rules and regulations and accomplish their regulatory functions. Such regulatory agencies should review and approve the plans and specifications to construct, enlarge, modify, remove or abandon a dam or reservoir; perform periodic inspections during construction; issue certificates of approval upon completion of construction; perform periodic safety inspections and evaluations; and issue notices for required remedial or maintenance work.

7. In Section 5(3) of Public Law 92-367, the Secretary of the Army is directed to report to the Congress his recommendations for a comprehensive national program for the inspection and regulation for safety purpose of dams of the Nation and the respective responsibilities which should be assumed by Federal, State and local governments and by public and private interests. The program I propose for your consideration consists of the following features:

a. Implementation of the National Dam Safety Program as outlined in this report. The States and Territories should be encouraged to prosecute the recommended dam safety program encompassing all dams not under Federal authority. Federal agencies owning and operating dams, owning the land on which dams are located and the agencies having existing regulatory jurisdiction over dams should prosecute the recommended dam safety program for the dams under their jurisdiction.

16 May 1975

SUBJECT: National Program of Inspection of Dams

b. The inspection of all existing dams having a high or significant hazard potential should be conducted in accordance with the Recommended Guidelines for Safety Inspection of Dams within a reasonable and practicable time period after implementation of the National Dam Safety Program.

c. Those Federal agencies possessing technical expertise and capabilities in dam design and construction should be authorized to furnish technical assistance and guidance, upon request, to the States concerning State programs and the elimination or mitigation of any hazardous conditions found by the States.

d. Authority and funds should be provided the Chief of Engineers to maintain the National Dam Inventory.

8. The total cost of implementing and prosecuting a national dam safety program is difficult to forecast; however, evaluation of limited cost experience leads us to believe that the total annual program cost would be about \$73,500,000 which represents an average of \$1,500 per dam per year. About \$65,500,000 would be the annual cost for the programs covering the 43,500 non-Federal dams and \$8,000,000 for the 5,500 Federal dams. The cost of performing the initial inspections of the significant and high hazard potential dams would range between \$5,000 and \$10,000 per dam depending upon the dam's size and complexity. The total annual cost of the initial inspection of the significant and high hazard potential dams would average \$30,000,000 if these dams are inspected over a five year period. About \$27,000,000 of this average annual cost would be for the initial inspection of non-Federal dams.

9. I am pleased at the opportunity afforded by Public Law 92-367 to report on a proposed comprehensive national dam safety program for the purpose of protecting human life and property from the potential hazards created by dams. I commend the conclusions and recommendations of the report for your consideration in preparing recommendations to the Congress at the earliest practicable date.

10. The report has been coordinated with the States and interested Federal agencies and their comments and views are inclosed.

  
W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers



# STATE OF ALABAMA

GOVERNOR'S OFFICE

MONTGOMERY

GEORGE C. WALLACE  
GOVERNOR

April 11, 1975

W. C. Gribble, Jr.  
Lieutenant General, USA  
Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

Dear General Gribble:

Thank you for the opportunity to comment on the report which you will submit to the Secretary of the Army as provided by The Dam Inspection Act, P.L. 92-367.

The need for a comprehensive national program for the inspection of dams, and their regulation for safety purposes, was brought into sharp focus only two months ago here in Alabama. As you are probably aware, on February 10, 1975, the earthen dam at the Walter Bouldin Hydro Plant suddenly and inexplicably collapsed. Thankfully, there was apparently little property damage and no personal injuries in the areas located downstream as a result of this sudden dam failure. As your report indicates, a sizeable saving might have been realized had an adequate state and/or federal inspection program, in conjunction with the owner's, been in effect.

I look forward to receiving a copy of the complete report, with Appendixes, as soon as it is available, and I wish to assure you that the State of Alabama is generally in favor of the proposals outlined in your report.

With best regards, I am

Sincerely yours,

  
George C. Wallace  
Governor





PAUL H. CASTRO  
GOVERNOR

OFFICE OF THE GOVERNOR

STATE HOUSE  
PHOENIX, ARIZONA 85007

IN REPLY  
REFER TO:

May 8, 1975

W. C. Gribble, Jr.  
Lieutenant General, U.S. Army  
Chief of Engineers  
Department of the Army  
Washington, D.C. 20314

ATTENTION: DAEN-CWE-O

Dear General Gribble:

Thank you for the opportunity to review and comment on the report of the Corps of Engineers to Congress on the National Dam Inspection Program. We have followed with great interest activities leading to preparation of the report and are particularly concerned with how the recommendations might affect state responsibilities and our state safety of dams program. Arizona has had a safety of dams program for many years, but it was only recently that changes in both the managing agency and the funding level enabled us to undertake a program approaching that described in your report.

I believe the state should protect its citizens from the type of hazard presented by an unsafe dam and was pleased to see the report recommends that the responsibility for safety of non-federal dams rest with the states.

Another area of concern is that the proposed Guidelines for Inspection of Dams, once adopted, will become mandatory and standards to be applied to all dams. Although the report clearly sets forth the intent that the Guidelines serve as guides rather than rigid criteria, this concern and the concept are of sufficient importance to also be treated in the recommendations.

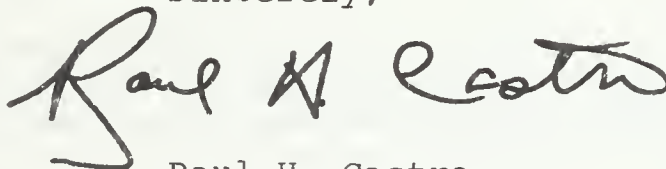
W. C. Gribble, Jr.  
May 8, 1975  
Page #2

In Arizona there are a significant number of jurisdictional size, non-federal dams which are located on U.S. Forest lands. The owners of these dams are now subject to regulation by both the State and the Forest Service. In one case the owner has to be responsive on dam safety not only to the State and the Forest Service, but also to the Federal Power Commission. Because this kind of multi-agency regulation places an unnecessary burden of government control upon the dam owners, the concept of single agency control recommended in your report will provide definite improvement.

However, the federal agencies whose regulatory control over non-federal dams presently overlaps that of the State do not appear, at this time, to have the technical staff necessary to execute a safety program at the level proposed in the report. If the single agency control recommendation is implemented, it would appear highly desirable to provide for program continuity by maintaining the state's program for these dams until the designated federal agencies have had time to institute an adequate program of their own.

In summary, I consider that the overall impact of the recommendations will be beneficial and offer my support. We have enjoyed working with your staff and look forward to receiving the complete report with appendices.

Sincerely,

A handwritten signature in dark ink, appearing to read "Raul H. Castro". The signature is fluid and cursive, with the first name "Raul" being the most prominent part.

Raul H. Castro  
Governor

RHC/gc



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

15 May 1975

Honorable Raul H. Castro  
Governor of Arizona  
Phoenix, Arizona 850007

Dear Governor Castro:

I thank you for your letter of 8 May 1975 regarding the Chief of Engineers report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

We agree with your view that the recommended guidelines for safety inspection of dams should not be made mandatory or establish standards to be applied to all dams. The Preface of the guidelines includes a statement that the establishment of rigid criteria or standards is not intended but rather outline the principal factors to be weighed in the determination of existing or potential hazards and to define the scope of the activities to be undertaken in the safety inspection of dams. Evaluation factors, considered reasonable, are included so that comparisons can be made with existing conditions.

The present inadequacies of some Federal agencies as well as those of many States in performing dam safety functions are recognized. A primary objective of the recommended National Dam Safety Program is to improve the capabilities of all dam supervising agencies.

Your comments and interest in the program are very much appreciated. Two copies of the completed report, with Appendixes, will be furnished the State of Arizona when the report is submitted to the Secretary of the Army.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "D. A. Raymond", is written over the typed name.

D. A. RAYMOND  
Major General, USA  
Acting Chief of Engineers

Claire T. Dedrick

EDMUND G. BROWN JR.

~~NORMAN D. LIVERMORE, JR.~~  
SECRETARY

~~RONALD REAGAN~~  
GOVERNOR OF  
CALIFORNIA

OFFICE OF THE SECRETARY  
RESOURCES BUILDING  
1416 NINTH STREET  
95814

Department of Conservation  
Department of Fish and Game  
Department of Navigation and  
Ocean Development  
Department of Parks and Recreation  
Department of Water Resources



Air Resources Board  
Colorado River Board  
San Francisco Bay Conservation and  
Development Commission  
Solid Waste Management Board  
State Lands Commission  
State Reclamation Board  
State Water Resources Control Board  
Regional Water Quality Control Boards

THE RESOURCES AGENCY OF CALIFORNIA  
SACRAMENTO, CALIFORNIA

Lt. General W. C. Gribble, Jr.  
Chief of Engineers  
Office of the Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

Dear General Gribble:

Governor Brown has requested that I reply to your letter of March 18, 1975, regarding the text of your report to the Secretary of the Army on the National Program of Inspection of Dams.

As you know, California has an effective program in dam safety. I note that the report suggests regulation of dam construction and operation, for safety, patterned after our statutes and regulations.

I concur in your general approach to the program for dam safety; that is, the primary responsibility for safety of non-Federal dams should be the states'. I do not concur in the conclusion that non-Federally-owned dams that are located on Federal lands or under the jurisdiction of Federal regulatory agencies be classified as Federal dams. Some of these Federal agencies do not have the expertise to properly judge the safety of these dams and must either develop the necessary expertise or contract to another Federal agency that is qualified. As the intent of the proposed program is to urge the states to pass the necessary legislation and to develop the expertise to administer a dam safety program, it would be appropriate for the states to approve the safety of all dams other than those specifically owned by a Federal agency.

I believe that early implementation of the proposed "Phase I" inspection of the national program is necessary as the first step



Lt. General W. C. Gribble, Jr. -2-

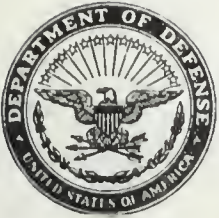
toward assuring public safety from dam failure. The implementation of "Phase I" should be in close cooperation with the various states utilizing whatever information is already available at the State level. In California, our records on dam safety are sufficiently complete to preclude any additional expenditure by the Federal Government.

Sincerely,

Deputy Secretary for Resources

*Larry E. Moss*  
*for* Secretary for Resources





DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

IN REPLY REFER TO

DAEN-CWE-D

15 May 1975

Mrs. Claire T. Dedrick  
Secretary for Resources  
The Resources Agency of California  
Resources Building  
1416 Ninth Street  
Sacramento, California 95814

Dear Mrs. Dedrick:

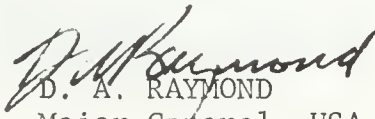
We appreciate the letter from your agency dated 30 April 1975 (signed by Mr. Larry E. Moss) regarding the Chief of Engineers report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

In regard to the question of jurisdiction over private dams located on Federal lands, we believe that the Federal Government has a primary responsibility to insure that Federal lands are not utilized in a manner detrimental to the public's safety. I believe we can agree that such hazards could develop in those cases where a State does not have an adequate dam safety program and the appropriate Federal agency neglects its responsibility in this regard. A cooperative effort between Federal agencies and the States to promote the safety of private dams on Federal lands would appear appropriate and desirable.

The present inadequacies of some Federal agencies as well as those of many States in performing dam safety functions are recognized. A primary objective of the recommended National Dam Safety Program is to improve the capabilities of all dam supervising agencies.

Your comments are very much appreciated. Two copies of the completed report, with Appendixes, will be furnished the State of California when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
D. A. RAYMOND  
Major General, USA  
Acting Chief of Engineers

ELLA GRASSO  
GOVERNOR



STATE OF CONNECTICUT  
EXECUTIVE CHAMBERS  
HARTFORD

April 28, 1975

W. C. Gribble, Jr., Lieutenant General  
Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

Dear Lieutenant Gribble:

Thank you for the opportunity to review and comment on the report prepared through the Chief of Engineers concerning a national program of dam inspection.

I have asked our Department of Environmental Protection to review your report and their comments are set forth below.

We appreciate the necessity for the Army Corps to conform with P. L. 92-367 and the criteria contained therein. However, the failure of dams smaller than those considered in the law could result in significant damages and possibly loss of life. According to the federal program summary, there are 676 dams of significance in Connecticut.

Our program inventory shows approximately 1036 dams which could be considered to be a hazard to life and property. A central problem with dam regulatory programs is that methods of characterizing the degree of hazard a dam poses to life and property are not precise. Various experts have given conflicting opinions as to how "hazard" should be determined. It appears necessary to resolve this question by developing reasonably precise and accurate methods of evaluating hazard before continuing too far into phase II of the program, as the methodology may influence the data obtained in phase II.

Phase I data exists on magnetic tape. In its present form it is not particularly useful to our state dam program. Is it possible to obtain information from the existing tape in processed form, i.e., sorted and listed by characteristics of the dams and impoundments? Also, can we add coded data to the tape such as date of last inspection, legal action pending, etc.?

Phase II will require, in some cases, extensive expenditures for data gathering and evaluation. Have guidelines been prepared to assure the extent of evaluation will be uniform from investigator to investigator? Without detailed guidelines, conditions may develop which could result in excessive examinations of some structures and marginal examinations of others.

Item 10-(5) on page 11 recommends that State regulatory agencies be authorized to perform required repairs if owners fail to do so. Connecticut is not able to bear this financial burden. A central problem is the high cost of design and construction. Has the Army Corps made estimates of annual expenditure that would be required to carry out this provision? Will federal funds be available to permit the State to assume this responsibility?

Item 12, page 14, indicates about 11% of the subject dams are federal structures; 89% are non-federal structures. The proposed funding for the program shows just about the same breakdown of total anticipated funds. This seems unreasonable as the design and condition of federal dams should be generally excellent in view of the high standards followed in the planning, design and construction phases, and the significant operation and maintenance funds these dams have received annually since their construction. Inspection and inventory should therefore be relatively inexpensive as compared to the non-federal dams.

The cost-effectiveness of the proposed program as described in the last paragraph of section 13, page 15, will only be achieved if funding is obtained for any redesign, repair or removal indicated by inspections. The cost figures presented do not appear to reflect this vital aspect of the program. Our experience at the state level has been that high hazard and high cost of repair tend to go hand in hand, and that private property owners are not capable of making the level of expenditure required to remove the hazard.

Section 14, paragraph (a) again refers to establishing priorities on the basis of the degree of hazard. This can only be done if a generally accepted, precise method of determining hazard can be worked out.

Section 15, paragraph (b) suggests it may be possible to fund the supervision of non-federal dams through state funds. We do not believe this is a reasonable assumption in view of our current state deficit and the competition for state funds by existing programs.

W. C. Gribble, Jr., Lieutenant General  
Page -3-  
April 28, 1975

We believe the program outlined is necessary and important. The funding made available to conduct the phase I inventory has permitted Connecticut to update and revise our existing dam inventory and we are grateful for the assistance provided to perform this update. We look forward to the opportunity to participate in future phases of a program that will ultimately reduce the exposure of our citizens and others to the hazard of dam failures.

With best wishes,

Cordially,

  
ELLA GRASSO  
Governor





DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

12 May 1975

Honorable Ella Grasso  
Governor of Connecticut  
Hartford, Connecticut 06115

Dear Governor Grasso:

I thank you for your letter of 28 April 1975 regarding my report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

The hazard classifications listed with the inventory data are tentative and it may be necessary to reclassify some of the dams when additional information becomes available. The inspection guidelines provide parameters for classifying dams with respect to both size and hazard potential and recognize the possibility that dams will need to be reclassified from time to time.

It should be possible to retrieve inventory data in specific statistical forms. Procedures are now being developed so that this can be done to satisfy certain anticipated requirements. We would welcome your suggestions or comments pertaining to your needs in this regard. With respect to adding coded data to the inventory, this will be possible. Our report recommends that the inventory be maintained current and that authority and funds be provided the Corps of Engineers to carry on this work. Individual States might also be furnished copies of that portion of the master tape containing dams within their States so that they could add, revise or extract information directly.

Recommended guidelines for safety inspections have been prepared and will be included in the report as Appendix D. A draft of the guidelines was published in the 28 August 1974 Federal Register (Volume 39, No. 168) for review and comment by all interested parties.

We have not attempted to assess the total impact on economic resources of the follow on design and modification work. The information needed

DAEN-CWE-D  
Honorable Ella Grasso

12 May 1975

for preparing such estimates can be developed only by the inspection program. We believe that the prosecution of that portion of the program concerned with non-Federal dams is a State responsibility. However, your concern about the availability of Federal financial assistance will be made known to the Secretary of the Army by the inclusion of your letter with our report.

While the condition of those Federal dams under the jurisdiction of Federal agencies having major responsibilities for dam construction should generally be much better than non-Federal dams, such would not be the case for the bulk of the 5,500 dams classified as non-Federal. Included in this category are private dams located on Federal lands and other dams under jurisdiction of Federal agencies lacking suitable capabilities in the field of dam design, construction and inspection.

Your comments and interest in the program are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of Connecticut when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
W.C. GRIBBLE, JR.,  
Lieutenant General, USA  
Chief of Engineers

XX



STATE OF FLORIDA  
**Office of the Governor**  
THE CAPITOL  
TALLAHASSEE 32304

REUBIN O'D. ASKEW  
GOVERNOR

April 2, 1975

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Washington, D.C. 20314

Dear General Gribble:

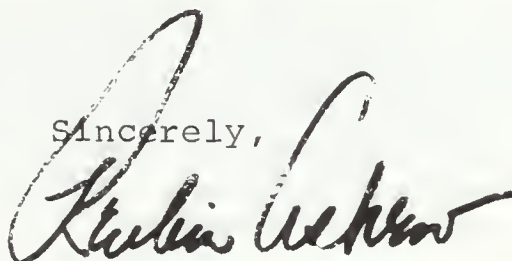
Thank you for your letter of March 18 with the enclosure of Volume 1, "National Program of Inspection of Dams." We agree with your conclusions and recommendations.

Our Water Resources Act of 1972 as amended in 1973 and now incorporated into Florida Statutes as Chapter 373 provides State authority to implement a program of dam safety through our five water management districts.

Please be assured that we will be happy to continue our cooperative efforts with the federal agencies in the State in this important matter.

With kind regards,

Sincerely,

  
Governor

ROA/frs



EXECUTIVE CHAMBERS

HONOLULU

GEORGE R. ARIYOSHI  
GOVERNOR

April 15, 1975

Lt. General W. C. Gribble, Jr., USA  
Chief of Engineers  
Office of the Chief of Engineers  
Department of the Army  
Washington, D.C. 20314

Dear General Gribble:

Thank you for your letter of March 18, 1975, requesting our comments on your report entitled, "National Program of Inspection of Dams", Volume I.

We have read your report with great interest and find it very comprehensive and factual. We have no recommended change for your report.

We would like to take this opportunity, however, to thank the Corps of Engineers for preparing the inventory of dams in the State of Hawaii, which identified a total of 119 dams and reservoirs, most of which are considerably smaller than those throughout the nation. Only five of the reservoirs in the State have dams that exceed 23 feet in height.

The construction of large dams in Hawaii has been a relatively minor concern and legislation on dam design, construction, operation and maintenance has not been provided for. The State, however, is reassessing its responsibility for regulation of dams. The extent of the State's involvement needs to be weighed against its financial resources to prosecute dam safety programs as recommended in your report.

We thank you for the opportunity to review your report and we assure you that we are seriously considering the matter of a dam safety program for Hawaii.

With warm personal regards, I remain,

Yours very truly,

  
GEORGE R. ARIYOSHI





# STATE OF IDAHO

DEPARTMENT OF WATER RESOURCES

STATE HOUSE BOISE, IDAHO 83720

April 17, 1975

Mr. W. C. Gribble, Jr.  
Lieutenant General, USA  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D.C. 20314

Dear Mr. Gribble:

This Department has been asked by Governor Andrus to respond to your March 18, 1975 request for comments on the report entitled "National Program of Inspection of Dams, Volume 1".

The people of Idaho agree whole-heartedly with the idea that regulation of dams is necessary to provide for public safety. For this reason, our 1969 state legislature revised Idaho's dam safety statutes to agree closely with what is now recommended by the USCOLD Model Law. It is our hope that any national effort to regulate dam safety be restricted to having each State conform to provisions of the USCOLD Model Law as set forth in Section 10.b of your report. Such action by the individual States would insure a sound approach to dam safety at a reasonable cost and effort. Dam safety regulation would remain where you indicated in Section 11.c that it should be - with the States. (Your proposed definition of a "Federal Dam" is so excessively broad that it certainly contributes nothing toward the idea of State control of dam safety.) While giving each State relative freedom to adopt measures it feels would be appropriate for its jurisdiction would result in great variation among the States, I cannot agree with Conclusion No. 3 in your report which implies that anything other than a unified approach nationwide would be inadequate.

It would also appear reasonable that different standards for existing dams could be adopted than are applied to new facilities as long as safety were still the prime consideration. Technology has changed rapidly and features reasonable to request at a new facility may not warrant costly work to upgrade an old dam that is proven to be basically safe. Such costs could amount to a serious nationwide impact and should be considered carefully.

The most effective way in which the Federal Government can insure that each State adopts reasonable controls is to provide training for State personnel and supplemental funding that would allow each State to be adequately staffed and equipped to do a good job. This would not be accomplished by having a Federal "superagency" step in with a massive program. Strong Federal support for State efforts to regulate all dams in each State appears to be the only realistic way

Mr. W. C. Gribble, Jr.

Page 2

April 17, 1975

to provide safe dams at a reasonable cost to the public. Having one impartial agency in each State with the expertise to review safety at all dams would eliminate some of the obvious problems inherent in having some of the inadequately staffed Federal agencies not only design, construct, and operate a dam but also pass judgement on whether or not they have done a good job.

In addition to the above comments regarding the proposed approach to the nationwide dam safety situation, I also have the following comments about specific sections of the report:

Section 6: I am not aware of how the inventory was conducted in other States, but in Idaho, this Department provided most of the inventory data for all Federal dams after the Federal agencies failed to comply with your requirements.

Sections 7.b & 11.b: The report indicates that MESA has authority over mining impoundments to provide for safety of mines - what about public safety when no danger to the mine exists? Also, MESA's new authority over coal-waste deposits would apparently not affect current practices with regard to other types of mining which also utilize waste deposit areas. I would be interested in knowing what MESA's jurisdiction is over mining impoundments that were abandoned years ago and existing impoundments after mining ceases. Would such a dam still be considered a "Federal Dam" if MESA ceased exercising control over the operation?

Section 13: From my understanding of the flooding that occurred in Rapid City in South Dakota, it appears very misleading to infer that such a situation would not have occurred with proper dam safety regulation. My understanding of the Rapid City flood is that it was caused by runoff exceeding normal spillway design standards. Significant damage would have occurred regardless of whether or not the dam had washed out.

Your "Guidelines for Safety Inspection of Dams" do not appear to agree with the idea expressed here that you are working for a "program that would virtually eliminate all preventable dam failures". It would seem more accurate to say the program should eliminate significant property damage or loss of life. Otherwise there would be no purpose in the Guidelines referring to hazard or size classifications. Every dam would be required to handle a Probable Max Flood - an unreasonable requirement in many cases.

Thank you for the opportunity to comment on this report.

Sincerely,

  
A. KENNETH DUNN  
Administrator, Operations Division

AKD:WRG:ldt

xxiv



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

9 May 1975

Mr. A. Kenneth Dunn  
Administrator, Operations Division  
Department of Water Resources  
State House  
Poise, Idaho 83720

Dear Mr. Dunn:

I thank you for your letter of 17 April 1975 regarding the Chief of Engineers report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

The term "Federal Dams" was used to simplify the discussion of responsibility for supervising dam safety. It is defined in the report as dams owned and operated by Federal agencies, dams located on lands under Federal jurisdiction, and dams under regulatory jurisdiction of Federal agencies. The inventory data indicate that only about 11% of all dams conforming to the height and capacity parameters of Public Law 92-367 fall under this definition of "Federal Dams."

The conclusion in paragraph 16a(3) of the report, which states a need for a unified approach to the dam safety problem, was based upon existing regulatory functions and practices in all the States and Federal agencies as revealed by the questionnaire survey. With few exceptions these practices and capabilities are considered inadequate, and we believe that improvement could best be attained through a concentrated national effort. Idaho has excellent legislative authority and perhaps one of the better existing surveillance programs; however, the adequacy of the reported \$18,500 annual budget for supervising 433 dams and reservoirs could be questioned. The need for a unified effort in this regard was also expressed by the participants at the Engineering Foundation Conferences at the Asilomar Conference Grounds on 23-28 September 1973 and at Henniker, New Hampshire, 4-9 August 1974.



9 May 1975

Mr. A. Kenneth Dunn

We agree with your view that standards and design criteria for new dams should not be made mandatory for existing dams. To this end, inspection "guidelines" rather than "standards" were developed. The guidelines do not establish rigid criteria but rather outline principal factors to be weighed in determining existing or potential hazards and define the scope of activities to be undertaken in safety inspections. Evaluation factors, considered reasonable are included so that comparisons can be made with existing conditions.

The report does not recommend the establishment of a Federal "superagency," but rather that the program be prosecuted by the individual States in the case of all dams not under Federal authority, and by the appropriate Federal agency for dams under its individual authority. Present inadequacies of some Federal agencies as well as those of many States in performing dam safety functions are recognized. A primary objective of the recommended National Dam Safety Program is to improve the capabilities of all dam supervising agencies.

The inventory data for Federal dams were, for the most part, supplied by the Federal agencies. However, where data were lacking or in need of verification, the States and private engineering firms collecting the data for non-Federal dams were contracted to obtain the supplemental information. Idaho's effort in this regard, I have been advised, was satisfactorily reimbursed. The failure to mention the help of States and private engineering firms in collecting the supplemental data for Federal dams was an oversight which we regret. I appreciate your bringing this to my attention in time to correct the report before its submission.

In reply to your questions about the jurisdiction of MESA, our understanding is that the present authority of that Agency with respect to mining impoundments is concerned with the safety of mines and coal miners on coal mine property only, and not the safety of the general public. Currently proposed revisions to regulations concerning coal refuse piles would not affect waste deposits from other types of mining. The question of abandoned coal refuse piles is being addressed in these proposed revisions; and MESA's or any other agency's control over abandoned waste embankments probably would depend upon the plans for abandonment, particularly with respect to whether or not provisions are made to prevent impoundment of water. All should recognize that the prosecution of the recommended dam safety program would require additional administrative authority for Federal agencies as well as additional legislative authority for many of the States. A more detailed discussion of your questions about current authorities of MESA may be obtained by writing to the Administrator, Mining Enforcement and Safety Administration, Washington, D.C. 20240.



9 May 1975

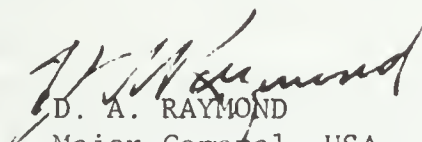
Mr. A. Kenneth Dunn

While an event of disaster proportion probably would have occurred at Rapid City had the Canyon Lake Dam not failed, much of the damage and many of the deaths were attributed in news accounts to the failure. In this regard, I refer you to the 15 June 1972 issue of the Engineering News-Record. The failure was also cited as one of the events leading to passage of P.L. 92-367, as attested by the Congressional Record-House, 24 July 1972, pages H6825 and H6827. It was also mentioned as a significant contributor to the disaster in the Committee on Public Works Report No. 92-1232, National Program for Inspection of Dams.

The statement in paragraph 13 of the report about virtually eliminating all preventable dam failures was intended to relate to significant failures, such that would require disaster assistance (see parenthetical expression in same sentence). Your suggested clarification is very helpful and will be incorporated into the report.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of Idaho when the report is submitted to the Secretary of the Army.

Sincerely yours,



D. A. RAYMOND  
Major General, USA  
Acting Chief of Engineers

# Illinois Department of Transportation

2300 South Dirksen Parkway Springfield Illinois 62764

Division of Water Resources

April 9, 1975

Lt. General W. C. Gribble, Jr.  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

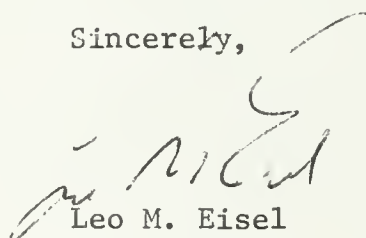
Dear General Gribble:

Governor Dan Walker has forwarded your letter and enclosures of March 18, 1975, to this Division for direct reply to you regarding the text of Volume I of the report on the National Program of Inspection of Dams which is to be submitted to the Secretary of the Army.

We have reviewed the material submitted and agree with the text and recommendations as written. Under Section 6, paragraph 3, at the top of page 4, we note that "The Governor of each State has been furnished a copy of that portion of the inventory containing the data for dams within his State." By letter of November 1, 1972, to Major General Ernest Graves, this Division was designated as the official State contact agency in the conduct of Dam Inspection programs. A search of our files fails to indicate receipt of the preliminary inventory furnished the Governor's office and it would be appreciated if you would send a copy direct to this office. Further, at the time the report is completed it would be appreciated if a copy could be sent direct to this Division.

If further comment or action is required of this Division, please advise.

Sincerely,



Leo M. Eisel  
Director  
Division of Water Resources

LME:LMP:mt

cc John C. McGuire

xxviii



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

21 April 1975

Mr. Leo M. Eisel  
Director, Division of Water Resources  
Illinois Department of Transportation  
2300 South Dirksen Parkway  
Springfield, Illinois 62764

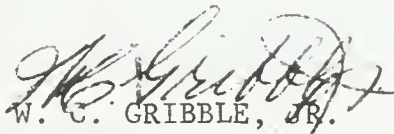
Dear Mr. Eisel:

I thank you for your letter of 9 April 1975 regarding my report on the National Program of Inspection of Dams. A copy of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

The North Central Division Engineer has been requested to have the Chicago District Engineer, under whose direction the inventory data was acquired, to furnish you a copy of the inventory of dams in Illinois as soon as possible.

Your comments are very much appreciated. Copies of the complete report, with Appendixes, will be furnished to you and the Governor of Illinois when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers

OFFICE OF THE GOVERNOR  
INDIANAPOLIS, INDIANA 46204

April 21, 1975

OTIS R. BOWEN, M.D.  
GOVERNOR

W. C. Gribble, Jr.  
Lieutenant General, USA  
Chief of Engineers  
Department of the Army  
Washington, D.C. 20314

Dear General Gribble:

This is in response to your request for review and comment on your report relative to the National Dam Inspection Program authorized by Public Law 92-367.

Indiana has, for many years, operated programs involving the review and approval of plans for dams prior to construction; requiring professional certification of construction in accordance with approved plans; and conducting annual inspections for the purpose of ensuring proper maintenance and repair. I believe that such programs are reasonably adequate and, therefore, see no need for the imposition of federal legislation in this regard.

I would add that if federal program requirements are imposed, then the federal government should provide adequate and continuing funding to the states to cover such costs.

As a final note, I would add the observation that, in the light of the corps' recent assertion concerning expansion of their jurisdiction and of recent federal district court rulings, the states are having great difficulty in visualizing just what is meant by your recommendation (a) that "all states and territories should be encouraged to prosecute dam safety programs encompassing all dams not under federal authority" (emphasis added).

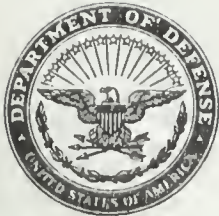
Kindest personal regards,

  
Otis R. Bowen, M.D.  
Governor

ORB:lcs

xxx





DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

6 May 1975

Honorable Otis R. Bowen, M.D.  
Governor of Indiana  
Indianapolis, Indiana 46204

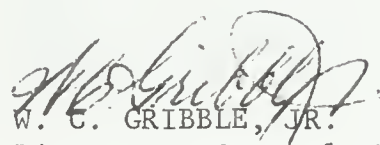
Dear Governor Bowen:

I thank you for your letter of 21 April 1975 regarding my report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

The recommendation in paragraph 17a of our report is directed toward the development of State responsibility for the safety of all non-Federal dams as defined in the report. The survey of existing practices and capabilities concerning the safety of dams revealed that many States have inadequate statutes and/or inadequate staffs to discharge responsibilities in this area.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of Indiana when the Report is submitted to the Secretary of the Army.

Sincerely yours,

  
W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers



# Office of the Governor

STATE CAPITOL  
DES MOINES, IOWA 50319

ROBERT D. RAY  
GOVERNOR

ELMER (DUTCH) VERMEER  
ADMINISTRATIVE ASSISTANT

March 31, 1975

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

Dear General Gribble:

We appreciate the opportunity to review the text of your report on the National Dam Inspection Program authorized by Public Law 92-367. As you are undoubtedly aware, we in Iowa chose to implement the first phase of the program calling for the inventory of all dams within the state meeting the criteria set out in the law and rules and regulations provided through your offices. The Iowa Natural Resources Board accepted this responsibility and has provided the Rock Island District of the U.S. Corps of Engineers with the inventory information as requested. We appreciate the financial aid support that was provided through the Rock Island District to permit our state agency to accomplish this task. The next phase of the program, including the inspection of the dams, poses some more difficult problems for the State of Iowa, since there are over 1400 individual structures listed on the inventory and inspection of these will require considerable expense and manpower. We believe, however, that due to the topography and many other factors, the percentage of individual structures falling in the critical or moderate hazard category will be less than the national average. We generally concur in your conclusions and recommendations for further implementation of the program. However, we would suggest in the matter of financial assistance to the states that a strong recommendation should be made for securing the necessary federal

Lieutenant General W.C. Gribble, Jr.  
March 31, 1975  
Page 2

funds to assist states to carry out the inspection part of the program. Without federal funding for this phase of the program, we doubt that our state would be in a position to accept and carry out this part. Our state agency does have authority to carry out the inspection program and the expertise providing funding is made available for this purpose.

Fortunately the State of Iowa has had what we consider an effective regulatory program dealing with the review of applications and plans for structures of this nature. The state also has a limited inspection and maintenance program in effect, but to comply with the proposed inspection program you have outlined a much greater effort would have to be made in this area.

We hope that sufficient federal funding can be made available to the states to enable them to carry out their responsibility in connection with Public Law 92-367 and that sufficient advance warning could be provided to permit states to properly gear up to utilize federal funding for the inspection purposes.

We hope that these comments may be of some value to you in submitting your report to the Secretary of the Army and thence to Congress, as provided in Public Law 92-367.

Sincerely yours,



Elmer H. Vermeer  
Administrative Assistant

EHV/jn



OFFICE OF THE GOVERNOR  
FRANKFORT, KENTUCKY 40601

JULIAN M. CARROLL  
GOVERNOR

April 4, 1975

Mr. W. C. Gribble, Jr.  
Lieutenant General, U.S.A.  
Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

Attention: DAEN-CWE-D

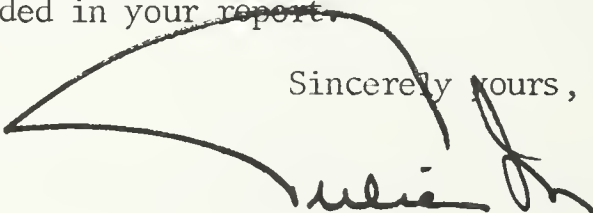
Dear General Gribble:

Your report relative to the National Dam Inspection Program authorized by Public Law 92-367 has been brought to my attention. This program has generated much interest in Kentucky because of the recognized need as well as the fact that our Department for Natural Resources and Environmental Protection obtained the inventory data for non-federal dams in Kentucky. They also previously reviewed and commented on the recommended guidelines for safety inspection of dams as presented in Appendix D of your report.

The Commonwealth of Kentucky is in complete agreement with the conclusions and recommendations presented in your report and will support, in any way possible, a dam safety program developed in accordance with these recommendations. It must be noted that we feel that the recommendations should have been extended to cover the matter of funding for the program. It remains a continuing concern that without substantial federal participation, this program will not be implemented as intended by Public Law 92-367.

I would also like to point out that Kentucky has already taken legislative action to strengthen existing laws as is recommended in your report.

Sincerely yours,

  
Julian M. Carroll





EDWIN EDWARDS  
GOVERNOR

# State of Louisiana

EXECUTIVE DEPARTMENT

Baton Rouge

April 23, 1975

General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

RE: DAEN-CWE-D  
March 18, 1975

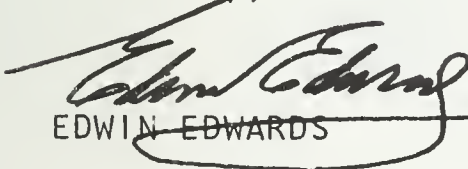
Dear General Gribble:

I am in receipt of a copy of a text for your report to the Secretary of the Army on the National Dam Inspection Program authorized by Public Law 92-367.

The report deals with the need for an overall program for the inspection of dams in the United States. I concur in the proposals recommended in your report as to the need for such a program and the responsibility of the states in this regard. While Louisiana does not have an appreciable number of impoundments having a high hazard potential, we do recognize our responsibilities in protecting the public and downstream improvements. The State of Louisiana is fortunate in having an engineering agency, the Department of Public Works, that can administer such a program in our behalf. While current legislation does not fully cover the needs in this area, we will work toward that end.

I would appreciate receiving copies of your completed report and Appendixes in order that we can continue to fill our obligations toward implementation of a National Dam Safety Program. I appreciate the opportunity to review and comment on your report.

Sincerely,

  
EDWIN EDWARDS



State of Maine  
Executive Department  
Augusta, Maine  
04330

JAMES B. LONGLEY  
GOVERNOR

April 8, 1975

W. C. Gribble, Jr.  
Lieutenant General, U. S. A.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C., 20314

Dear Mr. Gribble:

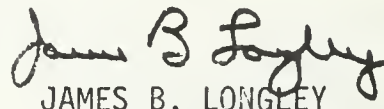
After reviewing the National Program of Inspection of Dams, I find it to be a sensible approach to the maintaining of our dams in a safe condition. The safety of dams should, however, remain the responsibility of each state, supplemented with Federal financial and technical assistance for national conformity.

The laws pertaining to dam safety in Maine are crisis-oriented, with limited control of dams and reservoirs in emergency situations caused by flooding. The State Inspector of Dams and Reservoirs only acts upon a complaint of ten resident taxpayers. The Maine Section of American Society of Civil Engineers has drafted dam safety legislation based on the U. S. Committee on Large Dams Model State Law to be submitted to the 107th Maine Legislature, which is presently in session. This proposed law should act in conjunction with PL 92-367.

I appreciate the opportunity of reviewing and commenting on the concepts of the text of the National Program of Inspection of Dams, Volume I.

Again, many thanks.

Sincerely,

  
JAMES B. LONGLEY  
Governor

JBL/mjm

xxxvi



STATE OF MARYLAND  
EXECUTIVE DEPARTMENT  
ANNAPOLIS, MARYLAND 21404

MARVIN MANDEL  
GOVERNOR

April 15, 1975

W. C. Gribble, Jr.  
Lieutenant General, USA  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear General Gribble:

Thank you for your letter regarding the National Dam Inspection Program. Maryland was happy to cooperate with the Corps of Engineers in its inventory of dams in the State.

The importance of dam safety cannot be overemphasized, and in Maryland we do have an ongoing program in this regard. Certainly, financial bulwarking of the program from Federal sources would be welcomed.

Basically, Maryland is in substantial agreement with the recommendations of the report, and we look forward to continued cooperation with the Corps of Engineers in this vital project.

Sincerely,

A handwritten signature in dark ink, reading "Marvin Mandel", written in a cursive style.

Governor



# *The Commonwealth of Massachusetts*

*Executive Office of Transportation and Construction*

*Department of Public Works*

*Office of the Commissioner*

*100 Nashua Street, Boston 02114*

April 7, 1975

Mr. W. C. Gribble, Jr.  
Lieutenant General, U.S.A.  
Chief of Engineers  
Department of the Army  
Washington, D.C. 20314

RE: PL 92-367 (National Dam Inspection Program)

Dear General Gribble:

Your letter, dated March 18, 1975, addressed to Governor Dukakis has been referred to the Massachusetts Department of Public Works, Division of Waterways for reply. The Division of Waterways is the designated administrator of the Massachusetts Dams-Safety Program which lies within the jurisdictional responsibility of the Commissioner of the Massachusetts Department of Public Works (Chapter 253 of the Massachusetts General Laws, as amended by Chapter 595 of the Acts of 1970).

Massachusetts has many old mill dams which no longer serve their original purpose. In many cases the present owner, through mesne conveyances, does not have the financial capability, technical know-how or the incentive to meet his obligation. PL 92-367 recognizes the potential hazards and responsibilities that Federal Agencies, State Authorities and Private Interests have for life and property due to the creation of a dam for whatever purpose.

As suggested the following views of your report are provided:

The National Dam Inspection Program must provide the leadership that is long overdue. It is in this regard that the Commonwealth of Massachusetts is most sensitive. There are many Federal Agencies with the capability of sharing the responsibilities that this massive undertaking requires. Utilization of existing programs should be given consideration. Limited financial incentives to encourage active dam safety programs on the State level could provide the catalyst needed. It is important that the initial inspection of dams under the National Dam Inspection Program be conducted by a Federal Agency. Whenever possible, personnel on the State level should participate jointly. This would provide uniformity of inspection procedures within the recommended guidelines. Regular periodic review of guidelines and technology by State and Federal Agencies on a regional level should be encouraged thus maintaining a continuing uniform approach to the dam-safety program.

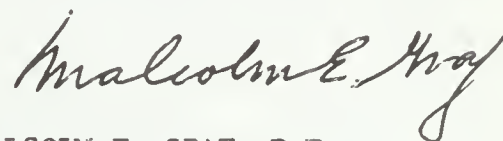


April 7, 1975

The regulatory functions outlined in paragraph 10b of your report are generally required as part of our operating procedures. Public awareness, suitable experienced staffing and funds, are some of our needs which have yet to be fulfilled. Public safety should not be sacrificed.

The Corps, thus far, has shown the leadership that is needed. The systematic approach to the multiplicity of disciplines of the various States appear to be headed toward a common goal for the general good of all people.

Very truly yours,



MALCOLM E. GRAF, P.E.  
Associate Commissioner

LRA: jmp



STATE OF MICHIGAN

OFFICE OF THE GOVERNOR

LANSING

WILLIAM G. MILLIKEN  
GOVERNOR

April 15, 1975

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers, Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear General Gribble:

Thank you for providing us the opportunity to review and comment on the text of your report to Congress on the activities performed under the National Dam Inspection Program, authorized by Public Law 92-367.

I concur with all the recommendations contained on page 19 of the report. I am particularly pleased with your recognition of the State's responsibility, under the police powers of the State, to protect the health, safety and welfare of its citizens, in recommending the states carry out a dam safety program involving all non-Federal dams. However, I feel if such a program is to be implemented by the states, some financial assistance will need to be provided by Congress.

I feel that Michigan's present dam safety statute, although deficient in some areas, is adequate to carry out a dam safety program of non-Federal dams in this State, as outlined in your report. As stated earlier, I feel that some financial assistance will be needed to implement such a program that would encompass the nearly 600 non-Federal Michigan dams.

It is my recommendation that Congress implement a National Dam Safety Program as outlined. The disasters that have occurred as the result of dam failures in this nation in recent years, certainly point out the need for such a program.

Kind personal regards.

Sincerely,

Governor



STATE OF  
MINNESOTA

DEPARTMENT OF NATURAL RESOURCES

CENTENNIAL OFFICE BUILDING • ST. PAUL, MINNESOTA • 55155

April 4, 1975

W. C. Gribble, Jr.  
Lieutenant General, U.S.A.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D.C. 20314

Dear General Gribble:

A review of your report, "National Program of Inspection of Dam", Volume I, has been made. Contained in your report and particular interest to us was the proposed state supervision of inspection of non-Federal dams. Contained in this letter are comments on that proposal and comments on the existing laws under Minnesota Statutes and how both pertain to safety inspections of dams to ensure adequate protection to those endangered by failure of dams and reservoirs.

Under Minnesota Statutes Chapter 105.52, the Commissioner of Natural Resources is authorized upon complaint or upon his own initiative to examine any reservoir, dam, control structure, or waterway obstruction.

Under Minnesota Statutes Chapter 105.48, all dams owned by the State or erected upon lands owned or controlled by the State shall be maintained under the direction of the Commissioner of Natural Resources and the same shall be operated under his direction and control.

In 1973 provisions were made under Minnesota Statutes to provide for a State program to repair and reconstruct dams owned by local units of government consisting of counties, cities, villages, or boroughs. On a cost-sharing basis, each year \$125,000 is available in grant-in-aid to those governmental units for dam repair and reconstruction. This Statute provides that the program be administered by the Commissioner of Natural Resources.

Minnesota has approximately 600 dams in the category of non-Federal dams which conform to the size requirements of the National Inventory of Dams. We have no program for systematic or regular safety inspections of these non-Federal dams.

Contained in your report is an estimated cost of \$1,500 per dam per year for the initial inspection. These costs do not include the costs of in-depth studies, investigations or analysis. With the Implementation of the National Program of inspection of dams the State of Minnesota would anticipate difficulties in allocating personnel and funding of an adequate program.

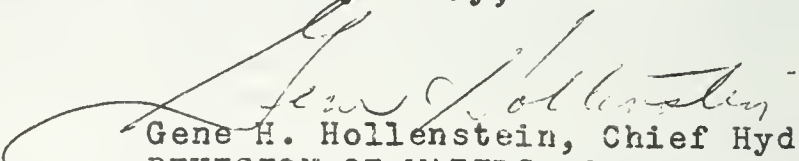
xLi

April 4, 1975

W. C. Gribble, Jr.

In summary, under Minnesota Statutes the Commissioner of Natural Resources is authorized to inspect any dam in the State, but inspections in most cases are made only after a request has been filed. The State of Minnesota makes a nominal amount of money (\$125,000 per year) through grants-in-aid to local units of government for repair and reconstruction of dams. The State of Minnesota has no on-going program for dam inspection. According to your estimated initial inspection cost of \$1,500 per dam per year, inspection of Minnesota's 600 non-Federal dams would require an enormous amount of money. The State of Minnesota does not have the funds nor personnel to supervise the inactment of the National Program of Inspection of Dams. We recommend that Federal financial assistance be provided for the initiation and implementation of National Program of Inspection of Dams.

Yours very truly,

  
Gene H. Hollenstein, Chief Hydrologist  
DIVISION OF WATERS, SOILS & MINERALS

GHH:dbs

Enc.





DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

21 April 1975

Mr. Gene H. Hollenstein  
Chief Hydrologist  
Division of Waters, Soils and Minerals  
Department of Natural Resources  
Centennial Building  
St. Paul, Minnesota 55155

Dear Mr. Hollenstein:

I thank you for your letter of 4 April 1975 regarding my report on the National Program of Inspection of Dams. Your letter and this reply will be appended to the report when submitted to the Secretary of the Army.

Your comment pertaining to the estimated cost of the initial inspections indicates that some clarification of the report is required. The average cost of \$1,500 per dam per year pertains to the total cost of conducting the entire program which includes all functions of the regulatory agency. This average annual cost includes the cost of performing the periodic technical inspections of the significant and high hazard potential dams at five year intervals. Based upon the estimated number of dams in the significant and high hazard potential category in the entire nation, the average annual cost of performing the initial inspections represents about 40 percent (\$600) of the estimated \$1,500 average annual cost per dam to conduct the recommended program.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of Minnesota when the report is submitted to the Secretary of the Army.

Sincerely yours,

W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers

xLiii



EXECUTIVE OFFICE  
STATE OF MISSOURI  
JEFFERSON CITY

CHRISTOPHER S. BOND  
GOVERNOR

April 18, 1975

Lt. General W. C. Gribble, Jr.  
Chief of Engineers  
Department of Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear General Gribble:

Thank you for the opportunity to review and comment upon your report on the National Dam Inspection Program. The Inventory Program carried out in Missouri by state personnel is considered in the best interest of our state.

Our Department of Natural Resources reports that the estimated unit costs of the "Phase I Inspection Program" appear somewhat high, principally because staff members indicate that they were able to identify hazardous dams and/or dams "needing additional investigation and study" during the course of their inventory work. We are optimistic that substantially less emphasis than indicated would be required in the initial phase of the inspection program in Missouri.

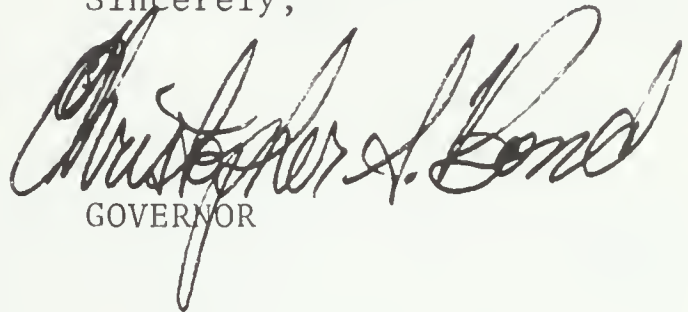
The provision that Phase II investigation costs (in the case of an existing structure) are to be borne by the non-Federal owner is troublesome; however, we see no practical alternative. Legislation currently under consideration by the Missouri General Assembly does not address this problem, although it provides for repair or demolition of hazardous structures, with the expense borne by the owner or by the state if the owner cannot be held responsible.

The proposed legislation calling for a State Dam Safety Program is modeled after the USCOLD Model Law, and I am hopeful that it will progress through the legislature during the current session.

Lt. General W. C. Gribble  
April 18, 1975  
Page 2

I urge the continuance of the National Dam Inventory Program so that the national effort can be current without major expenditure or significant lapse. This is especially important to states such as Missouri that do not as yet have Dam Safety Statutes.

Sincerely,

A handwritten signature in dark ink, appearing to read "Christopher S. Bond". The signature is fluid and cursive, with a large initial "C".

GOVERNOR

CSB:prw

xLv

2

State of Montana  
Office of The Governor  
Helena 59601

THOMAS L. JUDGE  
GOVERNOR

April 28, 1975

Mr. W. C. Gribble, Jr.  
Lieutenant General, USA  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear General Gribble:

I have referred the report by the Department of the Army, entitled "National Program of Inspection of Dams" to the Director, Montana Department of Natural Resources and Conservation for review. I am pleased to report that he is in substantial agreement with this document and has submitted the following comments, in which I concur.

Model Law - Montana does not have an effective dam safety law. The existing law contains no provisions for submission of plans and specifications for approval prior to construction. It does permit inspections of dams when such action is deemed warranted, but provides no means of enforcement of remedial measures recommended. Montana supports the USCOLD Committee Model Law draft and the recommendation that the Federal Government provide incentives for passage of effective State Dam Safety Laws.

Inventory of Dams - An inventory of dams would be of value to individuals, private organizations and public entities. However, without an effective dam safety law the state is hard pressed to maintain records on construction, rebuilding and removal of dams.

Technical Capabilities - It is questionable whether there are sufficient numbers of engineers trained and experienced in design and construction of dams in this state to meet the initial demands of such a program.

Economic Resources - Approximately 1,400 dams in Montana would come under the provisions of this model law. On the basis of estimates contained in the report the cost would be about 2.1 million dollars. Without state or federal subsidies considerable financial hardship could result to owners. This would be particularly true in the case of Phase II inspections.

I wish to express my appreciation for the opportunity to review and comment on this report.

Sincerely,

  
THOMAS L. JUDGE

cc: Gary Wicks

  
vLvi





## STATE OF NEBRASKA

LINCOLN 68509

April 23, 1975

Lieutenant General W. C. Gribble, Jr.  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Subject: Your DAEN-CWE-D

Dear General Gribble:

Thank you for providing me with a copy of your report to the Secretary of the Army to date with the National Dam Inspection Program and the Inventory of Dams authorized by Public Law 92-367 and an opportunity for our comments.

I wish to affirm my views that this State should and will continue to assume the primary responsibility for the safety of non-federal dams in Nebraska.

Most dams that have been constructed in Nebraska have been constructed by the Soil Conservation Service with significant amounts of federal funds provided; however, not in relative proportion with federal funds or state fees for inspection and maintenance. The Nebraska Department of Water Resources has the authority for inspecting dams in this State, and this Department reviews the plans for structural safety and has carried on an inspection program of the non-federal dams for approximately seven years. We have not carried on any inspection during construction of dams by the Department of Agriculture under the 566 program as this federal agency carries on the inspection during construction and during the first three years after the dams are turned over to an agency such as the watershed districts. The watershed districts have now been brought under the authority of 24 natural resources districts which have been organized in Nebraska.

Lieutenant General W. C. Gribble, Jr.  
April 23, 1975  
Page 2

We wish to emphasize that heretofore the filing fees for examination and approval of plans in Nebraska has not been adequate for the funding of inspections as you have suggested in the USCOLD Model Law as being an excellent example of an adequate inspection program.

The Department of Water Resources has in the past budgeted for the purpose of inspection of dams, but these budgets must be increased if we are to meet the federal requirements as mentioned in Volume I pertaining to the "National Program of Inspection of Dams." We would hope that federal funds would be available, perhaps on a matching basis, to carry on the inspection program to provide incentives, quality control, procedures for consistency, technical advice and training of inspectors.

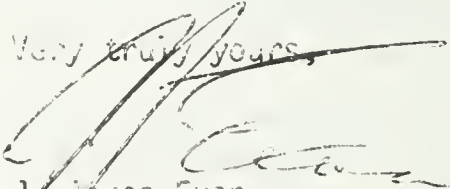
I would appreciate the continuance of the Corps of Engineers to inform me as to the procedure for the National Dam Inspection Program.

Many of the dams constructed by the Soil Conservation Service in Nebraska are beginning to reach an age where they need general attention by the Department of Agriculture. We have found in our inspection procedures that the outlet works are for the most part adequate and in good condition. We have found, however, that there has been erosion on the upstream faces of dams due to wind action, and we believe that the Department of Agriculture should consider initiating a program to repair the upstream faces of many of the dams which were constructed with too little regard for the owners ability to maintain such structures for the life of the project.

We concur wholeheartedly with the recommendations made in paragraph 17, on page 19, of Volume I of the Report, especially with recommendation "C" that "Those federal agencies possessing technical expertise and capabilities in the field of dam design and construction should be authorized to furnish technical assistance and guidance to the states ...."

Again, I thank you for giving me an opportunity to comment on your program.

Very truly yours,

  
J. James Exon  
Governor

JJC:ah2



MIKE O'CALLAGHAN  
GOVERNOR

THE STATE OF NEVADA  
EXECUTIVE CHAMBER  
CARSON CITY, NEVADA 89701

April 16, 1975

W. C. Gribble, Jr.  
Lieutenant General, USA  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D.C. 20314

Dear General Gribble:

I appreciated receiving the copies of your report attached to your March 18 letter regarding the National Dam Inspection Program. The report indicates that the Mining Enforcement and Safety Administration has some authority over dam safety and a responsibility for mining operations including water and silt impoundment which may affect the safety of mines. It would be helpful if the report could also indicate the duties of this agency as regards safety of tailings dams.

It is my view that the report is otherwise adequate and I thank you for the opportunity to review it.

Sincerely,

  
Mike O'Callaghan  
Governor of Nevada



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

IN REPLY REFER TO

DAEN-CWE-D

30 April 1975

Honorable Mike O'Callaghan  
Governor of Nevada  
Carson City, Nevada 89701

Dear Governor O'Callaghan:

I thank you for your letter of 16 April 1975 regarding the Chief of Engineers report on the National Program of Inspections of Dams. A copy of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

The Mining Enforcement and Safety Administration's responsibility in regard to tailings dams is outlined in the 1966 Federal Metal and Nonmetallic Mine Safety Act. This responsibility includes the safety of water and silt impoundments which may affect the safety of the mining operations and miners. The response to our questionnaire survey indicated that MESA inspects such dams as a regular part of mine inspections and also requires the dam operator to perform inspections at regular intervals. MESA also investigates any complaint concerning safety at mines. A more detailed description of the duties of MESA in this regard can be obtained by writing to the Assistant Administrator for Metal and Nonmetal Mine Health and Safety.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of Nevada when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
D. A. RAYMOND  
Major General, USA  
Acting Chief of Engineers





STATE OF NEW HAMPSHIRE  
CONCORD 03301

MELDRIM THOMSON, JR.  
GOVERNOR

April 23, 1975

W. C. Gribble, Jr.  
Lieutenant General, U.S.A.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear General Gribble:

This is in response to your letter dated March 18, 1975 requesting my comments to your report to Congress on the National Dam Inspection Program authorized by Public Law 92-367.

The State of New Hampshire presently has the authority and is regulating the construction, inspection, and operation of all non-federal dams. The New Hampshire Water Resources Board is administering all dam statutes and is presently conducting an active inspection program of all dams under the State's jurisdiction. Present State law and established criteria has basically the five regulatory functions as mentioned in your report.

I am in basic agreement with your recommendation in that the health, safety and welfare of all State's citizens should be protected by adequate safeguards in dam construction, inspection and proper operation; but I would like to strongly emphasize that each state should have final authority and jurisdiction in any recommended legislative programs to Congress.

Not having received Appendix D, Recommended Guidelines for Safety Inspection of Dams, I must make a reservation on a total approval of your recommendations as there may be procedures in the guidelines which are inconsistent with State law, established criteria and practices in the State.

I concur with the resolutions adopted by the two national conferences of the Engineering Foundation recommending that the States be provided Federal financial assistance for the initiation and implementation of the dam safety programs. This cost-sharing by Federal authorities with States would be an added incentive to establish a suitable dam inspection program.

My office would participate in a meeting with representatives from the Corps to discuss and review your recommended safety standard guidelines in relation to existing State laws and criteria.

Sincerely,

Meldrim Thomson, Jr.

MTJr:nl

Li



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

6 May 1975

Honorable Meldrim Thomson, Jr.  
Governor of New Hampshire  
Concord, New Hampshire 03301

Dear Governor Thomson:

I thank you for your letter of 23 April 1975 regarding my report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

We regret that you have no knowledge of the inspection guidelines. We furnished a preliminary draft to the Chairman of the New Hampshire Water Resources Board in November 1972, and an advanced draft, entitled "Proposed Guidelines for Safety Inspection of Dams," was furnished the Chief Engineer of the New Hampshire Water Resources Board in September 1974 by the New England Division Engineer. Also, "Proposed Guidelines" were published in the 28 August 1974 Federal Register (Volume 39, No. 168) for review and comment by all interested parties.

The New England Division Engineer would be pleased to make available representatives of his office to meet and discuss the provisions of the guidelines in relation to existing State laws and criteria.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of New Hampshire when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers

Lii



# STATE OF NEW MEXICO

OFFICE OF THE GOVERNOR

SANTA FE

87503

JERRY APODACA  
GOVERNOR

March 31, 1975

Lt. General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D.C. 20314

Dear General Gribble:

Your 18 March 1975 letter requests comments on the text of your report to the Secretary of the Army on the National Program of Inspection of Dams authorized by Public Law 92-367. It is my position that the prosecution of a dam safety program for all non-federal dams is a state responsibility. Accordingly, I cannot concur in the concept that private developments on federal lands are ultimately the responsibility of the agency holding the land (see last paragraph, page 12 of text and recommendation (d), page 19). In New Mexico anyone proposing to construct structures to utilize public waters, regardless of location, must obtain a permit from the State Engineer before commencing construction and by law the State Engineer is responsible for insuring the public safety as it may be endangered by such works. Of course, this is not to preclude a cooperative effort between federal agencies and the State of New Mexico to insure the safety of dams.

Except as noted above, I concur with your recommendations.

Please feel free to call on me or S. E. Reynolds, New Mexico State Engineer if you should desire further information.

Sincerely,

A handwritten signature in dark ink, appearing to read "Jerry Apodaca", written in a cursive style.

JERRY APODOCA  
GOVERNOR



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

21 April 1975

Honorable Jerry Apodaca  
Governor of New Mexico  
Santa Fe, New Mexico 87503

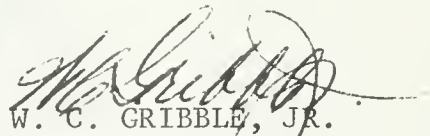
Dear Governor Apodaca:

I thank you for your letter of 31 March 1975 regarding my report on the National Program of Inspection of Dams. Your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

We agree that New Mexico has jurisdiction over the utilization of public waters and the authority to require a permit from the State Engineer before constructing a dam or impounding water on lands under Federal jurisdiction. We believe, however, that the Federal Government has the primary responsibility to insure that Federal lands are not utilized in a manner detrimental to the public's safety. I believe we can agree that such hazards could develop in those cases where States do not have an adequate dam safety program and the appropriate Federal agency neglects its responsibility in this regard. As you suggest, a cooperative effort between Federal agencies and the States to promote the safety of private dams on Federal lands would be appropriate and desirable.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished you when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers

Liv





STATE OF NEW YORK  
EXECUTIVE CHAMBER  
ALBANY 12224

HUGH L. CAREY  
GOVERNOR

April 18, 1975

Dear General Gribble:

Thank you for your letter of March 18th enclosing your report on the National Dam Inspection Program.

New York State recognizes the importance of the regulation and inspection of dams as they relate to public safety. The State has had dam safety laws dating back many years. Under existing statutes we have carried out, and are continuing to do so, a detailed review process involving the construction and reconstruction of dams. In addition, we have a program for the periodic inspection of existing dams in order to discover and correct conditions that might constitute a hazard to public safety.

In comparing this State's existing program to the proposed national program, we find there is a great difference in the size limits of dams that are subject to inspection and regulation. We currently have approximately 7,000 dams in the State subject to regulation and inspection. Under the proposed national program, only 770 of the larger dams would be subject to such regulation and inspection.

I am asking our Department of Environmental Conservation to review the National Dam Inspection Program as it relates to current staff capabilities, as well as to assess the impact of such a program on future staffing needs. The Department will be contacting your office shortly with additional comments.

It is our intention to follow closely the reactions to the national program and to work closely with the various Federal agencies that can offer assistance in this field.

Sincerely,

Lieutenant General W. C. Gribble, Jr.,  
Chief of Engineers  
Department of the Army  
Washington, D. C. 20314



# STATE OF NORTH DAKOTA

EXECUTIVE OFFICE

BISMARCK

ARTHUR A. LINK  
Governor

March 27, 1975

Mr. W. C. Gribble, Jr., Lt. Gen., USA  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C.

RE: DAEN-CWE-D

Dear General Gribble:

I am in receipt of your report on the National Program of Inspection of Dams and concur in your recommendations as outlined in the report.

It is hoped that the Congress will be sympathetic toward this needed program and provide necessary funding for the various federal agencies and states to allow proceeding toward the second stage investigations to determine the safety of the various dam structures.

Sincerely yours,

A handwritten signature in cursive script that reads "Arthur A. Link".

ARTHUR A. LINK  
Governor

AAL: km

cc: Senator Milton R. Young  
Senator Quentin N. Burdick  
Representative Mark Andrews



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Natural Resources  
DIVISION OF PLANNING AND DEVELOPMENT  
83 Park Street  
Providence, R. I. 02903

April 15, 1975

W. L. Cribble, Jr., Lt. General  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear General Cribble:

Your communication to Governor Noel in reference to the National Dam Inspection Program authorized by Public Law 92-367 has been forwarded to this office for answering.

The following observations are noted:

1. Appendices H thru F were not included in report so we cannot comment on them.
2. Page 2 - Section 5. Recognizes Federal Funding limitations - 'but not states', and in fact just assumes state responsibility.
3. Model Law - Appendix C not a part of Report, thus difficult to compare with state law.
4. Summary on page 10 of state responsibility is fine, provided monies for such activities can be provided.
5. On page 14 the cost per inspection for a High Hazard Dam (Phase I), runs from \$5,000 to \$10,000. Does not include cost for Phase II which is to be borne by the owner and likely to be much more expensive.

In general, we agree that program is necessary and recommendations should be adopted. However, the report does not resolve the most crucial question; - how is Program to be funded to provide people to implement and carry out work. Without this the Program is going nowhere.

Very truly yours,

Calvin B. Dunwoody  
Chief  
Planning & Development



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

2 May 1975

Mr. Calvin B. Dunwoody  
Chief, Planning and Development  
Department of Natural Resources  
83 Park Street  
Providence, Rhode Island 02903

Dear Mr. Dunwoody:

I thank you for your letter of 15 April 1975 regarding the Chief of Engineers report on the National Program of Inspection of Dams. A copy of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

In regard to your question on how the recommended program is to be funded, we believe that implementation of that portion of the program concerned with non-Federal dams is a State responsibility. However, your comments and similar expressions from others will inform the Secretary of the Army of the grave concern about sufficient funds to prosecute the program. I am certain that he will address this question in his remarks to the Congress.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of Rhode Island when the report is submitted to the Secretary of the Army.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "D. A. Raymond", is written over the typed name.

D. A. RAYMOND  
Major General, USA  
Acting Chief of Engineers

Lviii





STATE OF TENNESSEE  
OFFICE OF URBAN AND FEDERAL AFFAIRS

SUITE 108  
PARKWAY TOWERS BUILDING  
NASHVILLE 37219

615-741-2714

April 14, 1975

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

RE: National Program of Dam Inspection  
ATTN: DAEN-CWE-D

Dear General Gribble:

As the designated State Clearinghouse for Federal development programs, we acknowledge receipt of Volume I of the above captioned report prepared in response to Section 5 of the National Dam Inspection Act (P.L. 92-367).

The State of Tennessee endorses the proposal, and welcomes the opportunity to cooperate in its effective implementation.

We request that several copies of the final report be sent to this office upon its completion. If our office can be of further assistance, please do not hesitate to contact me.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Stephen H. Norris'.

Stephen H. Norris  
Grant Review Coordinator

SHN:mn



STATE OF UTAH  
OFFICE OF THE GOVERNOR  
SALT LAKE CITY

April 14, 1975

GALVIN L. RAMPTON  
GOVERNOR

W. C. Gribble, Jr.  
Lieutenant General  
Department of the Army  
Office of Chief of Engineers  
Washington D.C. 20314

Dear General Gribble:

I have reviewed Volume I of your National Program of Inspection of Dams and find that the overall program seems to be very comprehensive in substance. It certainly would prove beneficial if it could be implemented. It does, however, seem that even though the program as outlined is well founded that there would be some problems relative to financing and carrying out the program at this time without some very careful consideration on cost sharing provisions. Otherwise, it would place a severe burden on the state and the dam owners.

In Utah, the responsibility for dam safety rests with the State Engineer's Office. I have passed the information on to him for his review. If I can be of further assistance, please contact me at your convenience.

Sincerely,

A handwritten signature in dark ink, appearing to read "Calvin L. Rampton".  
Calvin L. Rampton  
GOVERNOR

CLR/DCH/jp



STATE OF VERMONT  
EXECUTIVE DEPARTMENT  
MONTPELIER, VERMONT

April 11, 1975

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
WASHINGTON, D.C. 20314

RE: DAEN - CWE - D

Dear Sir:

Thank you for the opportunity to review and comment on the text of your report for the Secretary of the Army on the national program of inspection of dams.

I wish to point out Vermont statutes and practices relating to the safety of dams are substantially similar to those advocated in your report.

I suggest an additional recommendation to the effect that the states be provided federal financial assistance for the initiation and implementation of dam safety programs.

A program engendered to protect the health, safety, and welfare of the citizens of Vermont is welcomed, and will continue to be supported.

Sincerely,

A handwritten signature in cursive script, appearing to read "Tom Salmon".

Thomas P. Salmon

TPS:mlj

Commonwealth of Virginia

# STATE WATER CONTROL BOARD

P.O.Box 11143, 2111 N. Hamilton St., Richmond, Va. 23230 (804) 770-1411

Eugene T. Jensen, Executive Secretary



APR 3 0 1975

## BOARD MEMBERS

Ray W. Edwards  
Chairman

Andrew W. McThenia, Jr.  
Vice-Chairman

J. Leo Bourassa  
Warren L. Braum  
Denis J. Brion  
Basil T. Carmody  
Mrs. Wayne Jackson

IN REPLY, CC1588  
REFER TO: \_\_\_\_\_

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

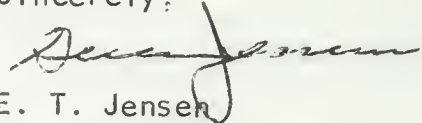
Re: DAEN-CWE-D

Dear General Gribble:

We have reviewed Volume I of "National Program of Inspection of Dams" which was sent to our Governor, Mills E. Godwin, Jr. on March 18, 1975 and find it to be a well prepared report.

We concur with the recommendations that are made.

Sincerely,

  
E. T. Jensen  
Executive Secretary

cfh





STATE OF WASHINGTON

OFFICE OF THE GOVERNOR

OLYMPIA

DANIEL J. EVANS  
GOVERNOR

April 3, 1975

Lt. Gen. W. B. Gribble  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D.C. 20314

Dear General Gribble:

Your letter of March 18 and the enclosed text of your report on the National Programs of Inspection of Dams (Vol. 1) are gratefully acknowledged. We appreciate the opportunity to review and comment prior to the transmittal of the report to the Secretary of the Army.

The conclusions and recommendations, drawn on pages 16-17, are items which we do endorse as matters of governmental concern and jurisdiction, particularly in light of the most revealing figures gathered in the inventory.

As indicated previously, the position of the State of Washington is one which favors a concept of shared responsibility between the states and the federal government, with the role of each clearly defined in enabling legislation. We maintain that state responsibility should prevail relative to nonfederal structures, and to the extent legally practicable on intrastate streams.

Further, we would reiterate our previous position that adequate financing must be available to both state and federal authorities charged with administering the program if it is to be effective. For the State of Washington to update and fully implement its existing statutes, some financial assistance would be helpful if not absolutely necessary.

No less assurance should be provided to federal agencies owning or operating dams including the Federal Power Commission interest in licensed projects.

We would suggest that one federal agency be given the responsibility for overall program coordination and to provide liaison with the states in procedures and inspection results made at the federal level within each state.

Again, we thank you for the opportunity to comment on the report and for the privilege of having participated in the inventory and reporting phase of the study.

Sincerely,



Daniel J. Evans  
Governor



STATE OF WISCONSIN  
OFFICE OF THE GOVERNOR  
MADISON, WISCONSIN 53702

PATRICK J. LUCEY  
GOVERNOR

April 17, 1975

Lt. General W. C. Gribble, Jr.  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear Lt. General Gribble:

I have received your report on the activities performed under the National Dam Inspection Program. I am pleased to extend my support to the program in order to insure that the National Dam inventory is current that dams with significant hazard potential are inspected periodically.

I appreciate your efforts and look forward to receiving the full report.

Sincerely,

*Patrick J. Lucey*  
PATRICK J. LUCEY  
Governor

PJL:spn



WYOMING  
EXECUTIVE DEPARTMENT  
CHEYENNE

ED HERSCHLER  
GOVERNOR

April 16, 1975

W. C. Gribble, Jr.  
Lieutenant General, USA  
Chief of Engineers  
DAEN-CWE-D  
Office of the Chief of Engineers  
Washington, D. C. 20314

Re: National Safety of Dams  
Program P.L. 92-367

Dear General Gribble:

With reference to your letter of 18 March 1975, requesting comments on the text of your report concerning the National Safety of Dams Program, we have the following to offer.

In August of 1974, the states and various organizations were requested to review the July 1974 draft of the proposed inspection guidelines. At this time it is unknown what consideration was given to these comments. Therefore, our following remarks may or may not be complete.

As you have mentioned, the states should have jurisdiction over dams within their boundaries except for federally owned dams or those on federal land. The apparent problem with this is the privately owned dams located on federal land could in some cases be required to use construction or repair techniques far more severe than any imposed by the states. This could only result in creating an adverse economic situation for these private owners.

Assuming the September 1974 suggestion of the Western States Water Council to reinstate the paragraph:

"...in cases where the hydrologic, hydraulic or stability criteria outlined herein conflict with criteria established by the state in which the dam is located, the state requirements shall prevail in safety evaluations of non-federal dams unless directed otherwise by the Governor."

page two

W. C. Gribbie, Jr., Lt. Gen. USA

April 16, 1975

was followed, then control of the privately owned dams on federal lands should be made to fall under state jurisdiction.

It is realized that many states do not have adequate Safety of Dams laws. This serves to justify your idea that, "...safety must be evaluated in light of peculiarities and local conditions." The criteria used for inspections must be considered on a state by state basis. This state's sparse population should not be made to conform with the more stringent controls necessary in the heavily populated states.

Your cost projection of \$5,000 to \$10,000 per dam for Phase I inspections of high hazard dams causes me to wonder what the cost of the highly technical Phase II might be. The performing of the National Safety of Dams inspection program and instigation of follow on programs by the states is, in fact, going to be quite expensive. In view of the development costs, most states' follow on Safety of Dams programs may take some years to become even partially active.

The end result of the inspection program may in most cases provide an owner with an expensive repair bill. There should then be some consideration of providing this person with a means of financing at low interest rates. Without such a plan numerous owners will be in the position of trying to ignore a state directive to repair their dams, or placed in a very difficult financial situation. This would be a very serious problem for the states and the nation. In the cases where federal law could far exceed state laws, private owners on federal land might have no other choice than to sell or abandon their dams and livelihoods.

Thank you for the opportunity to review your text prior to submittal to the Secretary of the Army and the Congress.

With best wishes,

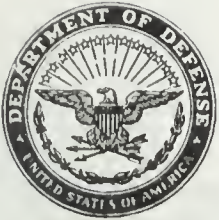
Yours sincerely,



EH:ata

cc: George L. Christopoulos,  
State Engineer





DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

6 May 1975

Honorable Ed Herschler  
Governor of Wyoming  
Cheyenne, Wyoming 82002

Dear Governor Herschler:

I thank you for your letter of 16 April 1975 regarding my report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

In formulating the recommended inspection guidelines careful attention was given to all comments received on the July 1974 draft. We recognized that some States may have established or will adopt inspection criteria incongruous in some respects with the guidelines and, therefore, we included in the Preface a statement that in such cases assessments of dam safety should recognize State requirements as well as guideline recommendations. This should create no problem in those instances where guideline recommendations are more stringent than State criteria because evaluation factors of the guidelines are intended to be flexible and are presented principally as reasonable basis for assessing existing conditions. The major objectives of the guidelines are to outline principal factors to be weighed in determining existing or potential hazards and to define the scope of activities to be undertaken in safety inspections. The establishment of rigid criteria is not intended.

In regard to the question of jurisdiction over private dams located on Federal lands, we believe that the Federal Government has a primary responsibility to insure that Federal lands are not utilized in a manner detrimental to the public's safety. I believe we can agree that such hazards could develop in those cases where States do not have an adequate dam safety program and the appropriate Federal agency neglects its responsibility in this regard. A cooperative effort between Federal agencies and the States to promote the safety of private dams on Federal lands would appear appropriate and desirable.

DAEN-CWE-D  
Honorable Ed Herschler

6 May 1975

The total impact of the recommended program on the economic resources of the Nation cannot be accurately assessed at this time. The information needed for such a forecast can be developed only by the inspection program. Recognizing that the costs of necessary in-depth studies and modifications to eliminate hazardous or potentially hazardous conditions may be substantial, the program benefits such as reductions in loss of life and property and minimization of social disruption and human suffering make a compelling case for implementing the recommended dam safety program.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the State of Wyoming when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers

*Puerto Rico Water Resources Authority*  
*San Juan, Puerto Rico*

CABLE ADDRESS  
PRWRA

April 8, 1975

P. O. BOX 4267  
G.P.O. 00936

Lieutenant General W. C. Gribble  
Chief of Engineers  
Department of the Army  
Washington, D. C. 00910

Attention: ' DAEN-CWE-D

Dear General Gribble:

Your letter dated 18 March 1975 addressed to the Honorable Rafael Hernández Colón, Governor of Puerto Rico, on the National Dam Inspection Program authorized by Public Law 92-367 accompanied by two copies of the text of your report to the Secretary of the Army has been referred to my office for review and comment.

As you know, the Puerto Rico Water Resources Authority, a public corporation is the government instrumentality which has planned, constructed and operated nearly all, to be more specific twenty (20) of the 25 existing dams in Puerto Rico. These dams were originally intended for the utilization of water resources on the Island and served the three-fold purpose of being sources of water supply and for irrigation for the generation of hydroelectric energy and for flood control. The other five remaining dams are being utilized and operated by the Aqueduct and Sewer Authority of Puerto Rico, another Commonwealth of Puerto Rico Government agency. As far as we know, any dams that may be planned and constructed in the future will be controlled and operated by the Commonwealth Government.

At present we have a program for the inspection and maintenance of dams as explained in our letter to Major General D. A. Raymond, U. S. A. copy of which is enclosed herewith. This program has been carried out with very limited funds. Additional funds will be required to implement all aspects of the program on a more thorough basis and regularity.

We have examined carefully the text of your Report to the

Secretary of the Army on the National Program of Inspection of Dams and have found it very thorough and completely adequate in all phases covered.

We would like to offer our comments on the subject of Responsibility for Supervision of Program as detailed in Paragraph II of Volume I of your report. Since our group of dams fall into the class covered by sub-paragraph c Non-Federal Dams as discussed on page 13 of said report, where it is stated that: "All dam owners, whether public or private interests, have the ultimate responsibility for safe structures and such responsibility needs to be adequately defined by State Legislation".

It has been the intention of our Commonwealth Government to institute such legislation, but thus far it has not become possible due to certain limitations of economic nature. Up to now the inspection and maintenance of these hydraulic structures has been done as one of the many functions of our regular maintenance program, although we have had the technical assistance of trained personnel provided by the U. S. Bureau of Reclamation.

It is my intention to recommend that the necessary legislation covering a program of dam safety be enacted and am looking forward to examine the USCOLD Model Law for State Supervision of Dams and Reservoirs (Appendix C) whenever this becomes available to help us in the preparation on the proposed legislative matters.

12. Cost of Program - We are in complete agreement as to the assumptions shown in your report concerning the cost of the program.

13. Impact of Program -

a) Technical Capabilities - The Commonwealth's Puerto Rico Water Resources Authority is confronted at present, with a shortage of qualified engineers in the design, construction and operations of dams. What mostly concerns us today is the outcome of in-depth studies resulting from the initial inspection where the engineering of remedial works may become imperative.

15. Financing of Program

b) State Activities - The Commonwealth of Puerto Rico will be among the number of States that would face difficulties in allocating the funds, if not the technical



April 8, 1975

personnel, needed for their share of a national dam safety program as contemplated in your report. We strongly support your idea for incentives to be provided by the Federal Government to the States to implement their share of a national dam safety program. These incentives could be as grants from the Government through the proper Agencies, or as a low-interest, long-term loans to these States which lack the necessary economic resources.

16. Conclusions

a) General

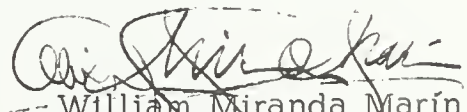
The conclusions in General are most realistic and encompass the entire program in all aspects, which are of great and varying degrees.

b) Safety Program

The concepts as defined in (1), (2) and (3) are most adequate and we doubt that they could be improved in their extent. Same goes for sub-paragraph c on Supervision.

17. Recommendations - We are all whole heartedly in agreement with your recommendations from a to e. We would, however, like to suggest that a sentence be added at the end of paragraph c indicating that funds should also be assigned for financial aids to the States and the Commonwealth of Puerto Rico.

Sincerely yours,

  
William Miranda Marín  
Executive Director

Enclosures  
/mlm



TERRITORY OF GUAM  
OFFICE OF THE GOVERNOR  
AGAÑA, GUAM 96910  
U.S.A.

APR 21 1975

W. L. Gribble, JR. LT. GEN. USA  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D. C. 20314

Dear General Gribble:

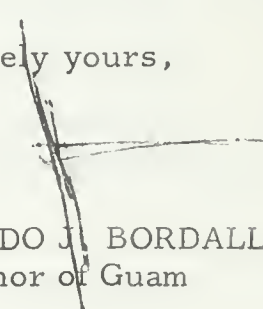
We share your concern for the safety and welfare of our citizens and agree that the protection of human life and property from potential hazards created by dams and the water they impound is a governmental responsibility.

The heavily populated central and northern portions of Guam have no streams with usable reservoir sites. The Navy's Fena Valley Reservoir is located on federal property in southern Guam. There are no developments downstream from the reservoir at this time, however, there are plans for subdivision developments in this area and we would want to be assured of the safety of this dam.

The Government of Guam plans to construct a reservoir on the Ugum River to supplement the primary source of water supply available from the underground water lens in the north.

We have a number of small water supply reservoirs in the south, however, these reservoirs are being phased out as we develop more dependable sources of water supply.

Sincerely yours,

  
RICARDO J. BORDALLO  
Governor of Guam



TRUST TERRITORY OF THE PACIFIC ISLANDS  
OFFICE OF THE HIGH COMMISSIONER  
SAIPAN, MARIANA ISLANDS 96950

CABLE ADDRESS  
HICOTT SAIPAN

APR 1 1975

Lt. Gen. W. C. Gribble, Jr. USA  
Chief of Engineers (DAEN-CWE-D)  
Department of the Army  
Washington, D.C. 20314

Dear General Gribble:

Your "National Program of Inspection of Dams," Volume I, which was sent to us recently, has been reviewed carefully by the Director of the Department of Public Works of the Trust Territory of the Pacific Islands. Neither he nor I have any comments to offer which would serve to change or amend your report.

We appreciate the opportunity you have given us to review and comment on this material.

Sincerely yours,

Peter T. Coleman  
Deputy High Commissioner



DEPARTMENT OF AGRICULTURE  
OFFICE OF THE SECRETARY  
WASHINGTON, D. C. 20250

Lt. General W. C. Gribble, Jr.  
Chief of Engineers  
Office of the Chief of Engineers  
Department of the Army

April 18, 1975

Dear General Gribble:

We appreciate having the opportunity to review and comment on the proposed National Program of Inspection of Dams. Comments from the Forest Service and Soil Conservation Service, as requested in your letters to them, are included in this response.

As stated in our earlier letters (latest 11/22/74), we are very concerned with this subject. Agencies in the Department have some association, either past or currently, or some responsibility for more dams than any other Federal agency. We feel that a program is urgently needed to assure the protection of life and property that is or may be located below or adjacent to dams. The proposed program is well conceived and, we feel, establishes the guidelines needed for a sound dam safety program. It is essential that this program be assigned to and controlled by the respective states.

It is requested that the proposed program be revised to require that private dams under permit or other right, located on Federal lands, be included in the states area of responsibility. This will provide dam owners and endangered citizens with a uniform approach to dam safety and will permit a complete state program. Federal dams, as described in the P.L. 92-367, should remain the responsibility of the Federal agency charged with management of the dam. The program should provide for a transfer of responsibility from the state when a mutual understanding can be reached between the state and the concerned Federal land managing agency. (This may be necessary when private dams are located in restricted areas or on military reservations).

We are concerned with the impact this proposed program may have on the resources of the state governments. This program will tax the financial and engineering resources of states and of the concerned Federal agencies. It is therefore essential that this program provide for a comprehensive implementation plan that establishes time frames, financial arrangements, and provisions for staffing adjustments. Such a plan must recognize both State and Federal problems and needs.



Lt. General W. C. Gribble, Jr.

2

Detailed comments on the report are enclosed.

This is an important program and we are anxious to see it carried forward to implementation. Please call on us if we can be of further assistance.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Robert W. Long', written in a cursive style.

ROBERT W. LONG  
Assistant Secretary

Enclosure

Detailed USDA Comments and Suggestions on National Program of Inspection of Dams, Vol. 1.

1. Page 11, item 5 - If Federal agencies are to be charged with regulating non-Federally owned dams, there may need to be major changes made in current agency policy. There are certain situations, for instance, that of a dam under a privately owned easement within a National Forest, in which the exercise of regulatory authority could constitute a "taking" of private property for which the United States would have to pay just compensation. In order to avoid any legal uncertainties and in the interests of uniformity in this area, it would be preferable that the states exercise regulatory authority over non-Federally owned dams.

2. Page 12, last paragraph - Comment 1 applies to the dams referred to in this paragraph.

3. Page 18, 3rd paragraph, last sentence - This sentence clearly assigns to the states the responsibility for control of dams constructed with technical and financial assistance from the Soil Conservation Service (SCS). We agree fully with this concept. However, this does seem to establish, within the proposal, an apparent conflict. Many private dams constructed with assistance from SCS are installed on Federal lands. The first sentence in this paragraph assigns responsibility for these dams to the Federal land managing agency.

We believe this apparent conflict can best be resolved by assigning responsibility for all private dams to the states, including those located on Federal lands.

4. Page 19, Recommendations -

- a. A recommendation on program implementation and financing is needed. This will support the discussion on this subject included in the report.
- b. Recommendation c. - We question if Federal agencies should be authorized to provide "technical assistance" to state governments. This is in conflict with the interest of consulting engineers and, involves Federal agencies directly in what is proposed to be a state program.
- c. Recommendation d. - As stated in our cover letter, we do not feel Federal agencies should be assigned responsibility for private dams that are located on their lands. The primary responsibility should rest with the state.



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

6 May 1975

Honorable Robert W. Long  
Assistant Secretary of Agriculture  
Washington, D.C. 20250

Dear Mr. Long:

I thank you for your letter of 18 April 1975 regarding my report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

In regard to your request that the proposed program be revised to place in the States' area of responsibility private dams located on Federal lands, we believe that the Federal Government has a primary responsibility to insure that Federal lands are not utilized in a manner detrimental to the public's safety. Such hazards could develop where States do not have an adequate dam safety program and the appropriate Federal agency neglects its responsibility in this regard. We do, however, agree that the development of a mutual understanding and agreement between the State and Federal land managing agency with respect to safety supervision of private dams on Federal lands would be appropriate and desirable.

The total impact of the recommended program on the economic resources of the Nation cannot be accurately assessed at this time. The information needed for such a forecast can be developed only by the inspection program. The impact on economic resources and technical capabilities to perform regulatory functions, including Phase I inspections, is discussed in paragraph 14 of the report. The technical inspection is an essential first step which will provide knowledge upon which each regulatory agency can then plan for an orderly prosecution of necessary in-depth studies and any follow on remedial work.

The conflict in paragraph 16c(1) of the report concerning the supervision of privately owned dams, located on Federal lands and constructed with technical and financial assistance from the Soil Conservation Service was corrected. The last sentence of that paragraph was modified to

Lxxvii

DAEN-CWE-D

6 May 1975

Honorable Robert W. Long

except from State jurisdiction those SCS dams under the regulatory jurisdiction of Federal agencies. I thank you for bringing this conflict to our attention.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the Forest Service, Soil Conservation Service and Department of Agriculture when the report is submitted to the Secretary of the Army.

Sincerely yours,



W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers





# United States Department of the Interior

BUREAU OF INDIAN AFFAIRS  
WASHINGTON, D.C. 20242

IN REPLY REFER TO:

Trust Facilitation  
Irrigation-BCCO 251

APR 18 1975

W. C. Gribble, Jr.  
Lieutenant General, USA  
U. S. Army Corps of Engineers  
Washington, D. C. 20314

Dear General Gribble:

We have reviewed your report, "National Program of Inspection of Dams," and find it very adequate.

We have one comment which concerns the paragraph entitled "(1) States," on page 18. There are a number of dams on Indian reservations, constructed by and under the jurisdiction of the Bureau of Indian Affairs, which were funded under the same authority as those funded by the Soil Conservation Service. These dams are subject to inspection under criteria prescribed by the Soil Conservation Service. We, therefore, suggest that on page 18, in the paragraph entitled "(1) States," in the last sentence after the words, "Soil Conservation Service," and before the word, "should," the words "except those under the regulatory jurisdiction of Federal agencies," be inserted.

Sincerely yours,

Director, Office of Trust  
Responsibilities



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

8 May 1975

Mr. Martin E. Seneca, Jr.  
Director, Office of Trust  
Responsibilities  
Bureau of Indian Affairs  
Department of the Interior  
Washington, D. C. 20242

Dear Mr. Seneca:

I thank you for your letter of 18 April 1975 regarding the Chief of Engineers report on the National Program of Inspection of Dams. A copy of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

I thank you for bringing to my attention the situation of dams constructed under the jurisdiction of the Bureau of Indian Affairs under the same authority as those funded by the Soil Conservation Service. The report will be revised in this regard in accordance with your suggestion.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the Bureau of Indian Affairs when the report is submitted to the Secretary of the Army.

Sincerely yours,

  
W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers

Lxxx



# United States Department of the Interior

BUREAU OF RECLAMATION  
WASHINGTON, D.C. 20240

IN REPLY  
REFER TO:  
510.2

430

APR 18 1975

Lieutenant General W. C. Gribble, Jr., USA  
Chief of Engineers  
Office of the Chief of Engineers  
Department of the Army  
Washington, D.C. 20314

Dear General Gribble:

This is in response to your letter of March 18, 1975, requesting comments on the Corps of Engineers' report entitled National Program of Inspection of Dams, volume I.

We have reviewed the report and our comments are as follows:

1. Paragraph 5, page 2--The report indicates that the lack of adequate funding was an instrumental factor in the decision not to inspect non-Federal dams. We believe it is extremely important that all dams in the United States be inspected, either by the Federal or State governments, and that the inspections be accomplished within a reasonable time frame. We realize that new authorizing legislation would be required to accomplish inspections of non-Federal dams not performed by the States.
2. Paragraph 5, page 3, first sentence--The reference to section 233 of Public Law 92-367 seems to be in error. Also, we suggest identification of the agency responsible for the inspections and appraisals of the coal mine refuse banks and impoundments.
3. Paragraph 9, page 9--We are in complete agreement with the need for a national program for the inspection and regulation of dams in the United States. The last sentence, first paragraph, page 8, indicates the probable need for revision of the program guidelines on the basis of experience. Statements on pages 17 and 19 indicate that most State programs and some Federal programs are deficient and that a unified approach to the safety of dams problem is needed. To ensure the expeditious accomplishment of a national program of inspection of dams, we believe authorizing legislation providing authoritative coordination or supervision is needed. Attached is a list of comments and suggestions directed toward such legislation.

Lxxxi



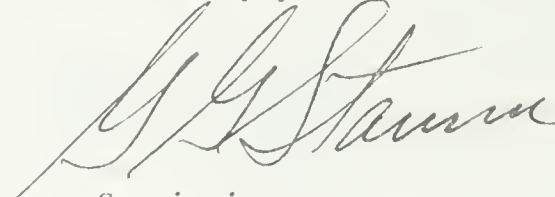
4. Paragraphs 10c, page 11; 12, page 14; and 17e, page 19--We interpret the proposed inspection guidelines to require phase I inspections for only those dams in the potentially high-hazard categories. The "Inventory of Dams" required hazard classification but did not provide for field inspection to determine that classification. The referenced paragraphs indicate that subsequent inspections will not include dams currently in a low-hazard classification, unless the dams are reclassified to a higher risk category in a subsequent inspection. We recommend that the report include a requirement for periodic field review of the hazard potential of all dams, including those initially determined to be in the low-hazard classification.

5. Paragraph 11b, page 12, first partial paragraph--The statement regarding Reclamation dams should read, ". . . dams under the jurisdiction of the Bureau of Reclamation, . . . ."

6. Paragraph 15b, page 16--The report recognizes the possible need for incentives to encourage the States to implement their share of a national dam safety program; however, the report does not define incentives. Paragraph 13, page 14, suggests that the real incentive is provided the Federal Government rather than the States by the potential reduction of the need for Federal disaster assistance. It is questionable whether the States will support a program that does not provide them with adequate incentives.

7. Paragraph 17c, page 19--We concur in the recommendations that qualified Federal agencies should be authorized to furnish technical assistance and guidance to the States. Also, we believe that it would be appropriate for the Bureau of Reclamation to assist other Department of the Interior agencies. In either case, agreements with Reclamation to provide assistance would need to include consideration of additional staffing and funding.

Sincerely yours,



Commissioner

Enclosure



COMMENTS AND SUGGESTIONS CONCERNING A  
COMPREHENSIVE, CONTINUING NATIONAL DAM SAFETY PROGRAM

1. A need exists for a comprehensive, continuing national program for dam safety.
2. A Federal office should be established for implementing a comprehensive, continuing national program.
3. The Federal office should have a relatively small but highly qualified staff to review periodically the effectiveness of the dam safety program of each State and Federal agency having dams under its jurisdiction.
4. Federal legislation should establish the functions, responsibilities, and authority of the Federal office for dam safety.
5. If the functions of the Federal office for dam safety are assigned to an existing Federal agency, there should be established in that agency a separate office or division for the purpose of performing those functions.
6. Federal legislation should provide general procedures and authority for the Federal office for dam safety to require corrective action when significant deficiencies in a State or Federal agency program are discovered.
7. The Federal office for dam safety should not be required to inspect and investigate dams, except to determine whether the State or other Federal agency has adequate procedures for such inspections and investigations.
8. A primary function of the Federal office for dam safety should be the development, dissemination, and updating of efficient and effective technical procedures for the various phases of safety inspection and investigation of existing dams. Expertise of the Bureau of Reclamation, the Corps of Engineers, engineering associations, and State engineers should be utilized in the development of the technical procedures and implementing guidelines. Such procedures should provide adequate, practical criteria for use in the proper surveillance and evaluation of the structural, hydro-meteorological, hydraulic, seismic, operational, and maintenance aspects of all types and sizes of existing dams.
9. Another primary function of the Federal office for dam safety should be the development of national codes for the design and construction of dams and of guidelines for their adoption. In the development of the codes and guidelines, the ideas, opinions, and suggestions of the various Federal, State, and private interests having expertise in these technical fields should be solicited and

considered. The principal purpose of the codes should be to provide (for engineering entities involved in the design and construction of dams) minimum specifications essential for the safety of the structures in regard to materials, structural and hydraulic design criteria, hydrometeorological and seismic design procedures, and construction control.

10. An essential aspect of a comprehensive, continuing national program for dam safety is that each State be required by Federal legislation to establish and support an adequate staff for effective surveillance of dam safety procedures in the design, construction, operation, and maintenance of dams in the States. Each State should be required to adopt a minimum national code or an equivalent for the surveillance of design, construction, and operation and maintenance of dams.



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

9 May 1975

Honorable Gilbert G. Stamm  
Commissioner of Reclamation  
Department of the Interior  
Washington, D.C. 20240

Dear Mr. Stamm:

I thank you for your letter of 18 April 1975 regarding the Chief of Engineers report on the National Program of Inspection of Dams. Copies of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

The citation of Public Law 92-367 on page 3, paragraph 5 of the report is in error and will be corrected to Public Law 91-611. I thank you for bringing this to our attention.

The field inspections of the coal mine refuse banks and impoundments were conducted by the Corps of Engineers in cooperation with State agencies and other appropriate Federal agencies. A board of review consisting of all participating agencies evaluated field inspection data. This board maintained liaison with the U.S. Department of the Interior Task Force for Studying Coal Waste Hazards.

As indicated in those portions of the report cited in paragraph 4 of your letter, Phase I inspections are contemplated for the potentially high hazard and significant hazard categories of dams. This is not in conflict with paragraph 2.2 of the recommended inspection guidelines which provides that the inspection of dams possessing a hazard potential classified high or significant should be given first and second priorities, respectively, in the inspection program. The guidelines also recognize the necessity for reclassification of dams as additional information becomes available.

The statement in the report regarding Reclamation dams will be revised as you suggest in paragraph 5 of your letter.

Lxxxv

DAEN-CWE D  
Honorable Gilbert G. Stamm

9 May 1975

With respect to your comments on program incentives, one incentive for the Federal Government is the potential reduction of the need for Federal disaster assistance. Other incentives for both Federal and State Governments, for which a monetary value cannot be accurately assigned, are the reductions in loss of human life and property and minimization of social disruption and human suffering due to dam failures.

Your interesting comments concerning a Federal office for dam safety and other aspects of our report are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the Bureau of Reclamation when the report is submitted to the Secretary of the Army.

Sincerely yours,



D. A. RAYMOND  
Major General, USA  
Acting Chief of Engineers





# United States Department of the Interior

FISH AND WILDLIFE SERVICE

WASHINGTON, D.C. 20240

W. C. Cribble, Jr. Lt. Gen. USA  
Chief of Engineers  
Office of the Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

Attn: DAEN-CWE-D

Dear General Cribble:

We have reviewed Volume 1, National Dam Inspection Program enclosed with your letter of March 18, 1975. We find that it is very complete and in compliance with Section 5 of the National Dam Inspection Act (Public Law 92-367).

We appreciate the opportunity of reviewing the program, and we will be glad to be of further service on the subject if required.

Sincerely yours,

*Walter L. McAllister*

WALTER L. McALLISTER Director



Lxxxvii

*Save Energy and You Serve America!*



# United States Department of the Interior

GEOLOGICAL SURVEY  
RESTON, VIRGINIA 22092

Lieutenant General W. C. Gribble, Jr.  
Office of the Chief of Engineers  
Department of the Army  
Washington, D.C. 20314

APR 18 1975

Attention: DAEN-CWE-D

Dear Lieutenant General Gribble:

This is in response to your letter of March 18, 1975, asking for comments on the "National Program of Inspection of Dams."

The opportunity to review and comment on this important and timely program is appreciated. The U.S. Geological Survey agrees that criteria, standards, and regulations should be established so that the public and national interest is protected. Your proposed program is a most logical first step toward that goal.

The program, as presented in Volume 1, was reviewed by our Engineering Geology Branch and Conservation Division. Both found the program and its recommendations to be comprehensive, logical, consistent with good engineering practice, and in the national interest.

We are looking forward to receiving the complete report, with appendices.

Sincerely yours,

*James H. ...*  
Assistant Director

Lxxxviii

FEDERAL POWER COMMISSION  
WASHINGTON, D.C. 20426

10/10/75

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers, U.S. Army  
Attention: DAEN-CWP-C  
Room 4E-086, Forrestal Building  
Washington, D.C. 20314

Dear General Gribble:

Chairman Nassikas has asked that I respond to your letter of March 18, 1975, requesting our comments and views on your report to the Secretary of the Army on your activities under the authority of Public Law 92-367.

We have been pleased to collaborate with you in preparing the inventory of those dams under license by the Federal Power Commission and those for which application for license has been filed. We have provided our comments on your proposed guidelines. We had only two significant comments on your last draft as contained in our letter of October 10, 1974. Those dealt with the size of the flood to be used for spillway adequacy evaluation and the consideration to be given to upstream flood control reservoirs. I am sure you have given careful consideration to these comments.

It is to be hoped that all Federal agencies involved in the supervision of design, construction, operation and maintenance of dams could agree on the key standards of size classification, hazard potential classification, hydrologic evaluation guidelines and factors of safety. Having agreed among ourselves we would be better able to encourage the use of a uniform code of standards by the states and private firms. We recommend that your report to the Congress include a specific recommendation to this effect.

Lxxxix



We have one minor comment on your report. The title of paragraph 11b. "Federal Dams" should preferably be "Federally Owned or Regulated Dams." Perhaps 15 percent of the 5,500 dams stated as being in this category are those licensed by the Federal Power Commission, but privately owned and operated. Again in paragraph 12, the 5,500 "Federal dams" should be changed to "Federally owned or regulated dams."

We concur in and support the conclusions and recommendations of your report.

Very truly yours,

  
T. A. Phillips  
Chief, Bureau of Power





DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

REPLY TO  
ATTENTION OF:

DAEN-CWE-D

7 May 1975

Mr. T. A. Phillips  
Chief, Bureau of Power  
Federal Power Commission  
Washington, D.C. 20426

Dear Mr. Phillips:

I thank you for your letter of 10 April 1975 regarding my report on the National Program of Inspection of Dams. A copy of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

Your comments of 10 October 1974 on the proposed inspection guidelines were given careful attention during the formulation of the present draft. Paragraph 4.3 was revised to include the need for an assessment of the impact of upstream flood control projects on peak flows or hydrograph analyses. However, we have retained the hydrologic evaluation guidelines listed in Table 3 of the July 1974 draft. The classifications of (1) small dams with high hazard potential, (2) intermediate dams with significant hazard potential and (3) large dams with low hazard potential represent a transition from the low risk combination of size and hazard potential, where a maximum flood of 1/2 PMF is recommended, to the high risk combination calling for the full PMF. We feel the recommended range of 1/2 PMF to PMF for these classifications provides the desired flexibility for selecting a flood size commensurate with the involved degree of risk at a specific project.

We share your hope that all Federal agencies will agree on the principal provisions of the inspection guidelines. Although the recommended guidelines represent the consensus of the agencies and engineering organizations that reviewed and commented on the previous two drafts, we believe that as experience is gained with their use additional revisions will be needed. Thus a continuing updating effort is foreseen.

As you have noted, our report uses "Federal Dams" to refer to all dams in which the Federal Government has a substantial interest. We believe

DAEN-CWE-D

7 May 1975

Mr. T. A. Phillips

the discussion makes it clear that this term covers dams owned and operated by Federal agencies, dams located on lands under Federal jurisdiction and dams under existing regulatory jurisdiction of Federal agencies.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the Federal Power Commission when the report is submitted to the Secretary of the Army.

Sincerely yours,



W. C. GRIBBLE, JR.  
Lieutenant General, USA  
Chief of Engineers



OFFICE OF THE COMMISSIONER  
UNITED STATES SECTION

INTERNATIONAL BOUNDARY AND WATER COMMISSION

UNITED STATES AND MEXICO

200 IBWC BUILDING

400 RIO BRAVO

EL PASO, TEXAS 79998

MAILING ADDRESS

P O BOX 20003

**MAY 12 1975**

Attn: DAEN-CWE-D

Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Office of the Chief of Engineers  
Washington, D.C. 20314

Dear General Gribble:

We appreciated the opportunity to review the report to the Secretary to the Army enclosed with your letter of March 18, 1975, summarizing the steps taken by the Corps with respect to a National Program of Inspection of Dams, pursuant to Public Law 92-367.

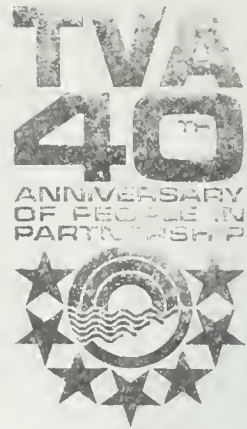
The report certainly presents a clear picture with respect to the program and reflects the in-depth review the Corps has given to the problem. Be assured that we will continue to follow your guidance in developing our joint international inspection program with Mexico for the two international dams, Falcon and Amistad, under jurisdiction of the Commission. We do appreciate the assistance given us by the Corps in establishing our own program.

We would appreciate ten copies of your agency's "guidelines" Appendix D, when such has been approved.

Thanks again for your good assistance.

Sincerely,

J. F. Friedkin  
Commissioner



Lieutenant General W. C. Gribble, Jr.  
Chief of Engineers  
Department of the Army  
Washington, D. C. 20314

Dear General Gribble:

DAEN-CWE-D

This is in response to your letter of March 18, 1975, to Mr. Wagner transmitting for our review and comment your report on the "National Program of Inspection of Dams." We endorse the overall concept of a comprehensive National Dam Safety Program as outlined generally in the report.

In commenting to General Morris on September 27, 1974, concerning the inspection guidelines, we suggested that they should be more flexible. We are glad to see that section 8 of the report now supports this viewpoint by pointing out that the guidelines "do not establish rigid criteria or standards but rather provide guidance on the scope of investigations. . . ." and that they must be applied using competent, experienced engineering judgment.

One additional comment concerns coal mine refuse piles and settling pond dikes which create impoundments incidental to their main function. Evidently the report considers these in the same category as dams which are engineered structures. It would seem advisable to treat refuse piles and dikes separately.

We appreciate the opportunity to review the report and to give our views on the subject.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Lynn Seeber'.

Lynn Seeber  
General Manager





DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314

IN REPLY REFER TO

DAEN-CWE-D

30 April 1975

Mr. Lynn Seeber  
General Manager  
Tennessee Valley Authority  
Knoxville, Tennessee 37902

Dear Mr. Seeber:

I thank you for your letter of 14 April 1975 regarding the Chief of Engineers report on the National Program of Inspection of Dams. A copy of your letter and this reply will be appended to the report as submitted to the Secretary of the Army.

We believe that coal mine refuse piles and structures impounding water, sediment or slurry can present a hazard to human life and should therefore be engineered with the same high degree of professional performance as required for other types of impounding structures.

Your comments are very much appreciated. Two copies of the complete report, with Appendixes, will be furnished the Tennessee Valley Authority when the report is submitted to the Secretary of the Army.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "D. A. Raymond", is written over the typed name.

D. A. RAYMOND  
Major General, USA  
Acting Chief of Engineers



REPORT OF THE CHIEF OF ENGINEERS TO THE  
SECRETARY OF THE ARMY ON THE  
NATIONAL PROGRAM OF INSPECTION OF DAMS

1. AUTHORITY

This report is in response to Section 5 of the National Dam Inspection Act (Public Law 92-367), approved 8 August 1972, which reads as follows:

"Section 5. The Secretary shall report to the Congress on or before July 1, 1974, on his activities under the Act, which report shall include, but not be limited to -

(1) an inventory of all dams located in the United States;

(2) a review of each inspection made, the recommendations furnished to the Governor of the State in which such dam is located and information as to the implementation of such recommendation;

(3) recommendations for a comprehensive national program for the inspection, and regulation for safety purpose of dams of the Nation, and the respective responsibilities which should be assumed by Federal, State and local governments and by public and private interests."

2. INTERIM REPORT

A progress report on the activities authorized by Public Law 92-367 was furnished to the Congress by letter dated 24 July 1974. That letter reported the status of work on the dam inventory; the survey of State and Federal agencies' practices, capabilities and regulations concerning dam safety; and the guidelines for the safety inspection of dams.

3. SCOPE

The activities performed under the program authorized by Public Law 92-367 have consisted of: (a) compiling the data for an inventory of Federal and non-Federal dams; (b) conducting a survey of each State and Federal agency's capabilities, practices, and regulations in regard to the design, construction, operation and maintenance of dams; (c) developing guidelines for the safety inspection and evaluation of dams; and (d) formulating recommendations for a comprehensive national program including the respective responsibilities which should be assumed by Federal, State and local governments and by public and private interests. This report submits the results of these activities.

#### 4. BACKGROUND

The Dam Inspection Act (P.L. 92-367) was enacted in the wake of several catastrophies due to dam failures and reflects the great concern of the public about dam safety. These events were the failures of the Canyon Lake Dam at Rapid City, South Dakota and the mine refuse embankment at Buffalo Creek, West Virginia. Also, the June 1972 hurricane named Agnes caused extremely heavy rainfall in the Northeastern region of the country resulting in unprecedented flooding which posed a serious threat to a large number of dams, some of which were overtopped or damaged, adding to the property damage otherwise caused by the flooding and further adding to the public's concern.

While the safety of dams and the consequences of failure of a dam or the untimely release of its reservoir contents have previously been a concern of several States, Federal water resources agencies and national professional engineering societies, no Federal study of this problem has previously been conducted on a national scale. The only previously known study of States' practices and regulations pertaining to the construction, operation and maintenance of dams was conducted in 1965 by the United States Committee on Large Dams (USCOLD). The United States Committee on Large Dams, a member of the International Commission on Large Dams, is an organization of professional engineers, geologists and individuals and organizations concerned with the design, construction, operation and maintenance of dams and embankments for the impoundment of water. The published report "Supervision of Dams by State Authorities" did not cover the practices and regulations of the Federal agencies having dams under their jurisdiction. The report indicated that 27,914 dams were under the control of State authorities and that the supervision of dams was not exercised by all States. It further indicated that there were many differences and inadequacies in the manner in which the States were carrying out their responsibilities to the public for the safety of dams.

#### 5. INSPECTIONS

While the authorizing legislation provided for the inspection of non-Federal dams, no inspections have been performed due to limited funding and the belief that such inspections should be accomplished by the concerned States as part of their normal responsibilities. However, consistent with Corps of Engineers past practice, technical assistance and advice regarding measures to eliminate or mitigate hazardous conditions found by others have been given in response to 127 requests since implementation of the Act. The Corps has also responded to 10 requests for assistance in developing or strengthening State dam safety programs.



In addition, inspections and appraisals of coal mine refuse banks and impoundments have been made in the Potomac, Susquehanna, Delaware and Ohio River basins in specific response to the 28 February 1972 Resolution of the Senate Committee on Public Works and were funded under the Strip Mine Study authorized by Section 233 of Public Law 91-611. These inspections have been completed at a total of 495 sites in Ohio, West Virginia, Virginia, Kentucky and Pennsylvania. Of these, 30 were classified as critically hazardous and 172 potentially hazardous, all requiring some corrective action. Where hazardous mine waste impoundments have been identified they have been immediately reported to the concerned mine owners, State Governors and Federal agencies for corrective action. The necessary remedial work is the responsibility of the mine owners and is monitored by the States or the Mining Enforcement and Safety Administration of the Department of the Interior.

#### 6. INVENTORY OF DAMS

The National Dam Inventory included in Appendix F of this report contains data on approximately 49,000 dams, in the 50 States and 4 Territories, which are 25 feet or more in height or have a maximum impounding capacity of fifty acre-feet or more. In conformance with Public Law 92-367 dams not in excess of six feet in height, regardless of storage capacity, or which have a storage capacity at maximum water storage elevation not in excess of fifteen acre-feet, regardless of height, are excluded from the inventory.

The inventory data for non-Federal dams were obtained under direct State supervision in 37 States or Territories and in 14 others by private engineering firms under contracts with the Corps of Engineers. In the remaining 3, the Corps developed the inventories in-house. The inventory data for dams under the jurisdiction of Federal agencies and dams licensed by the Federal Power Commission were compiled by the Federal agency having jurisdiction over the dams and were furnished to the Corps of Engineers for inclusion in the national inventory. Where data on Federal dams were lacking, the States and private engineering firms collecting the data for non-Federal dams were contracted to obtain the supplemental information. The data were collected using the two part inventory form contained in Appendix F. All items of Part I of the inventory forms were obtained for each dam inventoried and only the items of Part II which were readily available were obtained. All data have been stored on magnetic tape in a master file for easy access and use by all interested agencies and organizations.

The inventory data consist of the name of the dam or impoundment; the river or stream on which the dam is located; the type of dam; year completed; purpose of the dam; the height and maximum storage capacity; the name, population and distance from the dam to the nearest downstream city, town or village; the downstream hazard potential;

the owner of the dam; and the Congressional District in which the dam is located. The Governor of each State has been furnished a copy of that portion of the inventory containing the data for dams within his State.

The inventory data indicate that only 18% of the dams have been inspected under existing State or Federal authority. The downstream hazard potential indicating potential loss of life or property resulting from failure of the dam or mis-operation of facilities has been recorded for 76% of the dams inventoried. Fifty (50) percent of the dams inventoried are classified as having a low downstream hazard potential, with 11% having a high hazard potential and 15% having a significant hazard potential. No information is recorded on the hazard potential at the remaining 24% of the inventoried dams.

## 7. EXISTING REGULATORY FUNCTIONS AND PRACTICES

To aid in formulating the recommendations for a comprehensive dam safety program, a questionnaire survey was made to learn each State and Federal agency's capabilities, practices, and regulations regarding the design, construction, operation and maintenance of dams.

### a. State Authorities

All 50 States and 3 Territories responded to the questionnaire on Supervision of Dams by State Authorities. A tabulation of these responses is contained in Appendix A.

The responses indicated that 11 States and Territories have no laws regarding any aspect of dam supervision. The legislative authority of many of the others is considered inadequate from the standpoint of establishing all activities necessary for dam safety. Twenty-four (24) indicated that their current dam safety regulations do not fully meet present needs and 20 stated that they have active plans to modify existing regulations.

Forty-one (41) States and Territories require a permit or license to be issued prior to construction of a private dam; 36 require the review of plans and specifications prior to construction; and 23 provide on-site inspection by State personnel during construction. Thirty-two (32) States have authority to perform safety inspections after construction; however, in most cases firm schedules are not maintained. Many perform an inspection only when information is received that a hazardous condition might exist or under other special conditions.

The responses further indicated that 54,195 dams are under State supervision and that \$4,371,379 is the determinable approximate annual

budget of the State authorities directly related to dam and reservoir supervision. This number of dams is larger than that included in the inventory because in some cases State regulations encompass impoundments which do not meet the Public Law 92-367 definition of "dam."

There are great differences among the States in carrying out their responsibilities to the public for the safety of dams built within their jurisdictions. Many have inadequate statutes and others have inadequate staffs to enforce the statutes. Few States, if any, including those with adequate dam safety regulations, are prosecuting a program comparable to that recommended in this report. Principally, this is due to the lack of funds and staff to perform inspection duties. It is apparent that increased activity in the regulation of the design, construction, operation and maintenance of dams is required and desired to protect life and property from potential hazards created by dams.

#### b. Federal Agencies

Twelve (12) agencies responded to the questionnaire on Supervision of Dams by Federal Agencies. A tabulation of these responses is contained in Appendix B.

Three Federal agencies have regulatory authority over non-Federal dams. These agencies are the Federal Power Commission, the Corps of Engineers and the Mining Enforcement and Safety Administration of the Department of Interior. Under authority of the Federal Power Act the Federal Power Commission supervises the design, construction, operation and maintenance of dams under its jurisdiction. The Federal Power Act requires the licensing of hydroelectric power plants which (1) utilize surplus water from a Government dam; (2) occupy public lands or reservations; (3) are located on a navigable stream; or (4) produce energy which is transmitted across State lines, thus affecting interstate commerce.

A Corps of Engineers permit is required for those dams that fall under the authority of Section 9 of the River and Harbor Act of 1899. Section 9 of the River and Harbor Act prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the waterbody are wholly within the limits of a single State, the structure may be built under authority of the legislature of that State, if the location and plans or any modification thereof are approved by the Chief of Engineers and the Secretary of the Army. A separate Corps of Engineers permit is not required for licenses issued by the Federal Power Commission. Under the Corps of Engineers permit procedures, the design of the dam is the responsibility of the applicant. The Corps reviews the applicant's design to insure that good engineering



practices are applied. The construction, operation and maintenance of the dam must be in compliance with the permit, however the Corps does not provide direct supervision over these activities.

The third Federal agency having regulatory control of non-Federal dams is the Mining Enforcement and Safety Administration (MESA) of the Department of Interior. MESA's authority for dam safety is contained in the 1966 Federal Metal and Nonmetallic Mine Safety Act and the Federal Coal Mine Health and Safety Act of 1969. These Public Laws make MESA responsible for mining operations including water and silt impoundments which may affect the safety of mines. In January 1974 MESA proposed revisions to its regulations to provide additional requirements for the construction and maintenance of new and existing coal waste deposits and water and silt impounding structures to gain maximum assurances that such deposits or structures are stable and will not fail. A public hearing on these proposed changes was held 23 July 1974 in Charleston, West Virginia and the findings of the hearing were published in the Federal Register on 1 November 1974. The final revisions to the regulations are expected to be published in the near future.

The Soil Conservation Service (SCS) provides technical assistance and financial support to local sponsors for the design and construction of dams. The local sponsors own and are responsible for the operation and maintenance of the dams. The operation and maintenance agreements with the SCS require annual and special inspections by the local sponsors, and the Soil Conservation Service participates in these inspections for the first three years after construction. If conditions warrant and the sponsor so requests, the Soil Conservation Service will provide technical assistance in dealing with special operating and maintenance problems. These dams are not Federal dams since the ownership and responsibility for operation and maintenance rests with the local sponsors after completion of construction.

The Forest Service, Corps of Engineers, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, Bureau of Sport Fisheries and Wildlife, U.S. Geological Survey, Mining Enforcement and Safety Administration, Federal Power Commission, International Boundary and Water Commission and Tennessee Valley Authority have existing authority concerning the responsibility for safety of dams they own or operate or which are located on lands under their supervision. An exception to this is the case of dams located on lands within the National Forests under privately owned easements for which the Forest Service does not have specific jurisdiction. These Federal agencies discharge their safety responsibilities with varying capabilities and dissimilar manners. In general on-site inspection by agency personnel is required during construction and periodically thereafter. However, three agencies have no definite schedule for periodic inspections.



The dams under the jurisdiction of the Bureau of Reclamation, the Tennessee Valley Authority, the International Boundary and Water Commission and dams licensed by the Federal Power Commission, which are excluded from the inspection requirements of Public Law 92-367, and those owned and operated by the Corps of Engineers are presently being periodically inspected in accordance with existing agency regulations.

The responses to the questionnaire further indicate that the determinable annual budget directly related to dam and reservoir safety supervision by Federal agencies is approximately \$5,617,500 and that 16,473 dams, approximately 11,000 of which are not included in the definition of "dam" contained in Public Law 92-367, are under the jurisdiction of Federal agencies. Five (5) of the Federal agencies indicate that their current regulations pertaining to dam safety do not fully meet present requirements and plans are being made to modify existing regulations to improve and strengthen dam safety programs. These agencies are the Bureau of Land Management, Bureau of Sport Fisheries and Wildlife, U.S. Geological Survey, Mining Enforcement and Safety Administration, and the Corps of Engineers (regulations governing dam permits under Section 9 of the River and Harbor Act of 1899).

#### 8. INSPECTION GUIDELINES

Recommended technical guidelines for performing safety inspections of dams were drafted to outline principal factors to be weighed in identifying deficiencies and hazardous conditions. They were developed with the assistance of State agencies, other Federal agencies, professional engineering organizations, and private engineers. These "Recommended Guidelines" are attached to this report as Appendix D.

Since the scope and completeness of each investigation would depend upon the availability and suitability of engineering data, the validity of original design assumptions and the physical conditions at the dam, the guidelines provide for two phases of investigation. Phase I would be an inspection to assess the general condition of the dam and determine the need for any additional engineering investigations and analyses. It would consist of a visual examination of the dam and a review of available engineering data, including operating records. It is not intended that costly explorations or analyses would be performed during a Phase I inspection.

Phase II investigations would be performed where the results of the Phase I inspection indicate the need for additional investigations and studies. Phase II would include, as required, all additional visual examinations, measurements, foundation exploration and testing, materials testing, hydraulic and hydrologic analyses, and structural stability analyses deemed essential to evaluate the safety of the dam.

The inspection guidelines do not establish rigid criteria or standards but rather provide guidance on the scope of investigations, both Phase I and Phase II, and present reasonable evaluation factors with which to compare existing conditions. Safety must be evaluated in light of peculiarities and local conditions at a particular dam and in recognition of the many factors involved, some of which may not be precisely known. This can only be done by competent, experienced engineering judgement, which the guidelines are intended to supplement and not replace. Conditions found which do not meet guideline recommendations are to be assessed by the investigator as to their importance from the standpoint of the involved degree of hazard. Many deviations will not compromise project safety while others will involve various degrees of risk, the proper evaluation of which will afford a basis for priority of subsequent attention and possible remedial action. As experience is gained with use of the guidelines the need for revisions will become evident and a continuing updating effort is foreseen.

The guidelines present only procedures for investigating and evaluating existing conditions. Their scope does not encompass the studies and engineering required for project modifications to correct deficiencies found by the investigation.

#### 9. NEED FOR NATIONAL PROGRAM

Any artificial barrier which impounds or diverts water creates a potential hazard to human life and property located downstream. The potential hazard is created by the possibility of a sudden release of the water behind the dam as a result of failure of the dam or mis-operation of the discharge facilities. This ever present potential hazard dictates that dams be properly designed, constructed, operated and maintained to reduce the risk of failure or mis-operation throughout the life of the dam.

The United States Committee on Large Dams conducted a questionnaire survey of past dam failures (prior to 31 December 1972) within the United States. Results were recently published jointly by the American Society of Civil Engineers and the United States Committee on Large Dams in a report entitled "Lessons from Dam Incidents, USA," 1975. The report lists 39 major dam failures which resulted in complete abandonment of the dam, 37 major failures where the damage was successfully repaired and the dam placed in operation again, and some 104 accidents which were prevented from becoming failures by expeditious remedial work or operating measures, such as drawing down the pool. In addition, some 171 other types of accidents or damages were reported which were considered not to affect the immediate public safety.

It has long been recognized that the protection of the health, safety and welfare of its citizens is a governmental responsibility and,

therefore, the protection of human life and property from potential hazards created by dams and the water they impound is deemed a governmental concern. Although the adequacy and safety of dams owned and operated by numerous governmental agencies, public and private organizations, and private individuals are the obligations of the owners, the need for governmental regulation of some type to insure that the owners' obligations are properly carried out is considered evident. Similar social needs have long been recognized in building codes, elevator inspections, bridge inspections, and many other facets of modern life where governmental regulation has been found necessary to protect the public. A substantial number of Federal and State agencies as well as private engineering organizations agree that a national dam safety program should be implemented.

P.L. 92-367 has been the stimulus for two national conferences of the Engineering Foundation (an endowed, non-profit organization which sponsors meetings designed to increase engineering knowledge) and for actions taken at several meetings of interested State organizations. Engineering Foundation Conferences of national scope were held during September 1973 on "Inspection, Maintenance and Rehabilitation of Old Dams" and in August 1974 on "Safety of Small Dams." Resolutions adopted by participants at both Conferences emphasized the need for a dam safety program and recommended that such a program be financed on a Federal-State cost sharing basis. Copies of these resolutions are contained in Appendix E.

Also in Appendix E are copies of pertinent resolutions adopted by (1) the Association of Western State Engineers at their 47th Annual Meeting on 30 August 1974; (2) the Western States Water Council at a 13 October 1972 Meeting; and (3) the Southern Environmental Resources Conference on 6 June 1974. These organizations support the view that the States should have primary responsibility for the safety of non-Federal dams and recommend that the States be provided Federal financial assistance for the implementation of dam safety programs.

#### 10. ELEMENTS OF A NATIONAL PROGRAM

The prosecution of a national dam safety program would require suitable legislation and regulations to define the scope of supervision and authority over dams and to empower designated agencies (Regulatory Agencies) to carry out regulatory functions. These functions would pertain to the design, construction, operation, maintenance, enlargement, modification, removal or abandonment of dams and reservoirs.

##### a. Model Law

Following the failure of several large dams in the United States and Europe, the United States Committee on Large Dams (USCOLD) undertook a survey of the practices and regulations of the States controlling



the design and construction of dams in the United States. Concerned with the apparent lack of adequate supervision of dams revealed by its survey, USCOLD appointed a committee of its members to draft a model law for State supervision of dams and reservoirs. The committee developed the text of a proposed model law which was circulated to the Governors of the 50 States and to other concerned State officials for review and comment. Based upon comments received from 47 States the model law was revised and subsequently printed and distributed in 1970 to the Governors of the 50 States and their respective officials responsible for supervision of dams. The published Model Law for State Supervision of Safety of Dams and Reservoirs which is contained in Appendix C is an excellent example of what is considered adequate legislation covering State authority over the supervision of dams and reservoirs.

The USCOLD model law provides for the safety supervision of dams and reservoirs in all stages of design, construction, operation, maintenance, enlargement, modification, removal or abandonment. It was intended that the Model Law be modified as required to fit the needs of individual States.

b. Regulatory Functions

Based upon the provisions of the USCOLD Model Law and the reported experiences of State and Federal agencies and private engineering organizations, the regulatory agency should perform the following functions to insure the adequacy of dams and reservoirs:

(1) Review and approve the plans and specifications to construct, enlarge, modify, remove or abandon a dam or reservoir. The plans and specifications should be supported by engineering data, including design analyses, in sufficient detail to permit the regulatory agency to determine the safety, adequacy and suitability of the proposed action before the action is undertaken.

(2) Perform periodic inspections during construction for the purpose of insuring compliance with the approved plans and specifications.

(3) Upon completion of construction, issue a certificate of approval. The owner would be required to submit to the regulatory agency the "as-built" drawings and other construction records such as foundation data and geological features, properties of embankment and foundation materials, concrete properties and construction history for review and approval. Upon approval of data and the determination of the adequacy of the structure, the certificate of approval would be issued permitting the owner to store water.



(4) Investigate the dam and reservoir at least every five years to determine their continued safety. The investigations should be detailed, systematic, technical inspections and evaluations to analyze and evaluate the hydraulic and hydrologic capabilities, structural stability and operational adequacy of the project features in order to determine if the dam and reservoir constitute a danger to human life or property. The Recommended Guidelines for Safety Inspection of Dams, contained in Appendix D, present technical procedures for performing safety investigations.

(5) Issue notices when appropriate to require the owner of the dam and reservoir to perform necessary maintenance or remedial work, revise operating procedures or take other actions including breaching of the dam when deemed necessary. The regulatory agency, under the police power of the State, should enforce these notices and when emergencies exist have the work performed under its direction and supervision if the owner fails to do so.

c. Initial Inspections

Implementation of a periodic investigative program for existing dams would be accomplished by an intensive initial inspection effort. Essentially, this would consist of Phase I inspections to identify expeditiously those dams which may pose a hazard to human life or property. It is believed that a 5-year period would be a reasonable interval in which the estimated 20,000 dams in the significant and high hazard potential categories could be inspected effectively. When the results of the Phase I inspection indicate the need for additional investigations, the owner should be required, under supervision of the regulatory agency, to have the additional investigations, Phase II, performed by qualified personnel.

11. RESPONSIBILITY FOR SUPERVISION OF PROGRAM

a. General

The division of jurisdiction of the Federal and State governments over the water resources of the Nation has been fairly well defined by existing laws and precedent. Discussion of the supervision of dams is simplified by placing the dams in two broad categories, i.e., Federal and non-Federal dams. In developing recommendations for a comprehensive national dam safety program several alternatives were considered for assigning supervisory responsibility for both Federal and non-Federal dams.

b. Federal Dams

There are approximately 5,500 dams conforming to the height and capacity requirements of Public Law 92-367 in this category. These are

dams located on lands under the jurisdiction of the Forest Service, U.S. Geological Survey, and Bureau of Indian Affairs; dams owned and operated by the Corps of Engineers and dams otherwise under the jurisdiction of the Corps of Engineers under authority of Section 9 of the River and Harbor Act of 1899; dams owned, operated and located on lands under the jurisdiction of the Bureau of Land Management; dams under the jurisdiction of the Bureau of Reclamation; dams owned and operated by the Bureau of Sport Fisheries and Wildlife, the International Boundary and Water Commission and Tennessee Valley Authority; dams under the jurisdiction of the Mining Enforcement and Safety Administration under authority of the 1966 Federal Metal and Nonmetallic Mine Safety Act and the Federal Coal Mine Health and Safety Act of 1969; dams licensed by the Federal Power Commission under authority of the Federal Power Act; and dams located on lands of military installations and Federal prisons.

While various alternatives regarding the responsibility for supervising the safety of Federal dams are available, only one alternative is deemed acceptable and practicable. This alternative would require the Federal agency owning or operating the dam, owning the land on which the dam is located, or which has existing regulatory jurisdiction over the dam to assume the responsibility. Other possible alternatives include (1) the designation of a single Federal agency to regulate all dams under Federal jurisdiction; (2) expansion of the existing regulatory authority of the Federal Power Commission, Mining Enforcement and Safety Administration and Corps of Engineers to cover all dams under Federal jurisdiction; and (3) assign the responsibility for the program to designated agencies which have the existing expertise and capabilities to conduct the program.

The alternative considered most acceptable would assign responsibility for the dam safety program to the agency most familiar with the structure involved and would require no major shifts of project responsibilities among the Federal agencies. It would, however, require some revisions of agency administrative procedures and allocations of resources to implement the program. Those Federal agencies currently lacking technical expertise and capabilities to conduct the program could utilize upon request the existing expertise and capabilities of the Corps of Engineers, Bureau of Reclamation or others to assist in the implementation of a dam safety program.

Some privately owned dams are located on Federally owned lands. These dams are largely located within National Forest boundaries and occupy Federal lands under various authorities. While the administration of private developments on Federal lands generally is in cooperation with State and local authorities, the ultimate responsibility for public safety on Federal lands would appear to rest with the Federal

government. Hence it appears desirable to provide for supervision of such privately owned dams by the Federal agency most concerned.

#### c. Non-Federal Dams

The non-Federal dam category includes approximately 43,500 dams and reservoirs conforming to the height and capacity requirements of Public Law 92-367. These dams are owned and operated by numerous State and local governmental agencies, public and private organizations and private individuals and are not under the jurisdiction of the Federal government. In general the protection of the health, safety and welfare of its citizens has been recognized as a State responsibility in this country. Under this concept, as has been noted, the majority of the States and Territories have enacted laws recognizing the police powers of the State over the regulation of dams. Hence, a national program for dam safety should recognize the primacy of State authority in regulating non-Federal dams and seek to strengthen, not supplant, existing State efforts. Such a goal has been assumed in the recommendations of this report.

While some local governmental agencies and public and private organizations may have a technical capability adequate for supervising dam safety, it appears appropriate that the final authority and responsibility rest with the State agency designated by the Governor. Thus the responsibility of local government and public and private interests will be primarily dictated by the legislation of each State. All dam owners, whether public or private interests, have the ultimate responsibility for safe structures and such responsibility needs to be adequately defined by State legislation.

Where a State program for dam safety does not exist, one could be adopted by enactment of legislation similar to the USCOLD Model Law for State Supervision of Dams and Reservoirs (Appendix C). Changes in the Model Law to meet constitutional and legal requirements, the organizational structure, and financial system of the State would be appropriate. The State regulatory agency would need to be provided with adequate personnel, financing, and powers to enforce its rules and regulations.

#### 12. COST OF PROGRAM

The total cost of implementing and prosecuting a national dam safety program is extremely difficult to forecast because of uncertainties such as total number of dams to be investigated; the depth of investigations which would be found necessary; the amount of effort which would be involved in licensing and inspecting new construction,



including the review and approval of plans and specifications; and the supervision which would be needed in connection with repair and modifications. Cost data on the programs of the State of California, the Tennessee Valley Authority, the Bureau of Reclamation and the Corps of Engineers show a wide range of costs and reflect different intensities and frequencies of inspections and different scopes of other regulatory activities. Although no direct cost comparisons can be made between the programs of these agencies and the recommended dam safety program, an evaluation of the available cost experience leads us to believe that the total annual program cost for the 49,000 dams would be about \$73,500,000, which represents an average of \$1,500 per dam per year. About \$65,500,000 would be for the programs covering 43,500 non-Federal dams and \$8,000,000 for the 5,500 Federal dams. These costs assume that periodic inspections would be conducted at five year intervals and would be made only for the dams with significant and high hazard potential. We estimate that about 20,000 dams are in these categories with about 9,000 being in the high hazard potential category and 11,000 in the significant hazard potential category.

The cost of performing the initial Phase I inspections of significant and high hazard potential dams is expected to range between \$5,000 and \$10,000 per dam depending upon the dam's size and complexity. Assuming an average cost of \$7,500 per dam, the total annual cost of the initial Phase I inspections of significant and high hazard dams should be about \$30,000,000 if all these dams are inspected within a five-year interval. About \$27,000,000 of this annual cost would be for the inspection of non-Federal dams.

These estimates do not include the costs related to extensive in-depth studies, investigations or analyses required to evaluate deficiencies and hazardous conditions found by the regulatory agencies' investigations, nor the remedial work necessary to eliminate deficiencies or hazardous conditions.

### 13. COST-EFFECTIVENESS OF PROGRAM

While it is not possible to demonstrate absolutely that the proposed inspection and regulation program is the most cost-effective solution to the national dam safety problem it appears that it is cost effective. The proposed program would require substantial expenditures; however, we believe that in the long run the program would require less expenditure than continuation of the status quo. Under present conditions, when a dam failure occurs extensive assistance is necessary in the form of services during recovery operations and in the form of disaster relief payments.



It is difficult to ascertain the total cost of disasters such as those which occurred at Buffalo Creek and at Rapid City; but surely the cost is in the tens of millions of dollars, if not in the hundreds of millions. An inspection and regulation program that would virtually eliminate all significant property damage or loss of life should, in time, produce benefits (in terms of disaster assistance averted) that would exceed the cost of the program. These benefits, together with other benefits such as reductions in loss of life and property and minimization of social disruption and human suffering, make a compelling case for an inspection and regulation program.

#### 14. IMPACT OF PROGRAM

##### a. Economic Resources

As indicated in paragraph 12 the impact of the proposed program on the economic resources of the Nation cannot be forecast at this time. However, as stated above the total annual expenditure of funds to perform regulatory functions only would be about \$73,500,000. This sum includes, for the first five years, a recommended \$30,000,000 annual expenditure for performing initial inspections of existing dams. The initial inspections would provide a better understanding of the scope and nature of the problem and would develop information upon which an accurate assessment of the impact on the owners of dams, both public and private, could be based. The increased costs to be borne by dam owners would include the additional studies and investigations found necessary by the initial inspections as well as any remedial work. While these expenses may be substantial to correct deficiencies and inadequacies due to past neglect, the impact could be tempered by prudent scheduling and the establishment of priorities based upon the relative degree of involved hazards.

##### b. Technical Capabilities

The impact of the proposed program on technical capabilities would be an increasing need for qualified engineers experienced in the design, construction and operation of dams. Based upon California's experience and a cursory review of capabilities of Architect-Engineer firms, a sufficient number of qualified engineers and technicians are available in the public and private sectors to staff adequately the required regulatory staffs and to accomplish the proposed initial inspections of existing dams within a 5-year period. Other needs of the program, including in-depth studies and the engineering of remedial works, are expected to be met by proper scheduling and an expansion of capabilities which would accompany increased experience and demand.

## 15. FINANCING OF PROGRAM

As has been noted in responses by State agencies, implementing a national dam safety program as contemplated in this report would involve some financing problems for just the work of inspection and supervision by governmental agencies, neglecting any following costs for remedial work to correct conditions found in inspections. No comprehensive study has been made of the problems in financing inspection and supervision activities. Hence, no recommendations are made in regard to such financing arrangements. Some of the considerations applying to the financing problem are as follows:

### a. Federal Agencies

Several Federal agencies would require additional resources, both in funds and personnel, to implement their share of the national program contemplated in this report. However, once the program is adopted, it appears that each agency could obtain the needed resources through normal budgeting and appropriation procedures. For the Federal agencies having major responsibilities for dam construction and continuing supervision such resources should be adequate to permit, in addition to the implementation or continuation of a safety program for the dams for which the agency is responsible, the furnishing of technical assistance and guidance for State programs upon request.

### b. State Activities

As a number of State representatives have indicated, it appears that some States would face difficulties in allocating the personnel and funds needed for their share of a national dam safety program as contemplated in this report. It may be possible that the proposed State supervision of non-Federal dams could be implemented with funding from the general resources of each State involved augmented perhaps with fees collected from the owner of each dam supervised. However, in light of the indications of funding problems already expressed and the past inaction of many States in the face of recognized dam safety problems, it may be considered desirable to provide incentives to the States to implement their share of a national dam safety program.

## 16. CONCLUSIONS

### a. General

(1) Past incidents of dam failure have demonstrated that adequate attention has not always been given to the regulation of design, construction, operation and maintenance of dams.

(2) While the number of dams which are an actual hazard to human life or property is unknown, estimates based upon incomplete data from the inventory indicate that approximately 40% of existing dams present a significant or high hazard potential to downstream areas. That is, about 20,000 dams are so located that failure would result in loss of life and damage to homes, buildings, public utilities, highways or railroads. Although only a relatively low number are believed to present a real hazard at this time, a program to identify critical situations and to monitor future developments is deemed essential. Changing conditions due to aging of structures and facilities and growth in downstream areas necessitate that continual surveillance be provided.

(3) Dam safety programs in most States and in some Federal agencies having water resources responsibilities are either nonexistent or inadequate. The wide variations in practices, regulations and capabilities of supervising agencies attest to the need for a unified approach to the dam safety problem.

(4) The Federal agencies have discharged their responsibilities for the safety of dams under their jurisdiction with varying degrees of effectiveness depending upon technical capabilities and financial resources. Excellent technical capabilities for supervision of dam safety exist with the Federal agencies whose primary responsibility is the development of water resources. The capabilities of these water resources agencies should be utilized by other agencies which do not have the same expertise and experience in the design, construction, operation and maintenance of dams.

#### b. Safety Program

(1) A dam is a complex structure whose safety and continuing adequacy involve the ability of the structure to interact with its foundation in withstanding applied forces which are dependent upon many variable conditions. A high degree of professional engineering performance is required to insure adequacy of design and construction. To further reduce the risk of failure or mis-operation, continued surveillance of the dam and appurtenant works is necessary to detect conditions of significant structural distress or operational inadequacy and to provide a basis for timely initiation of restorative and remedial measures if necessary.

(2) Based on past history, recommendations of States and technical societies, and the general public's apprehension as recognized by P.L. 92-367, it is evident that a comprehensive national dam safety program is needed in the United States to provide for consistent regulation of design, construction, operation and maintenance of dams.



(3) Authorities should be established to regulate the design, construction, operation, maintenance, enlargement, modification, removal or abandonment of dams and reservoirs, and such authorities should be provided with adequate personnel, financing and powers to enforce their rules and regulations and accomplish their regulatory functions. The jurisdiction of regulatory agencies should cover all existing and future dams as defined by Public Law 92-367. These agencies should have authority to perform the five principal functions outlined in paragraph 10b.

c. Supervision

The adequate design, construction and surveillance of dams require professional engineering services. To insure that competent, professional attention is directed toward the question of dam safety, supervision of the recommended dam safety program should be placed under the jurisdiction of Federal and State agencies.

(1) States

Each State should have jurisdiction over all dams and reservoirs within its boundaries except for those owned or operated by an agency of the Federal government, those located on lands owned by an agency of the Federal government, and dams under the jurisdiction of (1) the Federal Power Commission under the authority of the Federal Power Act, (2) the Secretary of the Army under Section 9 of the River and Harbor Act of 1899, and (3) the Mining Enforcement and Safety Administration of the Department of Interior under authority of the 1966 Federal Metal and Nonmetallic Mine Safety Act and the Federal Coal Mine Health and Safety Act of 1969. Dams constructed with technical assistance and financial support of the Soil Conservation Service, except those under the regulatory jurisdiction of Federal agencies, should be under the jurisdiction of the States since the ownership and responsibility for operation and maintenance rest with the local sponsor after completion of construction.

(2) Federal

Federal agencies should have jurisdiction over all dams and reservoirs excluded from the States' jurisdiction.

d. National Dam Inventory

The data compiled in the national dam inventory should be of value in all aspects of water resources development and should prove useful to public and private interests in planning of future developments, utilization of existing water resources, and in emergency situations such as floods. It is, therefore, deemed advisable that the inventory



be kept current. Updating the inventory could also facilitate the monitoring of frequency of inspections and transfers of ownership.

#### 17. RECOMMENDATIONS

a. A comprehensive National Dam Safety Program such as outlined in this report should be implemented. State responsibility, under the police powers of the State, to protect the health, safety and welfare of its citizens should be recognized and all States and Territories should be encouraged to prosecute dam safety programs encompassing all dams not under Federal authority.

b. Implementation of a National Dam Safety Program should be followed immediately by the inspection over a reasonable and practicable time period of all existing dams which have a hazard potential of high or significant, as defined in the Inspection Guidelines, Appendix D.

c. Those Federal agencies possessing technical expertise and capabilities in the field of dam design and construction should be authorized to furnish technical assistance and guidance to the States, upon request, concerning State programs and the elimination or mitigation of any hazardous conditions which may be found by the States.

d. Federal agencies owning and operating dams, owning the land on which dams are located, and the agencies having existing regulatory jurisdiction over dams should prosecute the recommended dam safety program for the dams under their jurisdiction.

e. The Chief of Engineers, U.S. Army should be provided authority and funds to maintain current the National Dam Inventory.









APPENDIX A

RESPONSES TO QUESTIONNAIRE ON  
SUPERVISION OF DAMS BY STATE AUTHORITIES

| Contents                      | Page |
|-------------------------------|------|
| 1. Questionnaire              | A-3  |
| 2. Responses to Questionnaire | A-7  |

A survey of each State's and Territory's capabilities, practices and regulations regarding the design, construction, operation and maintenance of dams was conducted by furnishing the Governor of each State and Territory the attached questionnaire on Supervision of Dams by State Authorities. Fifty-three of the 55 States and Territories responded to the questionnaire. The responses from each State and Territory to each of the questions contained in the questionnaire are tabulated on pages A-7 through A-165.

**NATIONAL PROGRAM FOR INSPECTION OF DAMS  
QUESTIONNAIRE**

**SUPERVISION OF DAMS  
BY STATE AUTHORITIES**

Form Approved:  
OMB 49-S-73002

Reports Control Symbol:  
DAEN-CWE(OT) 973

STATE: \_\_\_\_\_

DATE: MO. \_\_\_\_\_ YR. \_\_\_\_\_

|     |                                                                                                                                                                                                                                                                       | YES | NO |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 1.  | Does the state government exercise control over dams and reservoirs with respect to:                                                                                                                                                                                  |     |    |
|     | a. Design?                                                                                                                                                                                                                                                            |     |    |
|     | b. Construction?                                                                                                                                                                                                                                                      |     |    |
|     | c. Operation?                                                                                                                                                                                                                                                         |     |    |
|     | d. Maintenance?                                                                                                                                                                                                                                                       |     |    |
| 2.  | As of the latest count, how many dams are under control of State? Give their number _____<br>(as of _____ Date)                                                                                                                                                       |     |    |
| 3.  | Is a roster of such dams readily available to Public?<br>Please give latest date of such roster _____                                                                                                                                                                 |     |    |
| 4.  | Is the function of dam supervision performed by a separate identifiable office, division or Bureau of the State?<br>Or is it merged in aid with some other general activities of the state engineer or some other official office?<br>Name organizational unit: _____ |     |    |
| 5.  | Is the supervisory function required to be directed by an engineer registered under state law?<br>Or are registered engineers required in the organizational unit or activity?<br>If so, name organizational unit: _____                                              |     |    |
| 6.  | Full title and address of office administering regulations; and name and title of official to whom inquiries and application should be made.                                                                                                                          |     |    |
| 7.  | Name of any other state agency the approval of which is required before the construction of a dam is undertaken, such as health, water rights, etc. If any, give name and address if other than above.                                                                |     |    |
| 8.  | Authority, legislation or other basic instrument establishing state supervision. Give original date and date of latest amendment. Please summarize and enclose copy if available.                                                                                     |     |    |
| 9.  | Are printed regulations and/or instructions available to the public?<br>If yes, give title and latest revision date.                                                                                                                                                  |     |    |
| 10. | Please state any limitations or exceptions, as to size, type, capacity, off-stream location, or class of ownership of dams (or reservoirs) subject to regulations.                                                                                                    |     |    |
| 11. | Are special agencies, such as municipal utility districts, irrigation districts, cities, etc., exempt from permit requirements?<br>If so, specify.                                                                                                                    |     |    |
| 12. | Under the regulations of your state, please give definition of "Height of Dam" and "Reservoir Capacity."                                                                                                                                                              |     |    |
| 13. | Is permit or license required prior to the commencement of construction of dam?                                                                                                                                                                                       |     |    |
| 14. | Is a fee charged?                                                                                                                                                                                                                                                     |     |    |
| 15. | Upon completion of a dam, is there a requirement for the issuance of a certificate or license before commencement of storage in reservoir?                                                                                                                            |     |    |

|     |                                                                                                                          | YES | NO |
|-----|--------------------------------------------------------------------------------------------------------------------------|-----|----|
| 16. | Is there any requirement for periodic renewal of license or permit to continue a dam in service?                         |     |    |
|     | If yes, for what period?                                                                                                 |     |    |
|     | Is a fee charged?                                                                                                        |     |    |
| 17. | Is a permit required for enlargement, modification or repair of dam?                                                     |     |    |
|     | If yes, under what circumstances?                                                                                        |     |    |
| 18. | Is on-site inspection by state personnel required during construction?                                                   |     |    |
| 19. | Are there any requirements for record keeping during the construction and operation of such dam or reservoir?            |     |    |
|     | If yes, what type of record is required, and what data are recorded?                                                     |     |    |
| 20. | What is done with the data accumulated?                                                                                  |     |    |
|     | Does the owner retain, or must it be sent to the state?                                                                  |     |    |
|     | What is frequency of sending data to the state?                                                                          |     |    |
|     | If sent to the state, is it reviewed and analyzed?                                                                       |     |    |
| 21. | Are inspections for safety purposes made by the state after completion of dam?                                           |     |    |
|     | If yes, is there a definite schedule of inspections?                                                                     |     |    |
| 22. | Who does the inspection, and at whose expense?                                                                           |     |    |
| 23. | Are there any other conditions, for example on complaint, under which inspections can be made?                           |     |    |
|     | If yes, what are these conditions, and to what official is request made?                                                 |     |    |
| 24. | Are there any state requirements for operation and maintenance?                                                          |     |    |
|     | Do these include continuous surveillance or monitoring?                                                                  |     |    |
| 25. | How is enforcement of supervision achieved? Please explain.                                                              |     |    |
| 26. | Is there a requirement that design of any dam under the regulations shall be done by a registered professional engineer? |     |    |
| 27. | Are there any exemptions to the above requirements?                                                                      |     |    |
|     | If yes, what are the circumstances?                                                                                      |     |    |
| 28. | Are design criteria prescribed by the state and available in printed form?                                               |     |    |
|     | If yes, give the title and date of latest revision or edition of such design criteria document.                          |     |    |
| 29. | Are plans and designs reviewed by the state in preliminary form?                                                         |     |    |
| 30. | Are contract plans and specifications reviewed by the state?                                                             |     |    |



|     |                                                                                                                                                                           | YES | NO |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 31. | Is there a requirement that they later be replaced and verified with final as constructed drawings?                                                                       |     |    |
| 32. | Are dam designs required to meet specific criteria relating to special hazards such as spillway design, floods or earthquakes, or location above densely populated areas? |     |    |
|     | If yes, explain.                                                                                                                                                          |     |    |
| 33. | Is there a requirement for geologic, soils and hydrologic data to be filed with application for permit?                                                                   |     |    |
|     |                                                                                                                                                                           |     |    |
| 34. | Are there any requirements for special instrumentation in interest of dam safety?                                                                                         |     |    |
|     | What kind? Please explain.                                                                                                                                                |     |    |
| 35. | Based on past experience, do the current regulations fully meet the present needs of the state?                                                                           |     |    |
|     | If no, what areas appear in need of change?                                                                                                                               |     |    |
| 36. | Are there any active plans under consideration to modify existing regulations?                                                                                            |     |    |
|     | If so, what?                                                                                                                                                              |     |    |
| 37. | What is the approximate annual budget for the current fiscal year to the office or staff directly related to dam and reservoir supervision?                               |     |    |
|     | In Dollars _____ In Man-Years _____                                                                                                                                       |     |    |
| 38. | What is the state policy with respect to dams now in operation which were constructed prior to present requirements for a permit?                                         |     |    |
| 39. | Where construction and/or performance records are missing or inadequate, does the state require field investigations and stability analyses to now be undertaken?         |     |    |
|     | If yes, explain.                                                                                                                                                          |     |    |

40. General remarks and expanded replies.

1. Does the State government exercise control over dams and reservoirs with respect to: a. Design? b. Construction? c. Operation? d. Maintenance?

|                                                                                                                                                                     | <u>DESIGN</u>      | <u>CONSTRUCTION</u> | <u>OPERATION</u> | <u>MAINTENANCE</u> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|------------------|--------------------|
| Alabama                                                                                                                                                             | No                 | No                  | No               | No                 |
| Alaska                                                                                                                                                              | No                 | No                  | No               | No                 |
| Arizona                                                                                                                                                             | Yes                | Yes                 | Yes              | Yes                |
| Arkansas                                                                                                                                                            | Yes                | Yes                 | Yes              | Yes                |
| California                                                                                                                                                          | Yes                | Yes                 | Yes              | Yes                |
| Colorado                                                                                                                                                            | Yes                | Yes                 | Yes              | Yes                |
| Connecticut                                                                                                                                                         | Yes                | Yes                 | No               | No                 |
| Delaware                                                                                                                                                            | Yes                | Yes                 | No               | No                 |
| Florida<br>DNR <sup>(1)</sup>                                                                                                                                       | No                 | No                  | Yes              | No                 |
| DPC <sup>(2)</sup>                                                                                                                                                  | Yes <sup>(3)</sup> | Yes                 | Yes              | Yes                |
| (1) Department of Natural Resources<br>(2) Department of Pollution Control<br>(3) Minimum Requirements for Earthen Dams, Phosphate Mining and Processing Operations |                    |                     |                  |                    |
| Georgia                                                                                                                                                             | No                 | No                  | No               | No                 |
| Hawaii                                                                                                                                                              | --                 | --                  | --               | --                 |
| Idaho                                                                                                                                                               | Yes                | Yes                 | Yes              | Yes                |
| Illinois                                                                                                                                                            | Yes <sup>(1)</sup> | No                  | No               | No                 |
| (1) Hydraulic Design only                                                                                                                                           |                    |                     |                  |                    |
| Indiana                                                                                                                                                             | Yes                | Yes                 | Yes              | Yes                |
| Iowa                                                                                                                                                                | Yes                | Yes                 | Yes              | Yes                |

1 (Continued)

|                          | <u>DESIGN</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <u>CONSTRUCTION</u> | <u>OPERATION</u>   | <u>MAINTENANCE</u> |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|--------------------|
| Kansas                   | Yes <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Yes <sup>(2)</sup>  | No                 | Yes <sup>(3)</sup> |
|                          | (1) With exceptions<br>(2) With exceptions to some extent<br>(3) With exceptions to some extent                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |                    |                    |
| Kentucky                 | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | No                  | No                 | No                 |
| Louisiana <sup>(1)</sup> | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | No                  | No                 | No                 |
|                          | (1) Louisiana exercises control over dam construction only with regard to State-owned water bottoms and/or natural drains through administration of permit applications. The operation and maintenance controls are only exercised on State-owned facilities by the agency responsible for the project.                                                                                                                                                                                                             |                     |                    |                    |
| Maine                    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | No                  | No                 | No                 |
| Maryland                 | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Yes                 | Yes                | Yes                |
| Massachusetts            | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Yes                 | Yes <sup>(1)</sup> | Yes <sup>(2)</sup> |
|                          | (1) Annual notice sent each Fall to owners and caretakers of dams, alerting them to prepare for possible high water conditions during Winter and Spring.<br><br>(2) Our biennial inspections provide us with a means of control. Hazardous conditions and visible structural defects are noted and subsequently reported to the owner or caretaker for appropriate action. In many instances no deficiencies are observed and our recommendations and comments pertain only to regular maintenance work on the dam. |                     |                    |                    |
| Michigan                 | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Yes                 | No                 | -- <sup>(1)</sup>  |
|                          | (1) Section 2c of Act 184, Public Acts of 1963 as amended states "When in the opinion of the department, a hazardous condition may exist in the structure of an existing dam, the department may require the owner to submit a report prepared by a professional engineer to the department on the condition of the dam. The report shall include statements as to whether leakage is present, whether there are any signs of disintegration                                                                        |                     |                    |                    |



|                      | <u>DESIGN</u>      | <u>CONSTRUCTION</u>                                                                                                                                                                                                                                                                                                                  | <u>OPERATION</u> | <u>MAINTENANCE</u> |
|----------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|
| Michigan (continued) |                    | or erosion of the material of the dam or the abutments or the foundation, and shall include statements of any other changes in the condition of the dam that may relate to its safety. After an inspection, the department may require the owner to make necessary repairs or to remove the dam if the public safety is endangered." |                  |                    |
| Minnesota            | Yes                | Yes                                                                                                                                                                                                                                                                                                                                  | Yes              | Yes                |
| Mississippi          | No                 | No                                                                                                                                                                                                                                                                                                                                   | Yes              | No                 |
| Missouri             | No                 | No                                                                                                                                                                                                                                                                                                                                   | No               | No                 |
| Montana              | No                 | No                                                                                                                                                                                                                                                                                                                                   | No               | No                 |
| Nebraska             | Yes                | Yes                                                                                                                                                                                                                                                                                                                                  | Yes              | Yes                |
| Nevada               | Yes                | Yes                                                                                                                                                                                                                                                                                                                                  | Yes              | Yes                |
| New Hampshire        | Yes                | Yes                                                                                                                                                                                                                                                                                                                                  | Yes              | Yes                |
| New Jersey           | Yes <sup>(1)</sup> | Yes                                                                                                                                                                                                                                                                                                                                  | No               | Yes <sup>(2)</sup> |

(1) In accordance with limitation of law, N.J. Title 58, Chapter 4-1 et seq.

(2) NJSA 58:4-5 "If in the judgement of the commission, such reservoir or dam is not sufficiently strong to resist the pressure of water upon it or there is a reasonable cause to believe that danger to life or property may be apprehended from the reservoir or dam, or if for any other cause the commission shall determine the reservoir or dam to be unsafe, it shall determine whether the water in such reservoir or above such dam shall be drawn off in whole or part, and what alternatives, additions or repairs are necessary to be made to the reservoir or dam to make the same safe. The commission shall forthwith in writing order the owner or person having control of the reservoir or dam to cause such alterations, additions and repairs to be made within the time to be limited in the order, and may order the waters above the dam or in the reservoir to be drawn off in whole or in part as it may determine.

## 1 (Continued)

|                | <u>DESIGN</u> | <u>CONSTRUCTION</u>                                                                                                                                                                                                                                                                                                                  | <u>OPERATION</u>   | <u>MAINTENANCE</u> |
|----------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|
| New Mexico     | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | No                 | No                 |
| New York       | Yes           | Yes <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                   | No <sup>(2)</sup>  | No <sup>(3)</sup>  |
|                | (1)           | Occasionally we may check adherence to plans and specifications.                                                                                                                                                                                                                                                                     |                    |                    |
|                | (2)           | Only if safety requires lowering water levels.                                                                                                                                                                                                                                                                                       |                    |                    |
|                | (3)           | Only if safety requires work to be done.                                                                                                                                                                                                                                                                                             |                    |                    |
| North Carolina | Yes           | --(1)                                                                                                                                                                                                                                                                                                                                | --(1)              | --(1)              |
|                | (1)           | It may subject to funds in accordance with Dam Safety Law of 1967.                                                                                                                                                                                                                                                                   |                    |                    |
| North Dakota   | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | Yes                |
| Ohio           | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | Yes                |
| Oklahoma       | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | Yes                |
| Oregon         | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | --                 |
| Pennsylvania   | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | Yes                |
| Rhode Island   | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | No                 | Yes                |
| South Carolina | No            | No                                                                                                                                                                                                                                                                                                                                   | No                 | No                 |
| South Dakota   | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes <sup>(1)</sup> | Yes                |
|                | (1)           | State authority contained in several different sections of Water Statutes as they relate to water rights granting and regulation; drainage district regulations; and watershed district regulation. Thus not the same degree of control over design, construction, operation and maintenance apply to all classes and types of dams. |                    |                    |
| Tennessee      | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | Yes                |
| Texas          | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | Yes                |
| Utah           | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | No                 | Yes                |
| Vermont        | Yes           | Yes                                                                                                                                                                                                                                                                                                                                  | Yes                | Yes                |

## 1 (Continued)

|                 | <u>DESIGN</u>                                                                                                                                                                                                 | <u>CONSTRUCTION</u> | <u>OPERATION</u>   | <u>MAINTENANCE</u> |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|--------------------|
| Virginia        | No                                                                                                                                                                                                            | Yes <sup>(1)</sup>  | Yes <sup>(1)</sup> | No                 |
|                 | (1) Regulation of construction and operation of dams within the Commonwealth of Virginia is exercised only for dams whose purpose is the generation of hydroelectric power for sale or use in public service. |                     |                    |                    |
| Washington      | Yes                                                                                                                                                                                                           | Yes                 | Yes                | Yes                |
| West Virginia   | Yes                                                                                                                                                                                                           | Yes                 | No                 | Yes                |
| Wisconsin       | Yes                                                                                                                                                                                                           | Yes                 | Yes                | Yes                |
| Wyoming         | Yes                                                                                                                                                                                                           | Yes                 | Yes                | Yes                |
| Puerto Rico     | --                                                                                                                                                                                                            | Yes                 | Yes                | Yes                |
| Virgin Islands  | Did Not Answer Questionnaire                                                                                                                                                                                  |                     |                    |                    |
| Guam            | Yes                                                                                                                                                                                                           | Yes                 | No                 | Yes <sup>(1)</sup> |
|                 | (1) Maintenance control is limited to permit requirements for enlargement, modification or repairs of dams.                                                                                                   |                     |                    |                    |
| Trust Territory | Yes                                                                                                                                                                                                           | Yes                 | Yes                | Yes                |
| American Samoa  | Did Not Answer Questionnaire                                                                                                                                                                                  |                     |                    |                    |

2. As of the latest count, how many dams are under control of State?  
Give the number, as of date.

|                                                                                                      | <u>NUMBER</u>     | <u>DATE</u>     |
|------------------------------------------------------------------------------------------------------|-------------------|-----------------|
| Alabama                                                                                              | None              | 15 June 1973    |
| Alaska                                                                                               | --                | --              |
| Arizona                                                                                              | 155               | 1 June 1973     |
| Arkansas                                                                                             | 146               | 31 May 1973     |
| California                                                                                           | 1,088             | 31 March 1973   |
| Colorado                                                                                             | 2,540             | 1 July 1973     |
| Connecticut                                                                                          | 1,036             | 1 August 1973   |
| Delaware                                                                                             | Undetermined      | --              |
| Florida                                                                                              |                   |                 |
| DNR                                                                                                  | Unknown           | --              |
| DPC                                                                                                  | 75 <sup>(1)</sup> | 20 March 1974   |
| (1) This is the number of permitted industrial waste disposal systems<br>which include impoundments. |                   |                 |
| Georgia                                                                                              | Number Unknown    | --              |
| Hawaii                                                                                               | --                | --              |
| Idaho                                                                                                | 433               | 22 October 1973 |
| Illinois                                                                                             | 38                | 3 August 1973   |
| Indiana                                                                                              | 550 (+)           | October 1973    |
| Iowa                                                                                                 | 1,250             | June 1973       |
| Kansas                                                                                               | 7,256             | July 1973       |
| Kentucky                                                                                             | 367               | 6 June 1973     |
| Louisiana                                                                                            | 4                 | September 1973  |
| Maine                                                                                                | N/A               | --              |



## 2 (Continued)

|                                                                                                                                                              | <u>NUMBER</u>              | <u>DATE</u>       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------|
| Maryland                                                                                                                                                     | -- (1)                     | --                |
| (1) The State is taking this opportunity to make a complete count of the number of dams. Our estimate is that there are approximately 120 dams in the State. |                            |                   |
| Massachusetts                                                                                                                                                | 2,704                      | 1 July 1973       |
| Michigan                                                                                                                                                     | 110                        | September 1973    |
| Minnesota                                                                                                                                                    | 1,200 (Approx.)            | 1 October 1973    |
| Mississippi                                                                                                                                                  | N/A                        | --                |
| Missouri                                                                                                                                                     | --                         | --                |
| Montana                                                                                                                                                      | 23                         | 25 May 1973       |
| Nebraska                                                                                                                                                     | 1,100 (+)                  | 1 October 1973    |
| Nevada                                                                                                                                                       | 133                        | April 1973        |
| New Hampshire                                                                                                                                                | 3,000 (Approx.)            | 1973              |
| New Jersey                                                                                                                                                   | 632 (Applications on file) | 16 November 1973  |
| New Mexico                                                                                                                                                   | 327                        | 5 January 1973    |
| New York                                                                                                                                                     | 7,000                      | May 1973          |
| North Carolina                                                                                                                                               | 105                        | 25 September 1973 |
| North Dakota                                                                                                                                                 | 850 (Approx.)              | 1 July 1973       |
| Ohio                                                                                                                                                         | 1,500 (Estimated)          | 1 October 1973    |
| Oklahoma                                                                                                                                                     | 4,000                      | 24 September 1973 |
| Oregon                                                                                                                                                       | 3,000                      | October 1973      |
| Pennsylvania                                                                                                                                                 | 2,700                      | 1 June 1973       |
| Rhode Island                                                                                                                                                 | 521                        | July 1973         |

|                | <u>NUMBER</u>         | <u>DATE</u>    |
|----------------|-----------------------|----------------|
| South Carolina | Unknown               | 30 August 1973 |
| South Dakota   | 1,200 (Estimated) (1) | August 1973    |

- (1) Estimated 1,200 falling in category to be inventoried (over 25 ft. of height and 15 acre feet or over 50 50 acre-feet and 6 ft. of height). In addition all stock dams, dugouts, irrigation dams, water supply, watershed dams subject to water rights provisions.

|            |                 |                   |
|------------|-----------------|-------------------|
| Tennessee  | 700 (Estimated) | 1 July 1973       |
| Texas      | 3,000           | 1 September 1973  |
| Utah       | 530             | 30 April 1973     |
| Vermont    | 355             | 5 March 1973      |
| Virginia   | --              | --                |
| Washington | 635 (1)         | 16 September 1974 |

- (1) The State has general authority over the construction and maintenance of all hydraulic structures with regard to assuring the safety of life and property (RCW 43.21.130). The indicated number of dams is based on an inventory of all dams, excluding those that are Federally owned and operated, that are 10 feet or more in height or have reservoirs that store 10 or more acre-feet of water.

|               |                                                                     |                  |
|---------------|---------------------------------------------------------------------|------------------|
| West Virginia | --                                                                  | --               |
| Wisconsin     | 1,107 (On Navigable waters) 2,000 (Approx. on non-navigable waters) | Current          |
| Wyoming       | 1,400 (1)                                                           | 1 September 1973 |

- (1) This is the number of dams meeting the criteria set up by the Corps of Engineers for the Safety of Dams Inventory. There are several thousand privately owned dams of lesser height or reservoirs of lesser capacity and numerous federally owned dams.

|                |                              |           |
|----------------|------------------------------|-----------|
| Puerto Rico    | 25                           | July 1973 |
| Virgin Islands | Did Not Answer Questionnaire |           |

2 (Continued)

|                 | <u>NUMBER</u>                | <u>DATE</u> |
|-----------------|------------------------------|-------------|
| Guam            | 5                            | July 1973   |
| Trust Territory | 3                            | 1 June 1973 |
| American Samoa  | Did Not Answer Questionnaire |             |

3. Is a roster of such dams readily available to the public? Please give latest date of roster.

| <u>STATE</u>                                                                                                                                                                                                                                                |                   | <u>DATE</u>         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------|
| Alabama                                                                                                                                                                                                                                                     | N/A               | --                  |
| Alaska                                                                                                                                                                                                                                                      | --                | --                  |
| Arizona                                                                                                                                                                                                                                                     | No                | Now being prepared  |
| Arkansas                                                                                                                                                                                                                                                    | Yes               | Current 31 May 1973 |
| California                                                                                                                                                                                                                                                  | Yes               | October 1971        |
| Colorado                                                                                                                                                                                                                                                    | Yes               | 1 July 1972         |
| Connecticut                                                                                                                                                                                                                                                 | Yes               | 1 August 1973       |
| Delaware                                                                                                                                                                                                                                                    | No                | --                  |
| Florida                                                                                                                                                                                                                                                     |                   |                     |
| DNR                                                                                                                                                                                                                                                         | No                |                     |
| DPC                                                                                                                                                                                                                                                         | No <sup>(1)</sup> |                     |
| <p>(1) A continuously updated inventory of permitted industrial waste systems is maintained. A roster of significant industrial waste impoundments only can easily be prepared from this inventory and distributed to anyone desiring such information.</p> |                   |                     |
| Georgia                                                                                                                                                                                                                                                     | No                | --                  |
| Hawaii                                                                                                                                                                                                                                                      | --                | --                  |
| Idaho                                                                                                                                                                                                                                                       | Yes               | August 1971         |
| Illinois                                                                                                                                                                                                                                                    | Yes               | 3 August 1973       |
| Indiana                                                                                                                                                                                                                                                     | Yes               | October 1973        |
| Iowa                                                                                                                                                                                                                                                        | Yes               | 1973                |
| Kansas                                                                                                                                                                                                                                                      | No                | --                  |
| Kentucky                                                                                                                                                                                                                                                    | Yes               | 6 June 1973         |



## 3 (Continued)

| <u>STATE</u>  |                   | <u>DATE</u>                   |
|---------------|-------------------|-------------------------------|
| Louisiana     | Yes               | Dept of P.W. Biennial 1970-71 |
| Maine         | No                | --                            |
| Maryland      | No                | --                            |
| Massachusetts | No <sup>(1)</sup> | 1 July 1973                   |

(1) Inventory files for city and town listing are open to the public, but no bound roster is available.

|               |                    |               |
|---------------|--------------------|---------------|
| Michigan      | No                 | --            |
| Minnesota     | Yes                | November 1968 |
| Mississippi   | No                 | --            |
| Missouri      | No                 | --            |
| Montana       | Yes                | October 1968  |
| Nebraska      | No                 | --            |
| Nevada        | Yes                | 1973          |
| New Hampshire | No                 | --            |
| New Jersey    | Yes                | Continuous    |
| New Mexico    | Yes                | January 1973  |
| New York      | Yes <sup>(1)</sup> | May 1973      |

(1) A county by county tabulation is available.

|                |                    |              |
|----------------|--------------------|--------------|
| North Carolina | Yes <sup>(1)</sup> | Kept current |
|----------------|--------------------|--------------|

(1) Available in office or by call - not published.

|              |                  |           |
|--------------|------------------|-----------|
| North Dakota | Yes (Incomplete) | June 1968 |
| Ohio         | No               | --        |
| Oklahoma     | No               | 1970      |

## 3 (Continued)

| <u>STATE</u>   |     | <u>DATE</u> |
|----------------|-----|-------------|
| Oregon         | Yes | 1973        |
| Pennsylvania   | Yes | 1970        |
| Rhode Island   | Yes | July 1973   |
| South Carolina | No  | --          |
| South Dakota   | No  | --          |
| Tennessee      | No  | --          |
| Texas          | No  | --          |
| Utah           | No  | Current     |
| Vermont        | No  | --          |
| Virginia       | No  | --          |
| Washington     | Yes | -- (1)      |

(1) A new roster will be prepared from the recent inventory to supercede old incomplete list prepared in 1953.

|               |                    |         |
|---------------|--------------------|---------|
| West Virginia | No                 | --      |
| Wisconsin     | Yes <sup>(1)</sup> | Current |

(1) On navigable waters only

|                   |                              |                                |
|-------------------|------------------------------|--------------------------------|
| Wyoming           | Yes                          | Computer printout as requested |
| Puerto Rico       | Yes                          | July 1973                      |
| Virgin Islands    | Did Not Answer Questionnaire |                                |
| Guam              | No                           | --                             |
| Trust Territories | No                           | --                             |
| American Samoa    | Did Not Answer Questionnaire |                                |

4. A. Is the function of dam supervision performed by a separate identifiable office, division or bureau of the State?

B. Or is it merged in and with some other general activities of the state engineer or some other official office?

C. Name Organizational Unit

| <u>STATE</u> | <u>A</u> | <u>B</u> | <u>C. NAME ORGANIZATIONAL UNIT</u>                                                                                    |
|--------------|----------|----------|-----------------------------------------------------------------------------------------------------------------------|
| Alabama      |          | N/A      |                                                                                                                       |
| Alaska       |          | N/A      |                                                                                                                       |
| Arizona      | Yes      | No       | Arizona Water Commission - Division of Safety of Dams                                                                 |
| Arkansas     | Yes      | No       | Division of Soil and Water Resources                                                                                  |
| California   | Yes      | --       | Division of Safety of Dams - A<br>Division of the State Department of Water Resources                                 |
| Colorado     | Yes      | Yes      | Engineering Section - Division of Water Resources, Dams and Reservoirs Branch                                         |
| Connecticut  | Yes      | No       | Department of Environmental Protection                                                                                |
| Delaware     | --       | Yes      | Water Resources Section, Division of Environmental Control, Department of Natural Resources and Environmental Control |
| Florida      |          |          |                                                                                                                       |
| DNR          | --       | --       |                                                                                                                       |
| DPC          | No       | Yes      | Regional Administrators, Department of Pollution Control                                                              |
| Georgia      |          | N/A      |                                                                                                                       |
| Hawaii       |          | N/A      |                                                                                                                       |
| Idaho        | No       | Yes      | Idaho Department of Water Administration                                                                              |
| Illinois     | No       | No       |                                                                                                                       |
| Indiana      | Yes      | No       | Natural Resources Commission through the Division of Water, Department of Natural Resources                           |

## 4 (Continued)

| <u>STATE</u>  | <u>A</u> | <u>B</u> | <u>C. NAME OF ORGANIZATIONAL UNIT</u>                                                                                                                                                                                                                                                                                                                          |
|---------------|----------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iowa          | No       | Yes      | Iowa Natural Resources Council                                                                                                                                                                                                                                                                                                                                 |
| Kansas        | Yes      | Yes      | Division of Water Resources, Kansas State Board of Agriculture                                                                                                                                                                                                                                                                                                 |
| Kentucky      | No       | Yes      | Division of Water (Water Resources), Department of Natural Resources and Environmental Protection                                                                                                                                                                                                                                                              |
| Louisiana     |          | N/A      |                                                                                                                                                                                                                                                                                                                                                                |
| Maine         |          | N/A      |                                                                                                                                                                                                                                                                                                                                                                |
| Maryland      | No       | Yes      | Department of Natural Resources - Water Resources Administration                                                                                                                                                                                                                                                                                               |
| Massachusetts | Yes      | No       | The administration of our safety-inspection dam program has been assigned to the Associate Commissioner of the Division of Waterways, by the Commissioner of the Massachusetts Department of Public Works. Inspections are conducted by available engineers from the eight Highway Districts, generally on a part-time basis because of other assigned duties. |
| Michigan      | No       | Yes      | Department of Natural Resources                                                                                                                                                                                                                                                                                                                                |
| Minnesota     | No       | Yes      | Division of Waters, Soils and Minerals of the Department of Natural Resources                                                                                                                                                                                                                                                                                  |
| Mississippi   | No       | Yes      | Mississippi Board of Water Commissioners                                                                                                                                                                                                                                                                                                                       |
| Missouri      |          | N/A      |                                                                                                                                                                                                                                                                                                                                                                |
| Montana       | No       | Yes      | State dams only - Department of Natural Resources and Conservation, Water Resources Division, Engineering Bureau                                                                                                                                                                                                                                               |
| Nebraska      | Yes      | --       | Department of Water Resources                                                                                                                                                                                                                                                                                                                                  |
| Nevada        | --       | Yes      | Division of Water Resources, State Engineer's Office                                                                                                                                                                                                                                                                                                           |



## 4 (Continued)

| <u>STATE</u>   | <u>A</u> | <u>B</u> | <u>C. NAME ORGANIZATIONAL UNIT</u>                                                |
|----------------|----------|----------|-----------------------------------------------------------------------------------|
| New Hampshire  | Yes      | --       | New Hampshire Water Resources Board                                               |
| New Jersey     | Yes      | No       | Division of Water Resources, Bureau of Water Control                              |
| New Mexico     | No       | Yes      | State Engineer                                                                    |
| New York       | No       | Yes      | Office of Environmental Analysis                                                  |
| North Carolina | No       | Yes      | Office of Water and Air Resources, Department of Natural and Economic Resources   |
| North Dakota   | Yes      | --       | North Dakota State Water Commission                                               |
| Ohio           | Yes      | No       | Division of Water in the Department of Natural Resources                          |
| Oklahoma       | No       | Yes      | Oklahoma Water Resources Board                                                    |
| Oregon         | --       | Yes      | Dams and Hydraulic Structures                                                     |
| Pennsylvania   | Yes      | No       | Division of Dams and Encroachments, Department of Environmental Resources         |
| Rhode Island   | No       | Yes      | Division of Planning and Development, Department of Natural Resources             |
| South Carolina | N/A      |          |                                                                                   |
| South Dakota   | No       | Yes      | Department of Natural Resource Development                                        |
| Tennessee      | No       | Yes      | Division of Water Resources, Tennessee Department of Conservation                 |
| Texas          | No       | Yes      | Texas Water Rights Commission                                                     |
| Utah           | No       | Yes      | Division of Water Rights, Department of Natural Resources                         |
| Vermont        | Yes      | --       | Water Resources Board; Public Service Board; Agency of Environmental Conservation |

## 4 (Continued)

| <u>STATE</u>    | <u>A</u>                     | <u>B</u> | <u>C. NAME ORGANIZATION UNIT</u>                                                                    |
|-----------------|------------------------------|----------|-----------------------------------------------------------------------------------------------------|
| Virginia        | Yes                          | No       | State Corporation Commission                                                                        |
| Washington      | No                           | Yes      | Department of Ecology                                                                               |
| West Virginia   | Yes                          | No       | West Virginia Department of Natural Resources                                                       |
| Wisconsin       | Yes                          | No       | Water Regulation Section, Bureau of Water and Shoreland Management, Department of Natural Resources |
| Wyoming         | No                           | Yes      | State Engineer                                                                                      |
| Puerto Rico     | Yes                          | Yes      | Puerto Rico Water Resources Authority, Dams and Related Facilities - Inspection Section             |
| Virgin Islands  | Did Not Answer Questionnaire |          |                                                                                                     |
| Guam            | No                           | Yes      | Department of Public Works                                                                          |
| Trust Territory | No                           | Yes      | District Public Works Utility Section                                                               |
| American Samoa  | Did Not Answer Questionnaire |          |                                                                                                     |

5. A. Is the supervisory function required to be directed by an engineer registered under state law?

B. Or are registered engineers required in organizational unit or activity?

C. If so, name organizational unit.

| <u>STATE</u> | <u>A</u> | <u>B</u> | C. <u>NAME ORGANIZATIONAL UNIT</u>                                                                                    |
|--------------|----------|----------|-----------------------------------------------------------------------------------------------------------------------|
| Alabama      |          | N/A      | --                                                                                                                    |
| Alaska       |          | N/A      | --                                                                                                                    |
| Arizona      | Yes      | Yes      | Division of Safety of Dams                                                                                            |
| Arkansas     | No       | Yes      | Division of Soil and Water Resources                                                                                  |
| California   | Yes      | --       | Division of Safety of Dams                                                                                            |
| Colorado     | Yes      | Yes      | Dams and reservoir Branch, Engineering Section, Division of Water Resources                                           |
| Connecticut  | No       | --       | --                                                                                                                    |
| Delaware     | Yes      | Yes      | Water Resources Section, Division of Environmental Control, Department of Natural Resources and Environmental Control |
| Florida      |          |          |                                                                                                                       |
| DNR          | --       | --       | --                                                                                                                    |
| DPC          | Yes      | --       | --                                                                                                                    |
| Georgia      |          | N/A      | --                                                                                                                    |
| Hawaii       |          | N/A      | --                                                                                                                    |
| Idaho        | No       | Yes      | Engineering and Environmental Protection Division                                                                     |
| Illinois     | No       | No       | None                                                                                                                  |
| Indiana      | Yes      | Yes      | Division of Water, Department of Natural Resources                                                                    |

## 5 (continued)

| <u>STATE</u>  | <u>A</u> | <u>B</u> | C. <u>NAME ORGANIZATIONAL UNIT</u>                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------|----------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iowa          | No       | No       | Although the supervisory function relative to construction of dams is not required to be directed by an engineer registered under State law, such function is, however, carried out by engineers registered in accordance with the State Engineering Registration Law.                                                                                                                                                         |
| Kansas        | No       | Yes      | Division of Water Resources Kansas State Board of Agriculture                                                                                                                                                                                                                                                                                                                                                                  |
| Kentucky      | No       | Yes      | Division of Water (Water Resources) Department of Natural Resources and Environmental Protection                                                                                                                                                                                                                                                                                                                               |
| Louisiana     | No       |          | None                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Maine         |          | N/A      |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Maryland      | No       | No       | There is nothing in the State Law which requires the Department of Natural Resources to employ a Registered Professional Engineer to supervise the construction of dams. However, as a practical matter, a Registered Professional Engineer has been employed for this activity. Perhaps, the State Registration Law would apply in this case.                                                                                 |
| Massachusetts | No       | No       | The Commissioner of Public Works is presently legally responsible according to Chapter 595 of the Acts of 1970. According to Massachusetts Law (Chapter 821, Acts of 1963) the Commissioner is not required to be a registered professional engineer, however, both Commissioner Campbell and Associate Commissioner Graf are registered in the Commonwealth. Some highway engineer inspectors are registered, others are not. |



| <u>STATE</u>   | <u>A</u> | <u>B</u> | C. <u>NAME ORGANIZATIONAL UNIT</u>                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Michigan       | No       | Yes      | Department of Natural Resources,<br>Hydrological Survey Division                                                                                                                                                                                                                                                                                                                                      |
| Minnesota      | Yes      | Yes      | Division of Waters, Soils and Minerals<br>of the Department of Natural Resources                                                                                                                                                                                                                                                                                                                      |
| Mississippi    | Yes      | Yes      | Mississippi Board of Water Commissioners                                                                                                                                                                                                                                                                                                                                                              |
| Missouri       | No       | No       | --                                                                                                                                                                                                                                                                                                                                                                                                    |
| Montana        | No       | No       | --                                                                                                                                                                                                                                                                                                                                                                                                    |
| Nebraska       | Yes      | --       | Department of Water Resources                                                                                                                                                                                                                                                                                                                                                                         |
| Nevada         | --       | Yes      | Division of Water Resources, State<br>Engineer's Office                                                                                                                                                                                                                                                                                                                                               |
| New Hampshire  | Yes      | Yes      | New Hampshire Water Resources Board                                                                                                                                                                                                                                                                                                                                                                   |
| New Jersey     | Yes      | Yes      | Bureau of Water Control, Dam Analysis<br>Section                                                                                                                                                                                                                                                                                                                                                      |
| New Mexico     | Yes      | Yes      | State Engineer                                                                                                                                                                                                                                                                                                                                                                                        |
| New York       | Yes      | No       | Bureau of Facilities and Construction<br>Management                                                                                                                                                                                                                                                                                                                                                   |
| North Carolina | Yes      | No       | --                                                                                                                                                                                                                                                                                                                                                                                                    |
| North Dakota   | Yes      | Yes      | North Dakota State Water Commission                                                                                                                                                                                                                                                                                                                                                                   |
| Ohio           | No       | Yes      | Division of Water. The position descrip-<br>tion of the office of the Chief, Division<br>of Water implies that the position be<br>filled by a registered engineer. However,<br>this is not a statutory requirement. The<br>position is presently filled by a registered<br>engineer. Various staff positions require<br>by position descriptions that these<br>persons be engineers licensed in Ohio. |
| Oklahoma       | Yes      | Yes      | Stream Water Branch, Oklahoma Water<br>Resources Board                                                                                                                                                                                                                                                                                                                                                |
| Oregon         | Yes      | --       | --                                                                                                                                                                                                                                                                                                                                                                                                    |
| Pennsylvania   | Yes      | Yes      |                                                                                                                                                                                                                                                                                                                                                                                                       |

## 5 (continued)

| <u>STATE</u>    | <u>A</u>                     | <u>B</u> | C. <u>NAME ORGANIZATIONAL UNIT</u>                                                                  |
|-----------------|------------------------------|----------|-----------------------------------------------------------------------------------------------------|
| Rhode Island    | No                           | No       | --                                                                                                  |
| South Carolina  | No                           | No       | None                                                                                                |
| South Dakota    | Yes                          | Yes      | Division of Water Rights, Department of Natural Resources Development                               |
| Tennessee       | Yes                          | Yes      | Division of Water Resources, Tennessee Department of Conservation                                   |
| Texas           | No                           | Yes      | Texas Water Rights Commission                                                                       |
| Utah            | No                           | Yes      | Division of Water Rights                                                                            |
| Vermont         | Yes                          | --       | --                                                                                                  |
| Virginia        | No                           | No       | N/A                                                                                                 |
| Washington      | Yes                          | Yes      | Office of Operations                                                                                |
| West Virginia   | Yes                          | Yes      | West Virginia Department of Natural Resources                                                       |
| Wisconsin       | Yes                          | Yes      | Water Regulation Section, Bureau of Water and Shoreline Management, Department of Natural Resources |
| Wyoming         | Yes                          | Yes      | State Engineer and Safety of Dams<br>Engineer must be registered engineer.                          |
| Puerto Rico     | Yes                          | Yes      | Engineer and Construction Division,<br>Puerto Rico Water Resources Authority                        |
| Virgin Islands  | Did Not Answer Questionnaire |          |                                                                                                     |
| Guam            | No                           | Yes      | Department of Public Works, Division of Engineering                                                 |
| Trust Territory | No                           | No       | --                                                                                                  |
| American Samoa  | Did Not Answer Questionnaire |          |                                                                                                     |

6. Full title and address of office administering regulations; and name and title of official to whom inquiries and application should be made.

|             |                                                                                                                                                                                                              |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | N/A                                                                                                                                                                                                          |
| Alaska      | N/A                                                                                                                                                                                                          |
| Arizona     | Wesley E. Steiner, State Water Engineer; Arizona Water Commission; 222 N. Central Avenue - Suite 800; Phoenix, Arizona 85004                                                                                 |
| Arkansas    | John P. Saxton, Director, Division of Soil and Water Resources; 1920 West Capitol; Little Rock, Arkansas 72201                                                                                               |
| California  | G. W. Dukleth, Division Engineer; Division of Safety of Dams, Department of Water Resources; P.O. Box 388; Sacramento, California 95802                                                                      |
| Colorado    | C. J. Kuiper, State Engineer; Division of Water Resources; 1845 Sherman Street, Denver, Colorado 80203                                                                                                       |
| Connecticut | Department of Environmental Protection; State Office Building; Hartford, Connecticut 06115                                                                                                                   |
| Delaware    | Director, Division of Environmental Control; Department of Natural Resources and Environmental Control; Tatnall Building, Capitol Complex; Dover, Delaware 19901                                             |
| Florida     |                                                                                                                                                                                                              |
| DNR         | N/A                                                                                                                                                                                                          |
| DPC         | Peter J. Baljet, Executive Director; Department of Pollution Control; 2562 Executive Center Circle East; Montgomery Building, Tallahassee, Florida 32301 and Regional Administrators for six Florida regions |
| Georgia     | N/A                                                                                                                                                                                                          |
| Hawaii      | N/A                                                                                                                                                                                                          |
| Idaho       | R. Keith Higginson, Director, Idaho Department of Water Administration, Statehouse-Annex 2; Boise, Idaho 83720                                                                                               |
| Illinois    | None                                                                                                                                                                                                         |
| Indiana     | Robert F. Jackson, Chief; Division of Water; Department of Natural Resources; 605 State Office Building; Indianapolis, Indiana 46204                                                                         |

|               |                                                                                                                                                                                                   |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iowa          | Othie R. McMurry, Director; Iowa Natural Resources Council; Grimes State Office Building; Des Moines, Iowa 50319                                                                                  |
| Kansas        | Guy E. Gibson, Chief Engineer; Division of Water Resources; Kansas State Board of Agriculture; Room 1026 South, State Office Building, Topeka, Kansas 66612                                       |
| Kentucky      | Oscar T. McCutchen, Director; Division of Water (Water Resources); Department of Natural Resources and Environmental Protection; Capital Plaza Office Tower, 6th Floor; Frankfort, Kentucky 40601 |
| Louisiana     | None                                                                                                                                                                                              |
| Maine         | N/A                                                                                                                                                                                               |
| Maryland      | Herbert M. Sachs, Director; Water Resources Administration; Tawes State Office Building; Annapolis, Maryland                                                                                      |
| Massachusetts | Malcolm E. Graf, P.E., Associate Commissioner; Division of Waterways; Massachusetts Department of Public Works; 100 Nashua Street, Boston, Massachusetts 02114                                    |
| Michigan      | Dale W. Granger, Division Chief; Department of Natural Resources, Hydrological Survey Division; Stevens T. Mason Building; Lansing, Michigan 48926                                                |
| Minnesota     | Eugene R. Gere, Director; Division of Waters, Soils and Minerals; Department of Natural Resources; Centennial Office Building, St. Paul, Minnesota 55155                                          |
| Mississippi   | Jack W. Pepper, State Water Engineer; Mississippi Board of Water Commissioners; 416 N. State Street; Jackson, Mississippi 39201                                                                   |
| Missouri      | N/A                                                                                                                                                                                               |
| Montana       | N/A                                                                                                                                                                                               |
| Nebraska      | Dan S. Jones, Jr., Director; Department of Water Resources; O.O. Box 94607 State Capitol, Lincoln, Nebraska                                                                                       |
| Nevada        | Roland D. Westergard, State Engineer; Division of Water Resources; 201 South Fall Street; Carson City, Nevada 89701                                                                               |



6 (Continued)

|                |                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New Hampshire  | George M. McGee, Sr., Chairman; New Hampshire Water Resources Board; 37 Green Street, Concord, N.H. 03301                                                                   |
| New Jersey     | Dirk C. Hofman, Chief; Bureau of Water Control; P.O. Box 2809; Trenton, New Jersey 08625                                                                                    |
| New Mexico     | S. E. Reynolds, State Engineer; Bataan Memorial Building; Santa Fe, New Mexico 87501                                                                                        |
| New York       | Robert S. Drew, Central Permit Agent; New York State Department of Environmental Conservation; Albany, New York 12201                                                       |
| North Carolina | Col. R.J.B. Page, Chief, Waters Resources Programs Division; Office of Water and Air Resources; Department of Natural and Economic Resources; Raleigh, North Carolina 27611 |
| North Dakota   | Vern Fahy, State Engineer; Chief Engineer and Secretary; North Dakota State Water Commission; 900 East Boulevard; Bismarck, North Dakota 58501                              |
| Ohio           | Roy Winkle, Chief; Ohio Department of Natural Resources Division of Water; 1500 Dublin Road; Columbus, Ohio 43215                                                           |
| Oklahoma       | Paul R. Wilson, Chief Engineer; Oklahoma Water Resources Board; 2241 N.W. 40th; Oklahoma City, Oklahoma 73112                                                               |
| Oregon         | Chris L. Wheeler, State Engineer; 1178 Chemeketa Street, N.E.; Salem, Oregon 97310                                                                                          |
| Pennsylvania   | V. R. Butler, Chief; Division of Dams and Encroachments; Department of Environmental Resources; P.O. Box 2063; Harrisburg, Pennsylvania 17120                               |
| Rhode Island   | Dennis J. Murphy, Jr., Director; Department of Natural Resources; 83 Park Street; Providence, R. I. 02903                                                                   |
| South Carolina | None at present.                                                                                                                                                            |
| South Dakota   | J. W. Grimes, Secretary; Department of Natural Resources Development; State Office Building No. 2; Pierre, South Dakota 57501                                               |

|                   |                                                                                                                                                           |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tennessee         | Raleigh W. Robinson, Director; Division of Water Resources; Tennessee Department of Conservation; 2611 West End Avenue; Nashville, Tennessee 37203        |
| Texas             | Chairman; Texas Water Rights Commission; P.O. Box 13207, Capitol Station; Austin, Texas 78711                                                             |
| Utah              | Gordon Harmston, Director; Department of Natural Resources; 225 State Capitol; Salt Lake City, Utah 84114                                                 |
| Vermont           | Chairman; Water Resources Board or Public Service Board; Agency of Environmental Conservation; Montpelier, Vermont 05602                                  |
| Virginia          | State Corporation Commission and Director's Office; Bureau of Conservation and Economic Development; 1110 State Office Building; Richmond, Virginia 23220 |
| Washington        | Gregory M. Hastings; Office of Operations; Department of Ecology; Olympia, Washington 98504                                                               |
| West Virginia     | Ira S. Latimer, Jr., Director; Department of Natural Resources; 1800 Washington Street, E.; Charleston, West Virginia                                     |
| Wisconsin         | Thomas G. Frangos, Administrator; Division of Environmental Protection; Wisconsin Division of Natural Resources; Box 450; Madison, Wisconsin 53701        |
| Wyoming           | Floyd A. Bishop, State Engineer; or Roger Shaffer, Safety of Dams Engineer; State Engineers Office; State Office Building; Cheyenne, Wyoming 82002        |
| Puerto Rico       | Engr. Reman Colon, Chief Engineer; Engineering and Construction Division, Puerto Rico Water Resources Authority; P.O. Box 4267; San Juan, Puerto Rico     |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                              |
| Guam              | Peter C. Taves, P.E.; Director of Public Works; Government of Guam; Agana, Guam 96910                                                                     |
| Trust Territories | Director of Public Works; Office of the High Commissioner, TTPI; Saipan, Marina Islands 96950                                                             |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                              |

7. Name of any other State Agency the approval of which is required before the construction of a dam is undertaken, such as health, water rights, etc. If any, give name and address of other than above.

|             |                                                                                                                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | N/A                                                                                                                                                                                                              |
| Alaska      | N/A                                                                                                                                                                                                              |
| Arizona     | --                                                                                                                                                                                                               |
| Arkansas    | None                                                                                                                                                                                                             |
| California  | State Water Resources Control Board, (Water Rights);<br>State Department of Fish and Game, (Fish protection<br>where applicable.)                                                                                |
| Colorado    | Not necessary                                                                                                                                                                                                    |
| Connecticut | --                                                                                                                                                                                                               |
| Delaware    | None                                                                                                                                                                                                             |
| Florida     |                                                                                                                                                                                                                  |
| DNR         | State of Florida, Department of Pollution Control,<br>Tallahassee, Florida                                                                                                                                       |
| DPC         | Trustees of the Internal Improvement Trust Fund; Water<br>Management Districts under the Division of Interior<br>Resources, Florida Department of Natural Resources.                                             |
| Georgia     | --                                                                                                                                                                                                               |
| Hawaii      | --                                                                                                                                                                                                               |
| Idaho       | Same agency administers water rights and water right<br>needed for storage behind a dam.                                                                                                                         |
| Illinois    | Division of Water Resource Management, Department of<br>Transportation, 201 W. Monroe, Springfield, Illinois                                                                                                     |
| Indiana     | None                                                                                                                                                                                                             |
| Iowa        | In addition to the construction permit for a dam a water<br>permit must be secured from the State Water Commissioner.<br>The State Water Commissioner is however, under the control<br>of the Resources Council. |
| Kansas      | None                                                                                                                                                                                                             |

|               |                                                                                                                                                                                                                                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kentucky      | Kentucky Department of Health (approves water supply intakes)                                                                                                                                                                     |
| Louisiana     | Permit applications involving state-owned water bottoms require approval of the State Land Office. If a navigable waterway is affected then Federal permit guidelines prevail.                                                    |
| Maine         | Inland Fisheries and Game-Need for Fish way; State House; Augusta, Maine 04330                                                                                                                                                    |
| Maryland      | Depending on the purpose, other agencies may become involved in the approval of dams and reservoirs. For example, the State Department of Health and Mental Hygiene would be involved in the approval of waste treatment lagoons. |
| Massachusetts | Approval to construct a dam may be required by the Massachusetts Department of Natural Resources, according to the provisions of the Commonwealth's Wetlands Act, Chapter 784, Acts of 1972.                                      |
| Michigan      | On dam construction for real estate developments, Department of Public Health rules on adequacy of water supply and waste disposal prior to issuing a permit, however not a statutory requirement.                                |
| Minnesota     | None                                                                                                                                                                                                                              |
| Mississippi   | --                                                                                                                                                                                                                                |
| Missouri      | --                                                                                                                                                                                                                                |
| Montana       | N/A                                                                                                                                                                                                                               |
| Nebraska      | --                                                                                                                                                                                                                                |
| Nevada        | None - Water rights are also administered by the State Engineer's office.                                                                                                                                                         |
| New Hampshire | Special Board - If dam constructed in waters of the State                                                                                                                                                                         |
| New Jersey    | --                                                                                                                                                                                                                                |
| New Mexico    | None                                                                                                                                                                                                                              |



7 (Continued)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New York       | No other State agency issues approvals; however, Department of Transportation does review structural features and soils in cooperation with this Department.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| North Carolina | Board of Health, Water Quality Division (for minimum flows)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| North Dakota   | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Ohio           | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Oklahoma       | Oklahoma State Health Department; 13th and Stonewall; Oklahoma City, Oklahoma                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Oregon         | State Engineer through Division of Water Rights                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Pennsylvania   | In Delaware River Basin if quantity of water impounded is 100,000 gallons or more, permit must be received from Delaware River Basin Commission; 25 State Police Drive; West Trenton, N.J. 08603. Comments on all new dams are also received from the Bureau of Fisheries and the Department of Environmental Resources (Regional Water Quality Management Division)                                                                                                                                                                                                             |
| Rhode Island   | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| South Carolina | None - Department of Health and Environmental Control must approve domestic water supplies also responsible for mosquito control. In all projects requiring a Corps of Engineers permit, the State of South Carolina is called upon to issue a permit before the Corps permit procedure can be completed. All interested state agencies provide comments which are compiled into a recommendation by the South Carolina Water Resources Commission. The State Budget and Control Board issues a State permit after a favorable recommendation by the Water Resources Commission. |
| South Dakota   | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Tennessee      | Division of Sanitation and Solid Waste Management; Tennessee Department of Public Health; Suite 320, Capitol Building; 301 7th Avenue N.; Nashville, Tennessee 37219                                                                                                                                                                                                                                                                                                                                                                                                             |
| Texas          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                   |                                                                                                                                          |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Utah              | None                                                                                                                                     |
| Vermont           | Agency of Environmental Conservation; Montpelier,<br>Vermont 05602                                                                       |
| Virginia          | None Required                                                                                                                            |
| Washington        | Washington State Department of Game; State Department<br>of Fisheries; Olympia, Washington 98504                                         |
| West Virginia     | --                                                                                                                                       |
| Wisconsin         | Dams generating power require permission from Public<br>Service Commission; Hill Farm State Office Building;<br>Madison, Wisconsin 53545 |
| Wyoming           | None                                                                                                                                     |
| Puerto Rico       | Puerto Rico Planning Board and Department of Natural<br>Resources                                                                        |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                             |
| Guam              | None                                                                                                                                     |
| Trust Territories | None                                                                                                                                     |
| American Samoa    | Did Not Answer Questionnaire                                                                                                             |

8. Authority, legislation or other basic instrument establishing state supervision. Give original date and date of latest amendment. Please summarize and inclose copy if available.

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Alaska      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Arizona     | Articles 1, 2 & 3, Chapter 3 Arizona Revised Statutes, Enacted 1929 Latest Revision July 26, 1973.                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Arkansas    | Act 81 of 1957 as amended by Act 14 of 1963, Act 80 of 1969 and Act 217 of 1969.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| California  | Statutory authority is found in Division 3 of the California Water Code. Legislation first became effective in August 1929; most recent amendment was in 1969.                                                                                                                                                                                                                                                                                                                                                                        |
| Colorado    | General Legislature 1899, General Legislature 1969                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Connecticut | Section 13 - Section 25-119 1963-1973                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Delaware    | Title 7, Delaware Code, Chapter 61 (1966); Title 7, Delaware Code, Chapter 60 (1973)                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Florida     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| DNR         | Chapter 373, Florida Statutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| DPC         | Chapter 403, Florida Statutes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Georgia     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Hawaii      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Idaho       | Section 42-1710, Idaho Code enacted in May 1969.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Illinois    | Illinois Laws Relating to Waterways - 1971                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Indiana     | Chapter 318, Acts of 1945 of the Indiana General Assembly as amended (Chapter 379, Acts of 1963); Chapter 84 Acts of the Indiana General Assembly. Chapter 318, Acts of 1945 and Chapter 84, Acts of 1961 refer to the Indiana Flood Control and Water Resources Commission. In 1965 this Commission, the Conservation Department and two other smaller agencies were combined into a new Department of Natural Resources and all duties, responsibilities, powers and authority were vested in the new Natural Resources Commission. |

|               |                                                                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iowa          | Chapter 455A, Code of Iowa 1949, amended 1957 and 1965; Chapter 469 Code of Iowa 1949.                                                                |
| Kansas        | Kansas Statute 82a-301 to 305, Original date - May 28, 1929. Date of latest Amendment - June 28, 1945.                                                |
| Kentucky      | Kentucky Revised Statutes - Chapter 151 Original date - 1966, Revised Date 1972                                                                       |
| Louisiana     | None                                                                                                                                                  |
| Maine         | None                                                                                                                                                  |
| Maryland      | Article 96A, Sections 10-22, Annotated Code of Maryland                                                                                               |
| Massachusetts | Chapter 253 of the Massachusetts General Laws, as amended by Chapter 595 of the Acts of 1970.                                                         |
| Michigan      | Act, 184, Public Acts 1963, as last amended by Act 68, Public Acts 1970. Also Act 146, Public Acts 1961 as last amended by Act 175, Public Acts 1969. |
| Minnesota     | M.S. Chapter 105, Originally adopted in 1937. Latest amendment 1973. Chapter 315 Session Laws.                                                        |
| Mississippi   | Mississippi Water Right Law. Mississippi Code Annotated (1942 recomp.) Section 5956-01 et seq.                                                        |
| Missouri      | --                                                                                                                                                    |
| Montana       | Not applicable                                                                                                                                        |
| Nebraska      | Section 46-208 three 46-278, Reissue Revised Statutes of Nebraska 1943 as amended by Legislative Bill 186, First Session 83 Legislature, 1973         |
| Nevada        | Chapter 535, Nevada Revised Statutes. Original Act enacted 1951, most recent amendment enacted 1973.                                                  |
| New Hampshire | By Statutes Chapter 481, 482, 483                                                                                                                     |
| New Jersey    | New Jersey Title 58, Chapter 4-1 et. seq. Original date 1912, latest revision 1953.                                                                   |
| New Mexico    | New Mexico Statutes Annotated, Sections 75-5-8 and 75-5-10. Originally enacted in 1907 and last amendment was in 1941.                                |



|                |                                                                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New York       | Section 15-0501 through 15-0515 and Part 608 as amended of Environmental Conservation Law                                                                                                                                                                                    |
| North Carolina | Dam Safety Law of 1967                                                                                                                                                                                                                                                       |
| North Dakota   | North Dakota Century Code 61-02-14                                                                                                                                                                                                                                           |
| Ohio           | Sections 1521.106, .061 and .062 of the Ohio Revised Code. Original date: 10 October 1963, Latest Revision: 18 December 1969. The Division of Water adopted administrative rules effective April 15, 1972 establishing procedures for issuing construction permits for dams. |
| Oklahoma       | 82 O.S. Supp, 1972 § 105.27                                                                                                                                                                                                                                                  |
| Oregon         | Water Laws of Oregon. No hydraulic structure (minor listed exceptions may be constructed or maintained without State Engineer approval in writing of the site and plans. 1927.                                                                                               |
| Pennsylvania   | Act of June 25, 1913, PL 555 as amended by Act of May 6, 1937, P.L. 559                                                                                                                                                                                                      |
| Rhode Island   | General Laws of Rhode Island, Title 46, Chapter 19, Inspection of Dams and Reservoirs. Original Law 1896, Latest reenactment 1970.                                                                                                                                           |
| South Carolina | None: But see S.C. Code Section 18-5-18-8 (Nuisance) and S.C. Code Section 28-647-28-656 (Fish Migration)                                                                                                                                                                    |
| South Dakota   | Title 46, SDCL 1967 as amended in Supplements.                                                                                                                                                                                                                               |
| Tennessee      | Safe Dams Act of 1973, Chapter 182, Tennessee Public Acts, 1973                                                                                                                                                                                                              |
| Texas          | Texas Water Code Sections 5.121-5.143, August 30, 1971, 6.0731 May 12, 1973.                                                                                                                                                                                                 |
| Utah           | Utah Water Code Annotated 1953, Sections 73-5-5, 6, 7, 12 and 13.                                                                                                                                                                                                            |
| Vermont        | Title 10, Vermont Statutes Annotated, Chapter 43, "Dams" 1929; 1959.                                                                                                                                                                                                         |
| Virginia       | Code of Virginia, Annotated, 1950, Sections 62.1-80 62.103 (Revised 1968), Volume 9, pp 160-167.                                                                                                                                                                             |

|                   |                                                                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Washington        | Chapter 90.03 Revised Code of Washington, 1917, 1965 (specifically sections 90.03.350, 90.03.370 and 90.03.470 RCW) and section 43.21.130 RCW, 1917, 1961.                 |
| West Virginia     | Chapter 20 of the Code of West Virginia 1931 as amended, and reamended by adding Dam Control Act - Senate Bill No. 2057 April 14, 1973.                                    |
| Wisconsin         | Chapter 31, 1963 Wisconsin Statutes and subsequent amendments.                                                                                                             |
| Wyoming           | Section 31, Article 1; Section 1, 2, and 5, Article 8 Constitution of State of Wyoming and Sections 41-26, 41-30 thru 32, 41-73 thru 75, and 41-201 Wyoming Statutes 1957. |
| Puerto Rico       | Puerto Rico Water Resources Act, No. 83 as amended.                                                                                                                        |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                               |
| Guam              | Building Law, Title XXII, Government Code of Guam                                                                                                                          |
| Trust Territories | United Nations Trusteeship Agreement - 1948                                                                                                                                |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                               |

9. Are printed regulations and/or instructions available to the public?  
If yes give title and latest revision date.

|             |     |                                                                                                                                                                                                                                                                                 |
|-------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No  | --                                                                                                                                                                                                                                                                              |
| Alaska      | No  | --                                                                                                                                                                                                                                                                              |
| Arizona     | No  | Under Preparation                                                                                                                                                                                                                                                               |
| Arkansas    | No  | --                                                                                                                                                                                                                                                                              |
| California  | Yes | Statutes and Regulations Pertaining to Supervision of Dams in California - 1972                                                                                                                                                                                                 |
| Colorado    | Yes | Manual of Rules and Regulations for Plans and Specifications for the Construction of Reservoir Dams - 1967                                                                                                                                                                      |
| Connecticut | Yes | General Statutes on Supervision of Dams - 1973                                                                                                                                                                                                                                  |
| Delaware    | Yes | Water Resources Regulations                                                                                                                                                                                                                                                     |
| Florida     |     |                                                                                                                                                                                                                                                                                 |
| DNR         | No  |                                                                                                                                                                                                                                                                                 |
| DPC         | Yes | Chapter 17-9, Florida Administrative Code (F.A.C.) covers minimum requirements for earthen dams used for the impoundment of liquid industrial wastes from phosphate mining and processing operations; Chapter 17-3 F.A.C. - Pollution of Waters; Chapter 17-4 F.A.C. - Permits. |
| Georgia     | --  |                                                                                                                                                                                                                                                                                 |
| Hawaii      | --  |                                                                                                                                                                                                                                                                                 |
| Idaho       | Yes | Rules and Regulations for Safety of Dams, November 1970                                                                                                                                                                                                                         |
| Illinois    | No  | --                                                                                                                                                                                                                                                                              |
| Indiana     | Yes | Instructions for Making Application for Approval of Construction in a Floodway                                                                                                                                                                                                  |

## 9 (Continued)

|               |     |                                                                                                                                                                                                                  |
|---------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iowa          | Yes | Iowa Natural Resources Council<br>Procedural Guide, 1961                                                                                                                                                         |
| Kansas        | No  | --                                                                                                                                                                                                               |
| Kentucky      | Yes | DOW-Rg-2 and EM-3, Design Criteria<br>for Dams and Associated Structures,<br>April 5, 1972 and DOW-RG-3, Ex-<br>emption of Non-Hazardous Sediment<br>Structures Relating to Surface<br>Mining, December 4, 1972. |
| Louisiana     | No  | --                                                                                                                                                                                                               |
| Maine         | N/A | --                                                                                                                                                                                                               |
| Maryland      | Yes | Water Resources Rules and Regula-<br>tions 08.05.03.01 - 08.05.03.07                                                                                                                                             |
| Massachusetts | Yes | Application for Authorization to<br>Construct or Alter a Reservoir,<br>Reservoir Dam or Mill Dam, Revised<br>3-13-73.                                                                                            |
| Michigan      | No  | --                                                                                                                                                                                                               |
| Minnesota     | No  | --                                                                                                                                                                                                               |
| Mississippi   | Yes | Instructions for Appropriating<br>Water of the State of Mississippi.                                                                                                                                             |
| Missouri      | No  | --                                                                                                                                                                                                               |
| Montana       | No  | --                                                                                                                                                                                                               |
| Nebraska      | Yes | Rules, Department of Water Resources<br>1968.                                                                                                                                                                    |
| Nevada        | Yes | Laws and Regulations Pertaining<br>to Dams, 1970.                                                                                                                                                                |
| New Hampshire | No  | --                                                                                                                                                                                                               |
| New Jersey    | Yes | Laws Relating to Construction and<br>Repair of Dams.                                                                                                                                                             |



|                |     |                                                                                                                                          |
|----------------|-----|------------------------------------------------------------------------------------------------------------------------------------------|
| New Mexico     | Yes | Manual of Rules and Regulations, August 1953.                                                                                            |
| New York       | Yes | Rules and Regulations and Guidelines for Design of Small Earth Dams. January 1, 1973.                                                    |
| North Carolina | No  | Requirements Furnished Upon Request or Proposed Dam Reported.                                                                            |
| North Dakota   | Yes | North Dakota Water Laws 1967-1969-1971 Supplement.                                                                                       |
| Ohio           | Yes | Ohio Revised Code Sections and Administrative Rules Effective 4/15/72.                                                                   |
| Oklahoma       | Yes | Oklahoma Water Resources Board, Rules and Regulations 1973.                                                                              |
| Oregon         | Yes | Water Laws of Oregon 1972 and Rules and Regulations of the State Engineer 1973.                                                          |
| Pennsylvania   | Yes | Construction or Repair of Dams, 1970.                                                                                                    |
| Rhode Island   | Yes | Application for Approval to Construct, Modify or Maintain a Dam. Last Revision, 1973.                                                    |
| South Carolina | No  | None                                                                                                                                     |
| South Dakota   | No  | --                                                                                                                                       |
| Tennessee      | --  | Tentative Rules and Regulations, August 7, 1973.                                                                                         |
| Texas          | Yes | Texas Water Code, published 1972, updated annually and Rules and Regulations, Texas Water Rights Commission, 1973, updated periodically. |
| Utah           | Yes | Utah, 1965.                                                                                                                              |
| Vermont        | No  | --                                                                                                                                       |
| Virginia       | Yes | Code of Virginia - Sections 62.1-80 thru 62.103                                                                                          |

## 9 (Continued)

|                   |                              |                                                                                                          |
|-------------------|------------------------------|----------------------------------------------------------------------------------------------------------|
| Washington        | Yes                          | Surface and Ground Water Codes, June 1973, Washington Administrative Code (WAC) 508-12-260, 270 and 280. |
| West Virginia     | Yes                          | Dam Control Act - Senate Bill No. 2057 of the State of West Virginia April 14, 1973.                     |
| Wisconsin         | Yes                          | Chapter 31, 1963 Wisconsin Statutes and subsequent amendments.                                           |
| Wyoming           | Yes                          | Regulations and Instructions. Manual presently being revised.                                            |
| Puerto Rico       | No                           | --                                                                                                       |
| Virgin Islands    | Did Not Answer Questionnaire |                                                                                                          |
| Guam              | No                           | --                                                                                                       |
| Trust Territories | No                           | --                                                                                                       |
| American Samoa    | Did Not Answer Questionnaire |                                                                                                          |

10. Please state any limitations or exceptions as to size, type, capacity, off-stream location, or class of ownership of dams (or reservoirs) subject to regulations.

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Alaska      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Arizona     | Dam must be equal to or greater than 25 feet high or store greater than 50 acre-feet. Barrier less than 6 feet high or storage equal to or less than 15 acre-feet is non-jurisdictional.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Arkansas    | Permits required for dams which impound 20 acre-feet or more. No permit required for dams constructed by Corps of Engineers, dams which impound only diffused surface waters on land wholly owned by a "person", dams the height of which is at or below the ordinary high water mark on the stream, dams constructed off-stream and dams constructed prior to January 1, 1957.                                                                                                                                                                                                                                                                                                             |
| California  | As defined in the code, a "dam" is 25 feet or more in height, storing 50 acre-feet or more. Exceptions include obstructions in canals, levees, highway and railroad fills, circular steel or concrete tanks, certain off-stream barriers for agriculture use, and certain spreading ponds.                                                                                                                                                                                                                                                                                                                                                                                                  |
| Colorado    | Any dam less than 10 feet in height -- less than 20 acre highwater surface area or less than 1,000 acre-feet capacity may be excepted -- provided it is less in all three categories.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Connecticut | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Delaware    | Shall not apply to: (a) The landlord's right to place a dam across a gully on his property or across a stream that originates on his property where provision is made for continued established average minimum flow occurring for seven (7) consecutive days within the lowest flow year of record; or (b) the right to build and maintain a dam or construct a pond and divert water from any stream having a minimum flow of not more than one-half million gallons of water per day, and utilize up to three hundred sixty (360) acre inches of impounded water per year so long as such action does not affect the established average minimum flow in the stream below the dam at any |

|                      |                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Delaware (Continued) | time; or (c) ponds not larger than 60,000 square feet constructed for purposes of conservation, recreation, propagation, and protection of fish and wildlife, watering of stock, or fire protection.                                                                                                                                                                                                     |
| Florida              |                                                                                                                                                                                                                                                                                                                                                                                                          |
| DNR                  | None                                                                                                                                                                                                                                                                                                                                                                                                     |
| DPC                  | There are no exceptions as to size, capacity, off-stream location or class of ownership. Chapter 17-9 F.A.C. applies only to the phosphate industry. However, the design criteria in Section 17-9.03 of Chapter 17-9 F.A.C. is used as a guide in insuring that significant impoundments used for treating and/or storing other waste-waters will not violate Chapter 17-3 F.A.C. - Pollution of Waters. |
| Georgia              | --                                                                                                                                                                                                                                                                                                                                                                                                       |
| Hawaii               | --                                                                                                                                                                                                                                                                                                                                                                                                       |
| Idaho                | Fills less than 10 feet in height (toe to maximum storage level) and which cannot impound 50 acre-feet of water are not classified as dams and are not subject to regulations. Highway fills and canal checks also exempt.                                                                                                                                                                               |
| Illinois             | None                                                                                                                                                                                                                                                                                                                                                                                                     |
| Indiana              | Prior approval of the Natural Resources Commission before construction unless all of following apply: (a) drainage area above dam site less than one square mile, (b) height of dam above natural stream bed or lowest point in the valley less than 20 feet, (c) volume of impounded water to emergency spillway level less than 100 acre-feet, and (d) rights of other property owners not affected.   |
| Iowa                 | Approval is required for any dam: (1) built for flood control purposes; (2) across any stream or water course which drains more than 5,000 acres; (3) that provides far more than 18 acre-feet permanent storage or more than 25 acre-feet combined permanent and temporary storage and (4) that is in an urban area and is 6 feet or more in height.                                                    |



|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kansas        | K.S.A. 82a-301 to 305 does not prohibit the placing in a purely private stream any dam not more than ten feet high and not impounding more than fifteen (15) acre-feet of water.                                                                                                                                                                                                                                                                                     |
| Kentucky      | DOW-Rg-2 exempts Class A - Low Hazard structures for which the product of storage times the height of the dam is less than 3,000. DOW-Rg-3 exempts non-hazardous silt structures.                                                                                                                                                                                                                                                                                    |
| Louisiana     | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Maine         | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Maryland      | Small dams having less than 1 square mile drainage area, less than 15 feet height and less than 12 acres surface area are exempt from permit provided plans and specifications approved by Soil Conservation District and meet minimum standards of safety established by State.                                                                                                                                                                                     |
| Massachusetts | Not applicable to small dams, constructed for irrigation or for other purposes, the breaking of which would involve no risk to life or property, nor to standpipes or tanks, nor to a dam where the area drainage into the pond formed thereby does not exceed one square mile, unless the dam is more than ten feet in height above the natural bed of the stream at any point, or unless the quantity of water which the dam impounds exceeds one million gallons. |
| Michigan      | Act 184 applies only to dams that impound over five (5) surface acres or over 5-foot of head.                                                                                                                                                                                                                                                                                                                                                                        |
| Minnesota     | Any dams constructed completely outside the beds of public water are exempt from these regulations.                                                                                                                                                                                                                                                                                                                                                                  |
| Mississippi   | Must be on stream flowing more than 1/2 MGD and dam must impound more than 300 acre-feet.                                                                                                                                                                                                                                                                                                                                                                            |
| Missouri      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Montana       | There are no limitations.                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nebraska       | Dam on an ordinarily dry watercourse for storing water for livestock purposes or for erosion control, with an impounding capacity of not to exceed fifteen acre-feet shall be exempt.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Nevada         | Statutes apply to all dams in excess of 10 feet in height or having a storage capacity in excess of 10 acre-feet. The regulations do not apply to work constructed by the U.S. Bureau of Reclamation or the U.S. Army Corps of Engineers, but plans and specifications are required to be submitted by these two Federal agencies.                                                                                                                                                                                                                                                                                                                                                    |
| New Hampshire  | All structures require Board approval.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| New Jersey     | Exempts dams on any river or stream which will raise the waters less than five feet or the drainage area above the dam is less than one-half square mile in extent. If off stream no permit required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| New Mexico     | Dams not subject to inspection are those constructed by the United States while under the supervision of the officers of the United States. Dams less than ten feet in height or impoundments containing less than ten acre-feet do not require a permit. Also, dams constructed solely for silt retention and which do not impound or divert water for beneficial use do not require a permit.                                                                                                                                                                                                                                                                                       |
| New York       | Drainage area less than one square mile; or structure less than ten feet high; or ompoundment less than one million gallons. If any of these parameters are exceeded, a permit is required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| North Carolina | <p>a. Any dam constructed by the United States Army Corps of Engineers, the Tennessee Valley Authority, or any other department or agency of the United States government, when such department or agency designed or approved plans and supervised construction.</p> <p>b. Any dam or flood retarding structure constructed with financial assistance from the United States Soil Conservation Service, when said agency designed or approved plans and supervised construction.</p> <p>c. The exemptions conferred by items a and b of this subdivision shall cease when the supervising federal agency relinquishes authority for operation and maintenance to a local entity.</p> |

North Carolina  
(Continued)

d. Any dam licensed by the Federal Power Commission, or which a license application is pending with the Federal Power Commission, or for use in connection with electric generating facilities to be constructed pursuant to a certificate of public convenience and necessity from the North Carolina Utilities Commission.

e. Any dam under a single private ownership, providing protection only to land or other property under such ownership, and posing no threat to life or property below the property under such single ownership.

f. Any dam less than 15 feet in height (measured from original stream bottom to crest of dam) or whose impoundment capacity is less than ten (10) acre-feet, or any dam costing less than five thousand dollars (\$5,000.00).

North Dakota

Storage capability in excess of 12½ acre-feet require permit.

Ohio

Construction permits are not required under Section 1521.06 for:

(A) A dam, dike, or levee constructed by a conservancy district or subdistrict thereof organized under Chapter 6101 of the Revised Code, according to plans and specifications prepared by a registered professional engineer employed or retained by the district or subdistrict;

(B) A dam, dike, or levee constructed according to plans and specifications prepared by the technical staff of a soil and water conservation district organized under Chapter 1515 of the Revised Code;

(C) A dam which is less than ten feet in height from the natural stream bed to spillway level, unless the product of the storage capacity of the impoundment at spillway level in acre-feet and its height in feet is greater than one thousand;

(D) A dam, dike, or levee which belongs to a class exempted by the chief of the division of water;

Ohio  
(Continued)

Additionally, Division of Water Administrative Rule NRd-19-01 exempts the following classes of dams, dikes, and levees from construction permit requirements:

A. Dams, dikes and levees designed and constructed by the United States Army Corps of Engineers.

B. Dams, dikes and levees constructed by the State of Ohio, Department of Natural Resources, provided that copies of the design report, plans and specifications called for in Rules NRd-5-05, NRd-5-06, and NRd-5-07 and prepared by a registered professional engineer in accordance with Rule NRd-5-02 are filed with and approved by the Chief.

C. Dams placed by the Chief in Class V under rule NRd-13-01. Dams may be placed in Class V when failure of the dam would result in property loss restricted almost entirely to the dam, and no loss of human life or hazard to health is envisioned. Only dams which are 20 feet or less in height, and have a storage volume of 50 acre-feet or less, and leave total drainage area of 100 acres or less, shall be placed in Class V.

No dam shall be placed in Class V unless the applicant has submitted the preliminary report required by Rule NRd-5-03.

Dams under 10 feet high and dams placed in Class V are exempt from the periodic inspection requirements under Section 1521.062. Conservancy district dams and soil and water conservation district assisted dams exempt from construction permit requirements are not exempted from periodic inspection requirements.

Oklahoma

The Board's responsibility over dams shall be limited to any artificial barrier, together with appurtenant works, which does or may impound or divert water and which either: (a) Is or will be 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of barrier or from the lowest elevation of the outside limit of the barrier, if it is not across a stream channel or watercourse, to the maximum possible water storage elevation; or (b) Has or will have an impounding capacity of 50 acre-feet or more.



|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oklahoma<br>(Continued) | Any such barrier which is or will be not in excess of six (6) feet in height, regardless of storage capacity, or which has or will have a storage capacity not in excess of 15 acre-feet, regardless of height shall not be considered a dam. No obstruction in a canal used to raise or tower water therein or divert water therefrom and no fill or structure primarily for highway or railroad traffic shall be considered a dam.                                                     |
| Oregon                  | All except: (1) any dam less than 10 feet high or impounding less than 3,000,000 gallons of water; (2) splash dams used for driving logs; (3) farm dikes constructed by individuals on own property and (4) ditches carrying less than 5.0 c.f.s.                                                                                                                                                                                                                                        |
| Pennsylvania            | A permit from the Department of Environmental Resources is required for the construction of a dam if the drainage area (watershed) above the site of a proposed dam is one-half square mile (320 acres) or more, or if the dam would endanger life or property. However, no permit is required for a dam not exceeding 3 feet in height in a stream not exceeding 50 feet in width, where such dam is constructed for the sole purpose of creating a pool for fish and fishing purposes. |
| Rhode Island            | Officially all dams are subject to regulation. No official definition of dam; however, we do operate under the unofficial concept that a dam is a structure capable of permanently impounding three (3) or more feet of water.                                                                                                                                                                                                                                                           |
| South Carolina          | None - Bounds of Owners Land.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| South Dakota            | Federal Agency Construction (while still under supervision of that agency).                                                                                                                                                                                                                                                                                                                                                                                                              |
| Tennessee               | Limited to non-Federal dams 20 feet or more in height and/or 30 acre-feet in reservoir volume. Farm ponds, wastewater treatment ponds and any dam less than six (6) feet in height or 15 acre-feet reservoir volume are exempt.                                                                                                                                                                                                                                                          |
| Texas                   | Without obtaining a permit, a person may construct on his own property a dam or reservoir to impound or contain not more than 200 acre-feet of water for domestic and livestock purposes.                                                                                                                                                                                                                                                                                                |

10 (Continued)

|                   |                                                                                                                                                                                                                                                                           |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Utah              | Dams under 20 acre-feet capacity are exempt under law on plans and specifications. The U.S. Bureau of Reclamation is not subject to regulations.                                                                                                                          |
| Vermont           | Statute covers on-stream impoundments greater than 500,000 cubic feet of water.                                                                                                                                                                                           |
| Virginia          | None                                                                                                                                                                                                                                                                      |
| Washington        | State administration covers all non-Federally owned and operated dams that impound water to depth of 10 feet or more or that store 10 or more acre-feet of water.                                                                                                         |
| West Virginia     | An artificial barrier that will impound or divert water. (1) Will be 15 feet or more in height from the natural bed of such stream or water course measured at the upstream toe of the dam. (2) Which does or will create a reservoir of water covering 10 acres or more. |
| Wisconsin         | All dams are subject to regulations except Federally owned dams.                                                                                                                                                                                                          |
| Wyoming           | Plans not required for diversion dams on streams below five (5) feet in height or diversion dams to retain water below 10 feet in height. Work by United States excepted from requirements of supervision by State.                                                       |
| Puerto Rico       | None                                                                                                                                                                                                                                                                      |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                                                                                              |
| Guam              | None                                                                                                                                                                                                                                                                      |
| Trust Territories | None                                                                                                                                                                                                                                                                      |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                                                                              |

11. Are special agencies, such as municipal utility districts irrigation districts, cities, etc., exempt from permit requirements? If so specify.

|               |                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------|
| Alabama       | N/A                                                                                                   |
| Alaska        | --                                                                                                    |
| Arizona       | No                                                                                                    |
| Arkansas      | Yes. Drainage and Levee Districts if dam is part of a levee system.                                   |
| California    | No. The Federal government only is exempt.                                                            |
| Colorado      | No                                                                                                    |
| Connecticut   | No                                                                                                    |
| Delaware      | No                                                                                                    |
| Florida       |                                                                                                       |
| DNR           | No                                                                                                    |
| DPC           | No                                                                                                    |
| Georgia       | --                                                                                                    |
| Hawaii        | ---                                                                                                   |
| Idaho         | Yes. Federal government exempt for obtaining construction and design approval for its own facilities. |
| Illinois      | No                                                                                                    |
| Indiana       | No                                                                                                    |
| Iowa          | No                                                                                                    |
| Kansas        | Some. Kansas State agencies. Federal government agencies.                                             |
| Kentucky      | Yes. Kentucky Department of Highways                                                                  |
| Louisiana     | N/A                                                                                                   |
| Maine         | N/A                                                                                                   |
| Maryland      | No                                                                                                    |
| Massachusetts | No                                                                                                    |

|                |                                                                      |
|----------------|----------------------------------------------------------------------|
| Michigan       | No                                                                   |
| Minnesota      | No                                                                   |
| Mississippi    | No                                                                   |
| Missouri       | N/A                                                                  |
| Montana        | No - No permit system                                                |
| Nebraska       | No                                                                   |
| Nevada         | No                                                                   |
| New Hampshire  | No                                                                   |
| New Jersey     | No                                                                   |
| New Mexico     | No                                                                   |
| New York       | No                                                                   |
| North Carolina | No                                                                   |
| North Dakota   | No                                                                   |
| Ohio           | Yes. Limits and exemptions are included in the reply to question 10. |
| Oklahoma       | No. Federal government.                                              |
| Oregon         | No                                                                   |
| Pennsylvania   | Yes. Only agencies of Federal government.                            |
| Rhode Island   | No                                                                   |
| South Carolina | No - N/A                                                             |
| South Dakota   | No                                                                   |
| Tennessee      | No                                                                   |
| Texas          | No                                                                   |
| Utah           | No                                                                   |
| Vermont        | No                                                                   |



|                   |                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------|
| Virginia          | No - N/A                                                                                          |
| Washington        | No                                                                                                |
| West Virginia     | Yes. Federal government - U.S. Soil Conservation Service.                                         |
| Wisconsin         | No                                                                                                |
| Wyoming           | No                                                                                                |
| Puerto Rico       | No                                                                                                |
| Virgin Islands    | Did Not Answer Questionnaire                                                                      |
| Guam              | Yes. Agencies of the Government of Guam such as Public Utility Agency, Department of Agriculture. |
| Trust Territories | N/A                                                                                               |
| American Samoa    | Did Not Answer Questionnaire                                                                      |

12. Under regulations of your State, please give definition of "Height of Dam" and "Reservoir Capacity."

|             |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | --                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Alaska      | --                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Arizona     | <u>Height</u> - Maximum vertical distance from ground intercept of dam to spillway crest. <u>Reservoir Capacity</u> - storage volume to spillway crest.                                                                                                                                                                                                                                                                       |
| Arkansas    | <u>Height</u> - the vertical distance from the lowest point of foundation surface to the top of dam. <u>Reservoir Capacity</u> - the acre-feet of normal storage below the normal retention level, including dead storage and excluding flood control storage.                                                                                                                                                                |
| California  | <u>Height of Dam</u> - is measured "from the natural bed of the stream or watercourse at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier, to the maximum possible water storage elevation." There is not statutory definition of <u>Reservoir Capacity</u> ; in practice, it is the capacity in acre-feet at the maximum water storage elevation, including dead storage. |
| Colorado    | <u>Height of Dam</u> - taken at center line at lowest point in valley to crest of dam. <u>Capacity of Reservoir</u> - from outlet invert to emergency spillway crest.                                                                                                                                                                                                                                                         |
| Connecticut | <u>Height of Dam</u> - Maximum height of structure above natural ground at spillway level. <u>Capacity of Reservoir</u> - Area times average depth.                                                                                                                                                                                                                                                                           |
| Delaware    | Not defined.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Florida     |                                                                                                                                                                                                                                                                                                                                                                                                                               |
| DNR         | None                                                                                                                                                                                                                                                                                                                                                                                                                          |
| DPC         | Not defined by Chapter 17-9 F.A.C.                                                                                                                                                                                                                                                                                                                                                                                            |
| Georgia     | --                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Hawaii      | --                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Idaho       | <u>Height of Dam</u> - Lowest point along downstream toe to maximum water storage. <u>Reservoir Capacity</u> - Volume of water stored below maximum storage elevation.                                                                                                                                                                                                                                                        |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Illinois  | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Indiana   | <u>Height of Dam</u> is the number of feet vertical to top of dam from natural stream bed or lowest point on the valley floor. <u>Reservoir Capacity</u> is the volume of water impounded by the dam to the emergency spillway level.                                                                                                                                                                                                                                                                                                                                                                                   |
| Iowa      | There is no regulation that define these terms. <u>Height of Dam</u> , however, is taken as the vertical distance between the top of the dam and the lowest point of the downstream toe of the embankment. <u>Reservoir Capacity</u> is broken into permanent and temporary storage. Permanent storage is the volume of water which is stored upstream from a dam or in an impoundment up to the level of the principal outlet works of the structure. Temporary storage is a volume of water measured in acre feet which may be stored upstream of a dam or impoundment above the level of the principal outlet works. |
| Kansas    | <u>Height of Dam</u> - Vertical distance from stream bed elevation to elevation of lowest point in the top of the dam along the axis of the dam. <u>Reservoir Capacity</u> - Permanent -- storage in acre-feet at the elevation of the lowest ungated outlet; Detention -- storage in acre-feet between top elevation of permanent storage and crest elevation of emergency spillway. Surchage -- storage in acre-feet between crest elevation of emergency spillway and reservoir stage when emergency spillway is in operation.                                                                                       |
| Kentucky  | <u>Height of Dam</u> - Difference in elevation in feet between the emergency spillway crest and the lowest point in the original cross-section on the center line of the dam. <u>Reservoir Capacity</u> - Original capacity of the reservoir in acre-feet at the elevation of the crest of the emergency spillway.                                                                                                                                                                                                                                                                                                      |
| Louisiana | Not defined by law.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Maine     | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Maryland  | <u>Height of Dam</u> - Maximum vertical distance from stream bed to top of dam or spillway wall. <u>Reservoir Capacity</u> - Volume from low point up to crest of overflow spillway.                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Massachusetts | <u>Height of Dam</u> - More than 10 feet above the natural stream bed at any point. <u>Reservoir Capacity</u> - exceeds one million gallons.                                                                                                                                                                                                                                                                                                                  |
| Michigan      | Act 184, PA 1963, as amended refers to "head of dam" which is defined in the statute as the difference in nearest 1/20 foot-between pond headwaters and downstream tail water.                                                                                                                                                                                                                                                                                |
| Minnesota     | No regulation N/A                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Mississippi   | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Missouri      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Montana       | <u>Height of Dam</u> - Twenty-five (25) feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the dam or dike or from the lowest elevation of the outside limit of the dam or dike if it is not across a stream or watercourse, to the maximum storage elevation.<br><u>Reservoir Capacity</u> - Has or will have an impounding capacity at the maximum water storage elevation of 50 acre-feet or more. |
| Nebraska      | <u>Height of Dam</u> - from top to lowest point of structure including piling. <u>Reservoir Capacity</u> - Total from stream bed to top of surcharge pool.                                                                                                                                                                                                                                                                                                    |
| Nevada        | <u>Height of Dam</u> - difference in elevation between stream bed at downstream toe of the dam and the crest of the dam. <u>Reservoir Capacity</u> - volume of water impounded behind the dam at the maximum operating level.                                                                                                                                                                                                                                 |
| New Hampshire | No limit on height or reservoir capacity exempted.                                                                                                                                                                                                                                                                                                                                                                                                            |
| New Jersey    | <u>Height of Dam</u> - From the mean low water height to spillway elevation. <u>Reservoir Capacity</u> - no definition.                                                                                                                                                                                                                                                                                                                                       |
| New Mexico    | <u>Height of Dam</u> - Distance measured from lowest natural ground elevation to crest. <u>Reservoir Capacity</u> - New Mexico regulations do not define "Reservoir Capacity," The term reservoir capacity is not used without qualification. The term total storage capacity is commonly used. Total storage capacity means the volume of the reservoir below the maximum design water surface level including dead storage.                                 |



|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New York       | <u>Height of Dam</u> - From bed of stream to top of structure.<br><u>Reservoir Capacity</u> - Quantity of water which the structure impounds.                                                                                                                                                                                                                                                                                                                    |
| North Carolina | <u>Height of Dam</u> - Measured from original stream bottom to crest of dam.                                                                                                                                                                                                                                                                                                                                                                                     |
| North Dakota   | <u>Height of Dam</u> - Lowest on stream bed to crest of embankment. <u>Reservoir Capacity</u> - capacity at crest of spillway and maximum water level during flood stage.                                                                                                                                                                                                                                                                                        |
| Ohio           | Under Chapter NRd-3 of the rules, <u>Height of Dam</u> means the vertical dimension from the natural stream bed to the top of the dam, at the intersection of the longitudinal axis of the dam and the stream or watercourse. <u>Reservoir Capacity</u> - The term "storage volume" as used in Rule NRd-13-01, Classification of Dams, shall be total volume impounded when the pool level is at the extreme top of the dam immediately before it is overtopped. |
| Oklahoma       | <u>Height of Dam</u> - Height from the natural bed of the stream or watercourse at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier. If it is not across a stream channel or watercourse to the maximum possible water storage elevation. <u>Reservoir Capacity</u> - Maximum possible impounding capacity.                                                                                                    |
| Oregon         | <u>Height of Dam</u> - Stream bed on centerline to crest.<br><u>Reservoir Capacity</u> - Total storage from bottom to spillway crest on top of gates in spillway.                                                                                                                                                                                                                                                                                                |
| Pennsylvania   | <u>Height of Dam</u> - As measured from stream bed on centerline to top of dam. <u>Reservoir Capacity</u> - Storage provided at normal pool elevation.                                                                                                                                                                                                                                                                                                           |
| Rhode Island   | No official definition.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| South Carolina | None                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| South Dakota   | <u>Height of Dam</u> - From foundation. <u>Reservoir Capacity</u> - No definition as such.                                                                                                                                                                                                                                                                                                                                                                       |
| Tennessee      | <u>Height of Dam</u> - Height in feet as measured from the natural bed of the stream or watercourse at the downstream toe of the barrier. <u>Reservoir Capacity</u> - impounding capacity at maximum water storage elevation.                                                                                                                                                                                                                                    |

12 (Continued)

|                   |                                                                                                                                                                                                                                                                                    |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Texas             | <u>Height of Dam</u> - Height of embankment above original stream channel. <u>Reservoir Capacity</u> - Capacity or reservoir when water is at normal maximum operating level.                                                                                                      |
| Utah              | <u>Height of Dam</u> - The distance from the lowest point of the stream channel to the crest of the dam. <u>Reservoir Capacity</u> - All water stored in the reservoir up to spillway crest.                                                                                       |
| Vermont           | None                                                                                                                                                                                                                                                                               |
| Virginia          | N/A - No existing regulations                                                                                                                                                                                                                                                      |
| Washington        | <u>Height of Dam</u> - Vertical distance from natural bed of stream or water course at downstream toe of barrier to highest point on crest of barrier. <u>Reservoir Capacity</u> - Total capacity at normal water surface elevation.                                               |
| West Virginia     | <u>Height of Dam</u> - 15 feet or more from the natural bed of such stream or watercourse measured at the upstream toe of the dam. <u>Reservoir Capacity</u> - Ten acres or more.                                                                                                  |
| Wisconsin         | No specific definition.                                                                                                                                                                                                                                                            |
| Wyoming           | <u>Height of Dam</u> - The vertical distance between the top of the dam and the original stream bed or the original ground level. <u>Reservoir Capacity</u> - The volume of the reservoir body between the lowest water storage elevation and the crest of the emergency spillway. |
| Puerto Rico       | N/A                                                                                                                                                                                                                                                                                |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                       |
| Guam              | Regulations are general in nature only and cover all grading operations. No specific regulations for reservoirs exist at this time.                                                                                                                                                |
| Trust Territories | N/A                                                                                                                                                                                                                                                                                |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                       |

13. Is a permit or license required prior to commencement of construction of dam?

|               |                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------|
| Alabama       | No                                                                                                    |
| Alaska        | --                                                                                                    |
| Arizona       | Yes                                                                                                   |
| Arkansas      | Yes                                                                                                   |
| California    | Yes                                                                                                   |
| Colorado      | No. Must have approved plans and specifications.                                                      |
| Connecticut   | Yes                                                                                                   |
| Delaware      | Yes                                                                                                   |
| Florida       |                                                                                                       |
| DNR           | Yes                                                                                                   |
| DPC           | Yes, in connection with phosphate slime ponds and for wastewater treatment systems requiring permits. |
| Georgia       | --                                                                                                    |
| Hawaii        | --                                                                                                    |
| Idaho         | Yes                                                                                                   |
| Illinois      | Yes                                                                                                   |
| Indiana       | Yes                                                                                                   |
| Iowa          | Yes                                                                                                   |
| Kansas        | Yes                                                                                                   |
| Kentucky      | Yes                                                                                                   |
| Louisiana     | No                                                                                                    |
| Maine         | No                                                                                                    |
| Maryland      | Yes                                                                                                   |
| Massachusetts | Yes                                                                                                   |
| Michigan      | Yes                                                                                                   |

|                |                                                 |
|----------------|-------------------------------------------------|
| Minnesota      | Yes                                             |
| Mississippi    | No                                              |
| Missouri       | No                                              |
| Montana        | No                                              |
| Nebraska       | Yes                                             |
| Nevada         | Yes                                             |
| New Hampshire  | Yes                                             |
| New Jersey     | Yes                                             |
| New Mexico     | Yes                                             |
| New York       | Yes                                             |
| North Carolina | Yes. (Approval of Plans)                        |
| North Dakota   | Yes                                             |
| Ohio           | Yes                                             |
| Oklahoma       | Yes                                             |
| Oregon         | Yes                                             |
| Pennsylvania   | Yes                                             |
| Rhode Island   | Yes                                             |
| South Carolina | No                                              |
| South Dakota   | Yes. Water Right Permit or Department approval. |
| Tennessee      | Yes                                             |
| Texas          | Yes                                             |
| Utah           | Yes                                             |
| Vermont        | Yes                                             |



|                   |                              |                                                                                                                                                                                                           |
|-------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virginia          | Yes.                         | Regulation of construction and operation of dams within the Commonwealth of Virginia is exercised only for dams whose purpose is the generation of hydroelectric power for sale or use in public service. |
| Washington        | Yes                          |                                                                                                                                                                                                           |
| West Virginia     | Yes                          |                                                                                                                                                                                                           |
| Wisconsin         | Yes                          |                                                                                                                                                                                                           |
| Wyoming           | Yes                          |                                                                                                                                                                                                           |
| Puerto Rico       | Yes                          |                                                                                                                                                                                                           |
| Virgin Islands    | Did Not Answer Questionnaire |                                                                                                                                                                                                           |
| Guam              | Yes                          |                                                                                                                                                                                                           |
| Trust Territories | No                           |                                                                                                                                                                                                           |
| American Samoa    | Did Not Answer Questionnaire |                                                                                                                                                                                                           |

14. Is a fee charged?

|               |                                                         |
|---------------|---------------------------------------------------------|
| Alabama       | --                                                      |
| Alaska        | --                                                      |
| Arizona       | Yes                                                     |
| Arkansas      | Yes                                                     |
| California    | Yes                                                     |
| Colorado      | Yes                                                     |
| Connecticut   | No                                                      |
| Delaware      | No                                                      |
| Florida       |                                                         |
| DNR           | No                                                      |
| DPC           | Yes (\$20 permit application fee.)                      |
| Georgia       | --                                                      |
| Hawaii        | --                                                      |
| Idaho         | Yes. Where plans required.                              |
| Illinois      | No                                                      |
| Indiana       | No                                                      |
| Iowa          | No                                                      |
| Kansas        | No                                                      |
| Kentucky      | No                                                      |
| Louisiana     | No                                                      |
| Maine         | N/A                                                     |
| Maryland      | No                                                      |
| Massachusetts | No                                                      |
| Michigan      | Yes                                                     |
| Minnesota     | No. A fee will be charged subsequent to 1 January 1974. |

|                |                                                                                              |
|----------------|----------------------------------------------------------------------------------------------|
| Mississippi    | No                                                                                           |
| Missouri       | No                                                                                           |
| Montana        | No                                                                                           |
| Nebraska       | Yes                                                                                          |
| Nevada         | No                                                                                           |
| New Hampshire  | No                                                                                           |
| New Jersey     | No                                                                                           |
| New Mexico     | Yes                                                                                          |
| New York       | No                                                                                           |
| North Carolina | No                                                                                           |
| North Dakota   | No                                                                                           |
| Ohio           | Yes. A fee of \$100 is a statutory requirement of the application for a construction permit. |
| Oklahoma       | Yes                                                                                          |
| Oregon         | Yes                                                                                          |
| Pennsylvania   | Yes                                                                                          |
| Rhode Island   | Yes                                                                                          |
| South Carolina | No                                                                                           |
| South Dakota   | Yes                                                                                          |
| Tennessee      | Yes                                                                                          |
| Texas          | Yes                                                                                          |
| Utah           | No                                                                                           |
| Vermont        | Yes                                                                                          |
| Virginia       | No                                                                                           |
| Washington     | Yes                                                                                          |

|                   |                              |
|-------------------|------------------------------|
| West Virginia     | Yes                          |
| Wisconsin         | No                           |
| Wyoming           | Yes                          |
| Puerto Rico       | No                           |
| Virgin Islands    | Did Not Answer Questionnaire |
| Guam              | Yes                          |
| Trust Territories | No                           |
| American Samoa    | Did Not Answer Questionnaire |



15. Upon completion of a dam, is there a requirement for the issuance of a certification or license before commencement of storage in reservoir?

|             |                                                                                                                                                          |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                       |
| Alaska      | --                                                                                                                                                       |
| Arizona     | Yes                                                                                                                                                      |
| Arkansas    | No                                                                                                                                                       |
| California  | Yes                                                                                                                                                      |
| Colorado    | Yes                                                                                                                                                      |
| Connecticut | Yes                                                                                                                                                      |
| Delaware    | No                                                                                                                                                       |
| Florida     |                                                                                                                                                          |
| DNR         | No                                                                                                                                                       |
| DPC         | Yes                                                                                                                                                      |
| Georgia     | --                                                                                                                                                       |
| Hawaii      | --                                                                                                                                                       |
| Idaho       | Yes                                                                                                                                                      |
| Illinois    | No                                                                                                                                                       |
| Indiana     | No                                                                                                                                                       |
| Iowa        | -- It is necessary to secure a water storage permit from the State Water Commissioner if the dam is to impound 18 acre-feet or more (permanent storage). |
| Kansas      | No                                                                                                                                                       |
| Kentucky    | Yes                                                                                                                                                      |
| Louisiana   | No                                                                                                                                                       |
| Maine       | No                                                                                                                                                       |
| Maryland    | No                                                                                                                                                       |

|                |                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Massachusetts  | No                                                                                                                                                                                                                                                                                                                                                                                |
| Michigan       | No                                                                                                                                                                                                                                                                                                                                                                                |
| Minnesota      | No                                                                                                                                                                                                                                                                                                                                                                                |
| Mississippi    | No                                                                                                                                                                                                                                                                                                                                                                                |
| Missouri       | No                                                                                                                                                                                                                                                                                                                                                                                |
| Montana        | No                                                                                                                                                                                                                                                                                                                                                                                |
| Nebraska       | No                                                                                                                                                                                                                                                                                                                                                                                |
| Nevada         | No                                                                                                                                                                                                                                                                                                                                                                                |
| New Hampshire  | No                                                                                                                                                                                                                                                                                                                                                                                |
| New Jersey     | Yes. Completion report must be submitted by licensed engineer and accepted by State.                                                                                                                                                                                                                                                                                              |
| New Mexico     | Yes                                                                                                                                                                                                                                                                                                                                                                               |
| New York       | No. An affidavit that the structure was constructed according to plans and specifications must be submitted, however, by a registered professional engineer.                                                                                                                                                                                                                      |
| North Carolina | No                                                                                                                                                                                                                                                                                                                                                                                |
| North Dakota   | No                                                                                                                                                                                                                                                                                                                                                                                |
| Ohio           | No. A certification or license is not specifically required before commencement of storage. In most instances, however, closing the drain to commence storing water requires the approval of the Chief of the Division of Water. The Chief may also order the drain be opened and the impoundment drained or lowered. Smaller projects placed in Class IV do not require a drain. |
| Oklahoma       | No                                                                                                                                                                                                                                                                                                                                                                                |
| Oregon         | No. Certification by engineer supervising construction that it was completed according to specifications filed with the State Engineer and State Engineer inspection made at sometime thereafter as well as on a permanent basis.                                                                                                                                                 |

|                   |                                                                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Pennsylvania      | No                                                                                                                                      |
| Rhode Island      | No                                                                                                                                      |
| South Carolina    | No                                                                                                                                      |
| South Dakota      | No                                                                                                                                      |
| Tennessee         | Yes                                                                                                                                     |
| Texas             | Yes                                                                                                                                     |
| Utah              | No                                                                                                                                      |
| Vermont           | Yes                                                                                                                                     |
| Virginia          | No                                                                                                                                      |
| Washington        | No                                                                                                                                      |
| West Virginia     | No                                                                                                                                      |
| Wisconsin         | Yes. Ten days after completion of the dam the owner<br>verifies that it was constructed in accordance<br>with plans and specifications. |
| Wyoming           | No                                                                                                                                      |
| Puerto Rico       | No                                                                                                                                      |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                            |
| Guam              | No                                                                                                                                      |
| Trust Territories | No                                                                                                                                      |
| American Samoa    | Did Not Answer Questionnaire                                                                                                            |

16. Is there any requirement for periodic renewal of license or permit to continue a dam in service? If yes, for what period? Is a fee charged?

|             |                                                                                                                                                                                                                                                                                            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                                                                         |
| Alaska      | --                                                                                                                                                                                                                                                                                         |
| Arizona     | No                                                                                                                                                                                                                                                                                         |
| Arkansas    | Yes. Annual renewal and a fee is charged.                                                                                                                                                                                                                                                  |
| California  | No. An annual fee is charged dam owners, not related to renewal or continuation of certification to store water (Section 6307 of Water Code).                                                                                                                                              |
| Colorado    | No                                                                                                                                                                                                                                                                                         |
| Connecticut | No                                                                                                                                                                                                                                                                                         |
| Delaware    | No                                                                                                                                                                                                                                                                                         |
| Florida     |                                                                                                                                                                                                                                                                                            |
| DNR         | No                                                                                                                                                                                                                                                                                         |
| DPC         | Yes. Where permitting is required. Operation permits extend for periods of time up to 5 years. A \$20 fee is required.                                                                                                                                                                     |
| Georgia     | --                                                                                                                                                                                                                                                                                         |
| Hawaii      | --                                                                                                                                                                                                                                                                                         |
| Idaho       | Yes, 2 years on dams 20 feet or more in height, no fee charged.                                                                                                                                                                                                                            |
| Illinois    | No                                                                                                                                                                                                                                                                                         |
| Indiana     | No                                                                                                                                                                                                                                                                                         |
| Iowa        | Yes. For dams licensed under the provisions of Chapter 469 (milldams), an annual license and inspection fee of \$100 is required. For dams approved under chapter 455A, no renewal is required, however, the water storage permit, if originally required, must be renewed every 10 years. |
| Kansas      | No                                                                                                                                                                                                                                                                                         |
| Kentucky    | No                                                                                                                                                                                                                                                                                         |
| Louisiana   | --                                                                                                                                                                                                                                                                                         |



## 16 (continued)

|                |     |                                                                                                                                                                                                                                                                                           |
|----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maine          | No  |                                                                                                                                                                                                                                                                                           |
| Maryland       | No  |                                                                                                                                                                                                                                                                                           |
| Massachusetts  | No  |                                                                                                                                                                                                                                                                                           |
| Michigan       | No  |                                                                                                                                                                                                                                                                                           |
| Minnesota      | No  |                                                                                                                                                                                                                                                                                           |
| Mississippi    | No  |                                                                                                                                                                                                                                                                                           |
| Missouri       | No  |                                                                                                                                                                                                                                                                                           |
| Montana        | No  |                                                                                                                                                                                                                                                                                           |
| Nebraska       | No  |                                                                                                                                                                                                                                                                                           |
| Nevada         | No  |                                                                                                                                                                                                                                                                                           |
| New Hampshire  | No  |                                                                                                                                                                                                                                                                                           |
| New Jersey     | No  |                                                                                                                                                                                                                                                                                           |
| New Mexico     | No  |                                                                                                                                                                                                                                                                                           |
| New York       | No  |                                                                                                                                                                                                                                                                                           |
| North Carolina | No  |                                                                                                                                                                                                                                                                                           |
| North Dakota   | No  |                                                                                                                                                                                                                                                                                           |
| Ohio           | No. | When a dam has been satisfactorily completed and the bond released, it is no longer under permit requirements of Section 152106. A permit is valid for two years unless a longer period is specified. If the permit expires before construction has begun, a new permit must be obtained. |
| Oklahoma       | No  |                                                                                                                                                                                                                                                                                           |
| Oregon         | No  |                                                                                                                                                                                                                                                                                           |
| Pennsylvania   | No. | Annual fee charged with variable rate depending on height of embankment measured from stream-bed.                                                                                                                                                                                         |
| Rhode Island   | No  |                                                                                                                                                                                                                                                                                           |

|                   |                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| South Carolina    | No                                                                                                                                                                                                                                                                                                                                                                                          |
| South Dakota      | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Tennessee         | Yes. Not more than five years and a fee is charged.                                                                                                                                                                                                                                                                                                                                         |
| Texas             | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Utah              | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Vermont           | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Virginia          | Yes. All licenses are granted and remain in effect for a period of 50 years from and after the date of granting thereof. From and after the expiration of such terms of 50 years the licensee, its successor and assigns, hold property rights acquired under the authority of this chapter under an indeterminate license until same is purchased or acquired by due process by the State. |
| Washington        | No                                                                                                                                                                                                                                                                                                                                                                                          |
| West Virginia     | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Wisconsin         | No. Permit for abandonment or transfer is required.                                                                                                                                                                                                                                                                                                                                         |
| Wyoming           | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Puerto Rico       | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Virgin Islands    | Did Not Answer Questionnaire.                                                                                                                                                                                                                                                                                                                                                               |
| Guam              | No                                                                                                                                                                                                                                                                                                                                                                                          |
| Trust Territories | No                                                                                                                                                                                                                                                                                                                                                                                          |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                                                                                                                                |

17. Is a permit required for enlargement, modification or repair of dam?  
If yes, under what circumstances?

|             |                                                                                                                                                                                                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                                                  |
| Alaska      | --                                                                                                                                                                                                                                                                  |
| Arizona     | Yes. Required in all cases of enlargement; and generally for modification on repair, unless for minor maintenance.                                                                                                                                                  |
| Arkansas    | Yes. For enlargement                                                                                                                                                                                                                                                |
| California  | Yes. Under all circumstances, except very minor alteration or repair.                                                                                                                                                                                               |
| Colorado    | -- Plans and specifications must be filed prior to repair, modification or enlargement. No permit involved.                                                                                                                                                         |
| Connecticut | Yes. Any enlargement, modification or repair.                                                                                                                                                                                                                       |
| Delaware    | No                                                                                                                                                                                                                                                                  |
| Florida     |                                                                                                                                                                                                                                                                     |
| DNR         | --                                                                                                                                                                                                                                                                  |
| DPC         | Yes. For enlargements or modifications which will result in significant changes in flow or other characteristics of discharge effluents for a permitted system. Otherwise DPC's acceptance of the work is indicated by letter from appropriate DPC regional office. |
| Georgia     | --                                                                                                                                                                                                                                                                  |
| Hawaii      | --                                                                                                                                                                                                                                                                  |
| Idaho       | Yes. Any enlargement requires permit. Modifications and repairs that directly affect the safety of the dam also require permit.                                                                                                                                     |
| Illinois    | Yes. Permit required for enlargement or modification, but not repair.                                                                                                                                                                                               |
| Indiana     | Yes. Required for any modification that alters the dam from the original approved plans and specifications                                                                                                                                                          |

|               |                                                                                                                                                                                                                           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iowa          | Yes. A permit is required for any material change of dam, i.e. - enlargement of embankment, modification of spillway, etc. No permit is required for repair as long as such repair does not constitute a material change. |
| Kansas        | Yes. Required for enlargement or modification, not for repair. K.S.A. 82a-301 requires a permit for any change in or addition to any existing water obstruction.                                                          |
| Kentucky      | Yes. Required for any modification of a structure falling under the regulations.                                                                                                                                          |
| Louisiana     | --                                                                                                                                                                                                                        |
| Maine         | No                                                                                                                                                                                                                        |
| Maryland      | Yes. Required for any circumstances except emergency repair.                                                                                                                                                              |
| Massachusetts | Yes. Required for major repairs, alterations require application and approval as per Chapter 595 Section 44. Replacement in kind or minor repairs do not require application.                                             |
| Michigan      | Yes. Statutes require permit for "repair or reconstruction where the previously existing dam failed for whatever reason."                                                                                                 |
| Minnesota     | Yes. Required when enlargements take place or when modifications or repairs include changes in stream-flow characteristics or water levels.                                                                               |
| Mississippi   | No                                                                                                                                                                                                                        |
| Missouri      | No                                                                                                                                                                                                                        |
| Montana       | No                                                                                                                                                                                                                        |
| Nebraska      | Yes. Required for any change or rehabilitation.                                                                                                                                                                           |
| Nevada        | Yes. A permit is required for the construction, reconstruction, or alteration of any dam coming within the purview of Chapter 535, Nevada Revised Statutes.                                                               |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New Hampshire  | Yes. Required for raising the height of any structure or changing the discharge capacity.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| New Jersey     | Yes. Consent required to repair, alter or improve existing dams which raise the water more than five feet above their usual mean low-water height.                                                                                                                                                                                                                                                                                                                                                                                                  |
| New Mexico     | Yes. When amount of storage is to be increased.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| New York       | Yes. Required for raising water levels, change in operation of mechanical equipment and major reconstruction.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| North Carolina | Yes. Application and written approval of Department required to repair, alter, or remove a dam.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| North Dakota   | Yes. Required for enlargement and modification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Ohio           | Yes. It is generally required that a permit be obtained to substantially enlarge modify or alter an existing dam. Normal or routine maintenance and repairs generally do not require a construction permit. The Chief may ask to review the plans and specifications in such cases.                                                                                                                                                                                                                                                                 |
| Oklahoma       | Yes. During the construction, enlargement, repair, alteration, or removal of any dam or reservoir, the Board may make periodic inspections at State expense but shall require the owner to perform at his expense such work or tests as necessary to disclose information sufficient to enable the Board to determine that conformity with the approved plans and specifications is being secured, which shall include adequate inspection, at owner's expense, to satisfy the Board of compliance to approved plans, drawings, and specifications. |
| Oregon         | Yes. Required for all enlargements and significant modifications or repairs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Pennsylvania   | Yes. Required in the case where any change will be made to raise or lower water level or in any way modify that which has been approved.                                                                                                                                                                                                                                                                                                                                                                                                            |
| Rhode Island   | Yes. Only routine maintenance is excluded from regulation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| South Carolina | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| South Dakota   | Yes. Only from a water right standpoint.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Tennessee      | Yes. Required for such modification or repair that may affect the safety of the dam or reservoir, as determined by the Commissioner. Enlargement means any change in, or addition to, an existing dam which does or may raise the water storage elevation.                                                                                                                                                                                                                                     |
| Texas          | Yes. An application to amend a permit is required for enlargement of reservoir, for addition of diversion point, or for change in water use. An application is not required for structural repair or minor modifications; however, Commission approval is required.                                                                                                                                                                                                                            |
| Utah           | Yes. Plans and specifications are required in all instances other than emergency repairs.                                                                                                                                                                                                                                                                                                                                                                                                      |
| Vermont        | Yes. Required to remodel, reconstruct alter, enlarge, raise or add to any existing dam used for electric power or private purposes or in cooperation with agencies of the Federal Government for flood control purposes, or as an aid to navigation for the purpose of increasing the flowage area by more than 25 acres or increasing the quantity of water to be impounded by more than 500,000 cubic feet.                                                                                  |
| Virginia       | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Washington     | Yes. For any modification (including enlargement) plans and specifications must be approved. If enlarged for more storage, a permit must be obtained.                                                                                                                                                                                                                                                                                                                                          |
| West Virginia  | Yes. Application and certificate of approval required for any change in or addition to an existing dam which (1) raises the height of the dam, (2) raises or may raise the water storage elevation of the water impounded by the dam, (3) increases or may increase the amount of water impounded by the dam, or (4) increases or may increase the watershed area from which water is impounded by the dam and (5) changes in the structure or integrity of a dam which may affect its safety. |

|                   |                                                                                                                                                          |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wisconsin         | Yes. Any change in the dam requires permit. Repairs do not require a permit.                                                                             |
| Wyoming           | Yes. A permit is required for enlargement or modification if the enlargement or modification increases the storage capacity of the reservoir.            |
| Puerto Rico       | Yes. After approval by the Puerto Rico Planning Board.                                                                                                   |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                             |
| Guam              | Yes. Required for any structural alterations, repairs exceeding 25 percent of value and any fills over one foot in depth or in excess of 50 cubic yards. |
| Trust Territories | No                                                                                                                                                       |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                             |

18. Is on-site inspection by State personnel required during construction?

|             |                                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                             |
| Alaska      | --                                                                                                             |
| Arizona     | Yes                                                                                                            |
| Arkansas    | Yes                                                                                                            |
| California  | Yes                                                                                                            |
| Colorado    | Yes. Periodic on-site inspections.                                                                             |
| Connecticut | Yes                                                                                                            |
| Delaware    | Yes                                                                                                            |
| Florida     |                                                                                                                |
| DNR         | No                                                                                                             |
| DPC         | No                                                                                                             |
| Georgia     | --                                                                                                             |
| Hawaii      | --                                                                                                             |
| Idaho       | Yes                                                                                                            |
| Illinois    | Yes                                                                                                            |
| Indiana     | No                                                                                                             |
| Iowa        | No                                                                                                             |
| Kansas      | Not required. Policy of Division is to have personnel make certain foundation inspections on major structures. |
| Kentucky    | No                                                                                                             |
| Louisiana   | --                                                                                                             |
| Maine       | No                                                                                                             |
| Maryland    | No                                                                                                             |

|                |                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Masachusetts   | Yes. Section 44 of Chapter 595 require the Commissioner to "inspect the work during its progress." This requirement cannot be completely satisfied because of the frequent unavailability of the District Engineer - inspectors to be present at the work site on a full-time basis. Our inspection can be described at best, as "periodic" because of shortages of engineering personnel. |
| Michigan       | Yes                                                                                                                                                                                                                                                                                                                                                                                        |
| Minnesota      | No                                                                                                                                                                                                                                                                                                                                                                                         |
| Mississippi    | No                                                                                                                                                                                                                                                                                                                                                                                         |
| Missouri       | No                                                                                                                                                                                                                                                                                                                                                                                         |
| Montana        | No                                                                                                                                                                                                                                                                                                                                                                                         |
| Nebraska       | No                                                                                                                                                                                                                                                                                                                                                                                         |
| Nevada         | No                                                                                                                                                                                                                                                                                                                                                                                         |
| New Hampshire  | No                                                                                                                                                                                                                                                                                                                                                                                         |
| New Jersey     | Yes                                                                                                                                                                                                                                                                                                                                                                                        |
| New Mexico     | No                                                                                                                                                                                                                                                                                                                                                                                         |
| New York       | No                                                                                                                                                                                                                                                                                                                                                                                         |
| North Carolina | No. Dam Safety Law provides for inspection but not required.                                                                                                                                                                                                                                                                                                                               |
| North Dakota   | No                                                                                                                                                                                                                                                                                                                                                                                         |
| Ohio           | No. Construction inspections by State personnel are not specifically required unless the required inspections by the owner are not being made. The State may then make the inspections and charge the cost to the owner. Generally, State personnel make spot checks during construction.                                                                                                  |
| Oklahoma       | Yes                                                                                                                                                                                                                                                                                                                                                                                        |
| Oregon         | Yes                                                                                                                                                                                                                                                                                                                                                                                        |

|                   |                                            |
|-------------------|--------------------------------------------|
| Pennsylvania      | Yes                                        |
| Rhode Island      | No                                         |
| South Carolina    | No                                         |
| South Dakota      | No                                         |
| Tennessee         | No                                         |
| Texas             | Yes. Monthly.                              |
| Utah              | Yes                                        |
| Vermont           | Yes. Periodic.                             |
| Virginia          | No                                         |
| Washington        | No                                         |
| West Virginia     | Yes                                        |
| Wisconsin         | Yes. It can be.                            |
| Wyoming           | Yes. In cases where circumstances warrant. |
| Puerto Rico       | Yes                                        |
| Virgin Islands    | Did Not Answer Questionnaire               |
| Guam              | Yes                                        |
| Trust Territories | Yes                                        |
| American Samoa    | Did Not Answer Questionnaire               |



19. Are there any requirements for record keeping during the construction and operation of such dam or reservoir? If yes, under what circumstances?

|             |                                                                                                                                                                                                                                                                                                                                               |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                                                                                                                            |
| Alaska      | --                                                                                                                                                                                                                                                                                                                                            |
| Arizona     | Yes. Control tests, survey data, grouting records, seepage, settlement and other surveillance data may be required depending upon size and hazard potential of the dam.                                                                                                                                                                       |
| Arkansas    | No                                                                                                                                                                                                                                                                                                                                            |
| California  | Yes. Reports of foundation exploration, including logs of drill holes, soils testing and rock testing; grouting reports; soils and concrete test data; instrumentation data, including pore pressures, movement data, stress and strain records; and any other items of permanent value having a bearing on the safety of dam (Section 6350). |
| Colorado    | Yes. Soils tests -- compaction tests on earth fills. Concrete cylinders -- files of data are kept permanently.                                                                                                                                                                                                                                |
| Connecticut | No                                                                                                                                                                                                                                                                                                                                            |
| Delaware    | No                                                                                                                                                                                                                                                                                                                                            |
| Florida     |                                                                                                                                                                                                                                                                                                                                               |
| DNR         | No                                                                                                                                                                                                                                                                                                                                            |
| DPC         | Yes. Data indicated in Sections 17-9.03, 17-9.04 and 17-9.05 of Chapter 17-9 F.A.C. for phosphate industry dams.                                                                                                                                                                                                                              |
| Georgia     | --                                                                                                                                                                                                                                                                                                                                            |
| Hawaii      | --                                                                                                                                                                                                                                                                                                                                            |
| Idaho       | Yes. Any records the department feels are necessary to insure safety may be required.                                                                                                                                                                                                                                                         |
| Illinois    | No                                                                                                                                                                                                                                                                                                                                            |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indiana       | No                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Iowa          | No. Not unless specifically required for a particular project.                                                                                                                                                                                                                                                                                                                                                                                        |
| Kansas        | Yes. On major structures, as built profile data on core trench, principal spillway trench and foundation drain trench.                                                                                                                                                                                                                                                                                                                                |
| Kentucky      | Yes. Data to complete as-built plans.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Louisiana     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Maine         | No                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Maryland      | Yes. Written assurance from engineer in charge that dam was constructed in accordance with plans and specifications. All test data, project history and "as built" plans.                                                                                                                                                                                                                                                                             |
| Massachusetts | No. At the present time there is no specific requirements for record-keeping during the project; however, we hope to revise our procedures, in the near future, that would require the applicant, as a condition of approval, to insure that a qualified engineer-inspector would be present on a full time basis during construction who would be required to submit written weekly or bi-monthly inspection reports to the Commissioner for review. |
| Michigan      | No                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Minnesota     | No. Not specifically; however, progress reports are usually required.                                                                                                                                                                                                                                                                                                                                                                                 |
| Mississippi   | No                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Missouri      | No                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Montana       | No                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Nebraska      | Yes. A progress report is required showing 1/10 completion during first year and progress to assure completion during time allowed in application approval.                                                                                                                                                                                                                                                                                           |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nevada         | Yes. A notice of commencement and a notice of completion of the dam are required to be filed, and periodic progress reports are required to be submitted during construction by the resident registered engineer.                                                                                                                                                                                                       |
| New Hampshire  | Yes. Depending on the conditions of the permit which the Board approves; inspection reports recorded.                                                                                                                                                                                                                                                                                                                   |
| New Jersey     | No                                                                                                                                                                                                                                                                                                                                                                                                                      |
| New Mexico     | No                                                                                                                                                                                                                                                                                                                                                                                                                      |
| New York       | No                                                                                                                                                                                                                                                                                                                                                                                                                      |
| North Carolina | No. Start and completion of construction must be reported.                                                                                                                                                                                                                                                                                                                                                              |
| North Dakota   | No                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Ohio           | Yes. Division of Water Administrative Rules require construction reports consisting of a daily log of construction operations. The registered engineer responsible for inspection is required to submit progress reports monthly or more often if required in the permit. As-built plans must be submitted upon completion of the project.                                                                              |
| Oklahoma       | Yes. May require the owner to keep records of and report on maintenance, operation, staffing, and engineering and geological investigations.                                                                                                                                                                                                                                                                            |
| Oregon         | Yes. Adequate supporting data to insure construction in accordance with approved plans and specifications must be furnished by engineer; varying from statement of compliance to detailed materials testing and analysis. On individual project basis: continuing measurements for settlement, deflection, seepage, pore pressures, pool elevation, etc. will be required if deemed necessary to insure safe operation. |
| Pennsylvania   | Yes. Progress reports during construction.                                                                                                                                                                                                                                                                                                                                                                              |

|                |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rhode Island   | No   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| South Carolina | No   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| South Dakota   | No   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Tennessee      | Yes. | All geological and foundation data; date, location and results of all material tests made, narrative of problems encountered; photographs of selected projects; and a record of permanent location points, bench marks and any embedded instruments.                                                                                                                                                                                                                                     |
| Texas          | Yes. | Construction progress report, monthly (percent time used and percent completion). Control records during construction including test results. (Soil moisture-density test locations and results are plotted on plan and profile of the dam. Piezometer readings, settlement observations, etc. are usually furnished by the Consulting Engineer in plotted form). As built plans after completion of construction. Owners are required to maintain records of maintenance and operation. |
| Utah           | Yes. | Inspection reports and other pertinent data and construction changes.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Vermont        | No   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Virginia       | No   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Washington     | No   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| West Virginia  | Yes. | According to W. Va. Senate Bill No. 2057 any inspections, tests and records necessary to provide adequate supervision of construction.                                                                                                                                                                                                                                                                                                                                                   |
| Wisconsin      | Yes. | Construction progress schedules, test results, and as built plans required during construction. During operation utility data is analyzed on a yearly basis; other data when called for.                                                                                                                                                                                                                                                                                                 |
| Wyoming        | No.  | Records of water administration-inflows, outflows, amounts of storage - are kept for some reservoirs.                                                                                                                                                                                                                                                                                                                                                                                    |

|                   |                                                                                                                                                                         |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Puerto Rico       | Yes. Weekly and monthly reports on construction; monthly reports on operation; and special inspection reports.                                                          |
| Virgin Islands    | Did Not Answer Questionnaire.                                                                                                                                           |
| Guam              | Yes. Engineering and geologic reports may be required by the Building Official to certify adequacy of foundation-soils, stability of slopes and adequacy of compaction. |
| Trust Territories | Yes. Test boring, concrete design criteria in accordance with specifications.                                                                                           |
| American Samoa    | Did Not Answer Questionnaire.                                                                                                                                           |



20. What is done with the data accumulated? Does the Owner retain, or must it be sent to the State? What is frequency of sending data to the State? If sent to the State, is it reviewed and analyzed?

|             |                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | --                                                                                                                                                                                                                                                                                                                                                                                                       |
| Alaska      | --                                                                                                                                                                                                                                                                                                                                                                                                       |
| Arizona     | The data is transmitted for State review, action and file. The owner retains with copy to State if required. The frequency varies according to nature and type.                                                                                                                                                                                                                                          |
| Arkansas    | N/A                                                                                                                                                                                                                                                                                                                                                                                                      |
| California  | The data is reviewed and evaluated periodically by the State or as received to maintain adequate surveillance of construction and operation of each dam. Data sent by owner to the State in all important cases. The frequency is variable depending on importance of dam and nature of data. Generally annually. In some cases monthly or quarterly and in a few cases at intervals more than one year. |
| Colorado    | Data permanently filed. Owner may retain -- State requires copy for review and analysis. The frequency is weekly or monthly on big or high dams; at the end of job on small dams.                                                                                                                                                                                                                        |
| Connecticut | Plans and specifications are reviewed by the State prior to issuance of Construction Permit.                                                                                                                                                                                                                                                                                                             |
| Delaware    | N/A                                                                                                                                                                                                                                                                                                                                                                                                      |
| Florida     |                                                                                                                                                                                                                                                                                                                                                                                                          |
| DNR         | --                                                                                                                                                                                                                                                                                                                                                                                                       |
| DPC         | Data is maintained by owner and reported to DPC regional office for phosphate industry dams. For all permitted wastewater treatment facilities (many of which include impoundments) operation reports containing wastewater analytical results is required monthly. All data received is reviewed by DPC regional personnel.                                                                             |
| Georgia     | --                                                                                                                                                                                                                                                                                                                                                                                                       |
| Hawaii      | --                                                                                                                                                                                                                                                                                                                                                                                                       |

|               |                                                                                                                                                                                                                         |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Idaho         | Copies submitted to the Department of Water Administration for review and filing. Owner not explicitly required to retain data. Frequency of submission is left to the department to decide.                            |
| Illinois      | N/A                                                                                                                                                                                                                     |
| Indiana       | N/A                                                                                                                                                                                                                     |
| Iowa          | Data submitted to regulatory agency for review and analysis. Frequency depends upon the nature of the project.                                                                                                          |
| Kansas        | Data must be sent to the State for review and analysis. Data plotted on approved plans and filed. The data is sent once upon completion.                                                                                |
| Kentucky      | As-buile drawings prepared by engineer must be submitted to the State for filing with the Division of Water. Changes to plans must be approved before they are made and construction permit amended to reflect changes. |
| Louisiana     | Accumulated data retained by owner.                                                                                                                                                                                     |
| Maine         | N/A                                                                                                                                                                                                                     |
| Maryland      | The data is forwarded to State for review and analysis when the project is complete. There is an option to require reporting at more frequent interval. Data filed for future use (investigation) if needed.            |
| Massachusetts | N/A                                                                                                                                                                                                                     |
| Michigan      | N/A                                                                                                                                                                                                                     |
| Minnesota     | Progress reports are reviewed and retained in appropriate Department records.                                                                                                                                           |
| Mississippi   | N/A                                                                                                                                                                                                                     |
| Missouri      | N/A                                                                                                                                                                                                                     |
| Montana       | N/A                                                                                                                                                                                                                     |

|                |                                                                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nebraska       | Data sent to the State for review and analysis to assure compliance. The frequency is variable as required in application or by inspection.                                                                                                                                                                                |
| Nevada         | The data must be forwarded when it is available to State Engineer for review and analysis and placed in the specific dam file.                                                                                                                                                                                             |
| New Hampshire  | Data accumulated kept on file for future reference. Owner may have copy of inspection reports; State retains all inspection reports. Frequency depends on permit requirements established by the Board. Reviewed by Engineering Staff.                                                                                     |
| New Jersey     | Data reviewed and analyzed and kept in State files. State retains drawings, specifications and reports. Data furnished at approximately five year intervals. New policy is to establish as a condition to permit, yearly inspection reports.                                                                               |
| New Mexico     | N/A                                                                                                                                                                                                                                                                                                                        |
| New York       | N/A                                                                                                                                                                                                                                                                                                                        |
| North Carolina | Filed for use in inspections and subsequent actions.                                                                                                                                                                                                                                                                       |
| North Dakota   | N/A                                                                                                                                                                                                                                                                                                                        |
| Ohio           | The data is reviewed and analyzed and made part of the file for that permit project. The State maintains a file on the project. Copies of the approved plans, etc. are returned to the owner. Reports made during construction are required to be submitted monthly. More frequent reporting may be required by the Chief. |
| Oklahoma       | Data sent to the State is reviewed and analyzed and filed at Oklahoma Water Resources Board. Frequency of sending data is as required by Oklahoma Water Resources Board.                                                                                                                                                   |
| Oregon         | Evaluated for compliance; any indicated problems are held for future evaluation if problem develops. Copies sent to the State and retained with file. Frequently as required to insure safe operation. The data is reviewed and analyzed.                                                                                  |

|                |                                                                                                                                                                                                                                                                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pennsylvania   | Data sent monthly to the State for review and analyses and filing.                                                                                                                                                                                                                                                                                |
| Rhode Island   | N/A                                                                                                                                                                                                                                                                                                                                               |
| South Carolina | N/A                                                                                                                                                                                                                                                                                                                                               |
| South Dakota   | N/A                                                                                                                                                                                                                                                                                                                                               |
| Tennessee      | Data compiled in history of project. Sent to State upon completion of construction for review and analysis                                                                                                                                                                                                                                        |
| Texas          | Data reviewed and analyzed and filed in central records of the Commission. Owner retains data with copy furnished to the State. Data submitted monthly during construction and yearly thereafter except in the event of an unprecedented flood or alarming circumstances in which case the Commission shall be promptly advised of the situation. |
| Utah           | Data filed as public record in files of Division of Water Rights. Schedule of submission established on each dam. This data is reviewed and analyzed.                                                                                                                                                                                             |
| Vermont        | N/A                                                                                                                                                                                                                                                                                                                                               |
| Virginia       | N/A                                                                                                                                                                                                                                                                                                                                               |
| Washington     | N/A                                                                                                                                                                                                                                                                                                                                               |
| West Virginia  | Data used in evaluation of project. Owner retains and sends to the State as requested. Data reviewed and analyzed to determine if design change is necessary.                                                                                                                                                                                     |
| Wisconsin      | Data kept in permanent files. Copies are sent to the State. During operation utility data is analyzed on a yearly basis; other data when called for.                                                                                                                                                                                              |
| Wyoming        | Data filed in State Engineers Office. Usually sent in after irrigation season. The data is reviewed and analyzed.                                                                                                                                                                                                                                 |
| Puerto Rico    | Data kept in record by PRWRA, Engineering and Construction Division. Retained by the Puerto Rico Water Resources Authority and Puerto Rico Aqueduct and Sewer Authority.                                                                                                                                                                          |

|                   |                                                                                                                                                                                                                                                           |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                                                                              |
| Guam              | Report must be sent to the Project Civil Engineer and the Department of Public Works, Building Official. Frequency is required by the Building Official. Reviewed by the Building Official who may consult with the Division of Engineering if necessary. |
| Trust Territories | Data is kept on file at Headquarters Public Works, copies at District and Headquarters. Data furnished as work and construction progresses. Data is reviewed and analyzed.                                                                                |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                                                              |



21. Are inspections for safety purposes made by State after completion of dam? If yes, is there a definite schedule of inspections?

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama               | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Alaska                | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Arizona               | Yes. Biannually, annually, semiannually or more frequently if required.                                                                                                                                                                                                                                                                                                                                                                                                             |
| Arkansas              | Yes. Annual                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| California            | Yes. Each dam is inspected and evaluated at least once annually. About one-third are inspected twice annually a few four times annually, and several at more frequent intervals depending on circumstances.                                                                                                                                                                                                                                                                         |
| Colorado              | Yes. Annual inspections after final on completion of dam.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Connecticut           | Yes. No definite schedule.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Delaware              | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Florida<br>DNR<br>DPC | No<br>Not routinely. The owner is responsible for adequately maintaining dams and impoundments. With respect to phosphate industry operations, the owner is responsible for having dams adequately inspected, maintaining inspection records, and submitting inspection reports to the DPC in accordance with Section 17-9.05 of Chapter 17-9 F.A.C. as part of the water pollution enforcement program, DPC regional staff members inspect impoundments when considered necessary. |
| Georgia               | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Hawaii                | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Idaho                 | Yes. Every two years on most dams (required on those 20 feet or more in height). Smaller dams as necessary (usually every two to four years).                                                                                                                                                                                                                                                                                                                                       |
| Illinois              | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Indiana               | Yes. Once a year.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

21 (Continued)

|               |                                                                                                                                                                                                                                                                                                                                                   |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iowa          | Yes. There are no statutory requirements for such inspections, although the Council does have a policy of inspecting all dams initially after construction and periodically thereafter for the larger dams. Budget limitations and the associated staff limitations coupled with increased work load have severely curtailed inspection activity. |
| Kansas        | -- Upon request. No definite schedule.                                                                                                                                                                                                                                                                                                            |
| Kentucky      | Yes. When a structure might constitute a hazard to life or property, but no definite schedule for inspections.                                                                                                                                                                                                                                    |
| Louisiana     | No                                                                                                                                                                                                                                                                                                                                                |
| Maine         | No                                                                                                                                                                                                                                                                                                                                                |
| Maryland      | No. No definite schedule at this time.                                                                                                                                                                                                                                                                                                            |
| Massachusetts | Yes. Law requires inspection at least once every two years. Present staff inadequate to completely satisfy this requirement.                                                                                                                                                                                                                      |
| Michigan      | Yes. No definite schedule.                                                                                                                                                                                                                                                                                                                        |
| Minnesota     | No. Only when there is obvious need for an inspection.                                                                                                                                                                                                                                                                                            |
| Mississippi   | No                                                                                                                                                                                                                                                                                                                                                |
| Missouri      | No                                                                                                                                                                                                                                                                                                                                                |
| Montana       | No                                                                                                                                                                                                                                                                                                                                                |
| Nebraska      | Yes. Annual.                                                                                                                                                                                                                                                                                                                                      |
| Nevada        | Yes. Inspections by State personnel are made as time allows.                                                                                                                                                                                                                                                                                      |
| New Hampshire | Yes. No definite time reference in statutes. Statutes state "from time to time" all dams be inspected.                                                                                                                                                                                                                                            |
| New Jersey    | Yes. Inspection is made only when information is received that some safety aspect may be involved.                                                                                                                                                                                                                                                |

21 (Continued)

|                |                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New Mexico     | Yes. Upon filing of proof of completion of works.                                                                                                                                                                                                                                                                                                                                              |
| New York       | No                                                                                                                                                                                                                                                                                                                                                                                             |
| North Carolina | Yes. Every five years, subject to availability of funds (none available). We are currently inspecting mine-tailings dams selected by State Mining Engineer.                                                                                                                                                                                                                                    |
| North Dakota   | No                                                                                                                                                                                                                                                                                                                                                                                             |
| Ohio           | Yes. There is a statutory requirement that intervals between inspections not exceed five years. Section 1521.062 of the Ohio Revised Code, requiring periodic inspections of dams became effective December 18, 1969. Due to lack of staff the inspection program has moved slowly. A State inventory of dams is currently being undertaken in conjunction with the Federal inventory of dams. |
| Oklahoma       | Yes. No definite schedule.                                                                                                                                                                                                                                                                                                                                                                     |
| Oregon         | Yes. Definite schedule on specific dams; random on others, with a minimum at least every five years.                                                                                                                                                                                                                                                                                           |
| Pennsylvania   | Yes. No definite schedule.                                                                                                                                                                                                                                                                                                                                                                     |
| Rhode Island   | Yes. No definite schedule.                                                                                                                                                                                                                                                                                                                                                                     |
| South Carolina | No                                                                                                                                                                                                                                                                                                                                                                                             |
| South Dakota   | Yes. No definite schedule but upon completion of the works.                                                                                                                                                                                                                                                                                                                                    |
| Tennessee      | Yes. Initial safety inspection is part of project review. A schedule for periodic safety inspections will be set for each structure. Each dam must be inspected at least once every five years.                                                                                                                                                                                                |
| Texas          | Yes. 500 acre-feet or larger, every two years; 200-500 acre-feet, every four years; less than 200 acre-feet, one time (if OK).                                                                                                                                                                                                                                                                 |
| Utah           | Yes. There is a definite schedule.                                                                                                                                                                                                                                                                                                                                                             |
| Vermont        | Yes. Class I, annually; Class II, every three years; Class III every five years.                                                                                                                                                                                                                                                                                                               |

|                   |                                                                                                                                                                                |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virginia          | No                                                                                                                                                                             |
| Washington        | Yes. Inspections are scheduled for different periods depending upon the condition of each project.                                                                             |
| West Virginia     | Yes. No definite schedule, periodic only.                                                                                                                                      |
| Wisconsin         | Yes. All dams with a potential of 750 HP or more are inspected annually; others are inspected upon request or complaint.                                                       |
| Wyoming           | No. Inspection made by Water Division Superintendent for final proof of construction prior to adjudication of water right. Otherwise only when the safety might be questioned. |
| Puerto Rico       | Yes. PRWRA Inspection of Dams and Related Facilities presently plans normal inspections every three years.                                                                     |
| Virginia Island   | Did Not Answer Questionnaire                                                                                                                                                   |
| Guam              | No                                                                                                                                                                             |
| Trust Territories | Yes. Every six months.                                                                                                                                                         |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                   |

22. Who does the inspection and at whose expense?

|             |                                                                                                                                                                                    |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | --                                                                                                                                                                                 |
| Alaska      | --                                                                                                                                                                                 |
| Arizona     | The State, at their expense.                                                                                                                                                       |
| Arkansas    | Engineers from the Division of Soil and Water Resources at State expense.                                                                                                          |
| California  | Staff engineers of the Department of Water Resources at State expense.                                                                                                             |
| Colorado    | Division of Water Resources (State) employees at State expense.                                                                                                                    |
| Connecticut | State personnel or consultants at State expense.                                                                                                                                   |
| Delaware    | N/A                                                                                                                                                                                |
| Florida     |                                                                                                                                                                                    |
| DNR         | --                                                                                                                                                                                 |
| DPC         | Inspections are made at State expense when such inspections are considered necessary to facilitate water pollution control.                                                        |
| Georgia     | --                                                                                                                                                                                 |
| Hawaii      | --                                                                                                                                                                                 |
| Idaho       | Idaho Department of Water Administration inspects at its expense, usually, an engineer or technician under engineer's supervision inspects.                                        |
| Illinois    | N/A                                                                                                                                                                                |
| Indiana     | Staff members of the Division of Water at State expense                                                                                                                            |
| Iowa        | Inspections are made by staff members at the Council's expense, except for dams licensed under Chapter 469 (milledams) for which the owner pays an annual inspection fee of \$100. |
| Kansas      | Representative of Division of Water Resources, at State expense.                                                                                                                   |



|                |                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kentucky       | State personnel at State expense.                                                                                                                                                                   |
| Louisiana      | N/A                                                                                                                                                                                                 |
| Maine          | N/A                                                                                                                                                                                                 |
| Maryland       | State engineers at State expense.                                                                                                                                                                   |
| Massachusetts  | Department of Public Works Engineers at the expense of the Commonwealth.                                                                                                                            |
| Michigan       | On dam construction or reconstruction permits, final inspection is made by DNR engineers and permit fee covers inspection. On old dams, DNR engineers conduct brief inspections at State's expense. |
| Minnesota      | Either Department personnel or a registered professional engineer this is done at the owner's expense.                                                                                              |
| Mississippi    | N/A                                                                                                                                                                                                 |
| Missouri       | N/A                                                                                                                                                                                                 |
| Montana        | N/A                                                                                                                                                                                                 |
| Nebraska       | State.                                                                                                                                                                                              |
| Nevada         | Inspections are made by the Surface Water Engineer of the Division of Water Resources at State expense.                                                                                             |
| New Hampshire  | Water Resources Board engineering staff or Board can hire consultants all at State expense.                                                                                                         |
| New Jersey     | The engineer in charge of dam analysis within the Bureau of Water Control of the State.                                                                                                             |
| New Mexico     | Usually made by authorized engineer at owners expense. The State may make the inspection.                                                                                                           |
| New York       | N/A                                                                                                                                                                                                 |
| North Carolina | By consultant at State expense - visual inspections are made by State personnel to establish priorities for consultants.                                                                            |
| North Dakota   | N/A                                                                                                                                                                                                 |

|                |                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------|
| Ohio           | The State may make the inspection or use inspection reports prepared for the owner by a registered engineer.           |
| Oklahoma       | Staff of Oklahoma Water Resources Board at State expense.                                                              |
| Oregon         | State Engineer's office.                                                                                               |
| Pennsylvania   | Engineers on staff at State expense.                                                                                   |
| Rhode Island   | State personnel at State expense.                                                                                      |
| South Carolina | N/A                                                                                                                    |
| South Dakota   | Water Rights Division Personnel. Nominal fee required for Certificate of Completion.                                   |
| Tennessee      | State engineers at owner's expense.                                                                                    |
| Texas          | Texas Water Rights Commission staff at State expense.                                                                  |
| Utah           | Personnel of Division of Water Rights at State expense.                                                                |
| Vermont        | Staff of Agency of Environmental Conservation at State expense from general appropriations.                            |
| Virginia       | N/A                                                                                                                    |
| Washington     | State Department of Ecology personnel at State expense.                                                                |
| West Virginia  | West Virginia Department of Natural Resources at State expense.                                                        |
| Wisconsin      | Personnel from the department inspect and charge owner actual costs - municipalities are exempt from inspection costs. |
| Wyoming        | Personnel of the State Engineers office at State expense.                                                              |
| Puerto Rico    | Puerto Rico Water Resources Authority.                                                                                 |

22 (continued)

|                   |                                                                                                       |
|-------------------|-------------------------------------------------------------------------------------------------------|
| Virgin Islands    | Did Not Answer Questionnaire.                                                                         |
| Guam              | N/A                                                                                                   |
| Trust Territories | Headquarters Safety Inspector with assistance of District Public Works, at Trust Territories expense. |
| American Samoa    | Did Not Answer Questionnaire.                                                                         |

23. Are there any other conditions, for example on complaint, under which inspections can be made? If yes, what are these conditions, and to what official is request made?

|             |                                                                                                                                                                                                                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | Yes. The State Health Department and other departments respond to complaints of any sort by Alabamians.                                                                                                                                                                                                 |
| Alaska      | --                                                                                                                                                                                                                                                                                                      |
| Arizona     | Yes. By informal request or by formal complaint to the State Water Engineer.                                                                                                                                                                                                                            |
| Arkansas    | Yes. On complaint to Director of the Division of Soil and Water Resources.                                                                                                                                                                                                                              |
| California  | Yes. Upon written complaint to the Department of Water Resources and upon deposit of an amount to cover cost of inspection if complaint is believed to be nonmeritorious, in accordance with Article 5 of Division 3 of the Water Code. Ordinarily, however, these inspections are made without charge. |
| Colorado    | Yes. Any written request or oral request of one party for an inspection.                                                                                                                                                                                                                                |
| Connecticut | Yes. Anyone who would suffer damage if a dam failed may petition the Commissioner for an inspection.                                                                                                                                                                                                    |
| Delaware    | No                                                                                                                                                                                                                                                                                                      |
| Florida     | No                                                                                                                                                                                                                                                                                                      |
| DNR         | -- All water pollution complaints are investigated by DPC regional personnel. Investigative procedures where applicable require prompt investigations of impoundments and dams.                                                                                                                         |
| DPC         |                                                                                                                                                                                                                                                                                                         |
| Georgia     | --                                                                                                                                                                                                                                                                                                      |
| Hawaii      | --                                                                                                                                                                                                                                                                                                      |
| Idaho       | Yes. Any complaint made, in writing, to the Department that a hazard exists must be followed by inspection as soon as possible.                                                                                                                                                                         |
| Illinois    | Yes. Complaint filed with request for inspection, investigation or public hearing to Chief Waterway Engineer.                                                                                                                                                                                           |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indiana       | Yes. On report by an individual or agency that a possible problem might occur or may have occurred. Request made to Mr. Robert F. Jackson, Chief, Division of Water.                                                                                                                                                                                                                                                             |
| Iowa          | Yes. Any request or complaint made to the Director will be investigated.                                                                                                                                                                                                                                                                                                                                                         |
| Kansas        | Yes. Inspection will be made upon complaint. Request to Chief Engineer, Division of Water Resources.                                                                                                                                                                                                                                                                                                                             |
| Kentucky      | Yes. The Division may inspect a dam from the standpoint of safety under authority of KRS151.290.                                                                                                                                                                                                                                                                                                                                 |
| Louisiana     | Yes. Upon request by a public agency or official, an inspection can be made if agreeable to owner and recommendations made.                                                                                                                                                                                                                                                                                                      |
| Maine         | Yes. If Governor receives petition from 10 downstream landowners he can appoint an Inspector of dams to conduct an investigation.                                                                                                                                                                                                                                                                                                |
| Maryland      | Yes. Nothing formal, upon complaint or upon its own initiative, the Department has power to cause an investigation or examination to be made of any reservoir, dam, or waterway obstruction now existing or hereafter constructed.                                                                                                                                                                                               |
| Massachusetts | Yes. Any party whose property is likely to be damaged may make written application to the commissioners, setting forth the facts and ownership of such structure which is believed to be unsafe and the Commissioners may thereupon cause said structure to be examined. If upon examination the structure is deemed safe the costs of such application and examination may be ordered paid by the party making the application. |
| Michigan      | Yes. No formal procedure. Requests can be made by letter to Hydrological Survey Division, Department of Natural Resources.                                                                                                                                                                                                                                                                                                       |
| Minnesota     | Yes. An individual can request the Department or the Department can on its own initiative, examine a dam to determine if additional engineering investigations are necessary. If so, the Department can require the owner undertake such investigations at his own expense.                                                                                                                                                      |



|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mississippi    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Missouri       | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Montana        | Yes. Department on its own motion, and it shall upon complaint on oath being made to the Department by three or more persons, immediately examine or cause to be examined.                                                                                                                                                                                                                                                                                                                                                                                                       |
| Nebraska       | Yes. Director of Department.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Nevada         | Yes. Inspections are made if a complaint is received from anyone deemed knowledgeable of the fact and conditions. Complaints are directed to the State Engineer.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| New Hampshire  | Yes. Complaints as to high or low lake levels and complaints about condition of existing structures. Water Resources Board investigates all complaints.                                                                                                                                                                                                                                                                                                                                                                                                                          |
| New Jersey     | Yes. Upon written application by any persons owning or representing property liable to be injured or destroyed by breaking of any reservoir or dam, or upon application by the mayor or governing body of any municipality on account of possible danger of loss of life or of injury to any highway or bridge within his or its jurisdiction from the breaking of any reservoir or dam, or without such complaint whenever the commission shall have cause to apprehend that any reservoir or dam is unsafe. Complaint as to safety directed to Chief, Bureau of Water Control. |
| New Mexico     | Yes. An inspection made by State Engineer personnel upon a complaint to the State Engineer of unsafe works.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| New York       | Yes. Any legitimate complaint regarding dam safety is followed up.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| North Carolina | Yes. Complaint to Board of Water and Air Resources. Board of Water and Air Resources can also inspect on its own motion.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| North Dakota   | Yes. All complaints are recognized and investigated. Request made to North Dakota State Water Commission.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                |                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ohio           | Yes. Complaints that the condition and use of the dam constitutes a hazard to life, health or property may be made to the Chief, Division of Water.                                                                                                                                                                            |
| Oklahoma       | Yes. Upon the request of any party, accompanied by the estimated cost of inspection, the Board shall cause any alleged unsafe works to be inspected. If the works are found to be unsafe by the Board the money deposited by such party shall be refunded and the fee for inspection shall be paid by the owner of such works. |
| Oregon         | Yes. Any person owning or residing on land near the structure may request the State Engineer to make an inspection. Costs may be assessed to owner or petitioner if totally unfounded.                                                                                                                                         |
| Pennsylvania   | Yes. Complaint of unauthorized dams. Also complaint of unsafe conditions at dams. Requests made to Chief, Division of Dams and Encroachments, Department of Environmental Resources.                                                                                                                                           |
| Rhode Island   | Yes. Verbal or written complaints are handled by the Director of Natural Resources.                                                                                                                                                                                                                                            |
| South Carolina | No                                                                                                                                                                                                                                                                                                                             |
| South Dakota   | Yes. Upon request of any person accompanied with estimated cost of inspection. If found unsafe cost of inspection shifts to owner, otherwise stays with complainer.                                                                                                                                                            |
| Tennessee      | Yes. Commissioner's orders and emergencies.                                                                                                                                                                                                                                                                                    |
| Texas          | Yes. Complaints to Texas Water Rights Commission are evaluated and inspections made if necessary.                                                                                                                                                                                                                              |
| Utah           | Yes. Any complaint made to Utah State Engineer is investigated.                                                                                                                                                                                                                                                                |
| Vermont        | Yes. Requests from municipal officials or other responsible citizens. Requests made to Secretary of the agency of Environmental Conservation.                                                                                                                                                                                  |
| Virginia       | Yes. The Commission reserves the right to employ expert engineers or other experts or persons to examine and report upon projects as proposed in application for license or the                                                                                                                                                |

|                      |                                                                                                                                                                       |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virginia (continued) | or upon plans submitted after the issuance of licenses covering additional details of succeeding stages of construction.                                              |
| Washington           | Yes. Complaints involving safety. Request made to Director, Department of Ecology.                                                                                    |
| West Virginia        | Yes. Potential failure.                                                                                                                                               |
| Wisconsin            | Yes. Inspected upon request or complaint. Request made to Administrator, Division of Environmental Protection.                                                        |
| Wyoming              | Yes. The State Engineer, at his discretion, on request or complaint may inspect or order an inspection at any time during the construction, operation or repair work. |
| Puerto Rico          | Yes. Special requests to the Puerto Rico Water Resources Authority.                                                                                                   |
| Virgin Islands       | Did Not Answer Questionnaire.                                                                                                                                         |
| Guam                 | Yes. Complaints from any concerned persons may be made to the Governor, Village Commissioner, or Director of Public Works.                                            |
| Trust Territories    | Yes. On complaint or as though necessary by Public Works staff or District Administrator.                                                                             |
| American Samoa       | Did Not Answer Questionnaire.                                                                                                                                         |

24. Are there any State requirements for operation and maintenance? Do these include continuous surveillance or monitoring?

|             |                                                                                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                          |
| Alaska      | --                                                                                                                                                                                                                                          |
| Arizona     | Yes. At the State's discretion, continuous surveillance and reporting may be required.                                                                                                                                                      |
| Arkansas    | Yes. Does not include continuous surveillance or monitoring.                                                                                                                                                                                |
| California  | Yes. Optionally includes continuous surveillance or monitoring as found necessary on an individual basis.                                                                                                                                   |
| Colorado    | Yes. Includes continuous surveillance or monitoring depending on structure and conditions.                                                                                                                                                  |
| Connecticut | No                                                                                                                                                                                                                                          |
| Delaware    | No                                                                                                                                                                                                                                          |
| Florida     |                                                                                                                                                                                                                                             |
| DNR         | No                                                                                                                                                                                                                                          |
| DPC         | Yes. For phosphate industry dams see Sections 17-9.04 and 17-9.05 of Chapter 17-9 F.A.C. For other wastewater disposal systems, impoundments, operation and maintenance must be sufficient for assuring compliance with Chapter 17-3 F.A.C. |
| Georgia     | --                                                                                                                                                                                                                                          |
| Hawaii      | --                                                                                                                                                                                                                                          |
| Idaho       | Yes. Does not include continuous surveillance or monitoring.                                                                                                                                                                                |
| Illinois    | No                                                                                                                                                                                                                                          |
| Indiana     | Yes. At least once a year inspected by Commission. Dams and levees must be maintained in a safe condition.                                                                                                                                  |
| Iowa        | Yes. Does not include continuous surveillance and monitoring unless Council specifically requires such.                                                                                                                                     |

|               |                                                                                                                                                                                       |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kansas        | Yes. Project is expected to be maintained substantially in accordance with approved plans and specifications. Does in a few instances include continuous surveillance and monitoring. |
| Kentucky      | No                                                                                                                                                                                    |
| Louisiana     | No                                                                                                                                                                                    |
| Maine         | No                                                                                                                                                                                    |
| Maryland      | Yes. The State's requirements for operation and maintenance and the surveillance depend upon each specific project. Measures range from nothing to complete instrumentation.          |
| Massachusetts | No                                                                                                                                                                                    |
| Michigan      | No. On lake level control structures under authority of Act 146, P. A. 1961 as Amended, inspection report must be submitted every three years.                                        |
| Minnesota     | Yes. As part of permit provisions, if applicable. Includes continuous surveillance or monitoring in some cases.                                                                       |
| Mississippi   | Yes. Only applies to release of minimum flow past dam.                                                                                                                                |
| Missouri      | No                                                                                                                                                                                    |
| Montana       | No                                                                                                                                                                                    |
| Nebraska      | Yes. Includes continuous surveillance and monitoring.                                                                                                                                 |
| Nevada        | Yes. Does not include continuous surveillance. The owner is required to maintain a valid water right for waters to be impounded.                                                      |
| New Hampshire | Yes. Includes continuous surveillance or monitoring for special projects only.                                                                                                        |
| New Jersey    | Yes. Only maintenance. State requires periodic reports on the condition of the dam.                                                                                                   |



|                |                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------|
| New Mexico     | No                                                                                                       |
| New York       | No                                                                                                       |
| North Carolina | Yes. Includes continuous surveillance or monitoring.                                                     |
| North Dakota   | No                                                                                                       |
| Ohio           | Yes. Includes continuous surveillance or monitoring if so ordered by the Chief of the Division of Water. |
| Oklahoma       | Yes. Does not include continuous surveillance or monitoring.                                             |
| Oregon         | Yes. Includes continuous surveillance or monitoring if deemed necessary for safe operation.              |
| Pennsylvania   | Yes. Does not include continuous surveillance or monitoring.                                             |
| Rhode Island   | No                                                                                                       |
| South Carolina | No                                                                                                       |
| South Dakota   | No                                                                                                       |
| Tennessee      | Yes. Includes continuous surveillance or monitoring if deemed necessary.                                 |
| Texas          | Yes. Includes continuous surveillance or monitoring.                                                     |
| Utah           | Yes. Includes continuous surveillance or monitoring in emergency cases.                                  |
| Vermont        | Yes. Does not include continuous surveillance or monitoring.                                             |
| Virginia       | No                                                                                                       |
| Washington     | Yes. Does not include continuous surveillance or monitoring.                                             |
| West Virginia  | Yes. Does not include continuous surveillance or monitoring.                                             |

24 (continued)

|                   |                                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Wisconsin         | Yes. Depends upon permit or specific orders.<br>Includes continuous surveillance or monitoring.                                   |
| Wyoming           | No. Does include continuous surveillance or<br>monitoring for water administration or at such time<br>that repairs are necessary. |
| Puerto Rico       | No                                                                                                                                |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                      |
| Guam              | No                                                                                                                                |
| Trust Territories | Yes. Does not include continuous surveillance or<br>monitoring.                                                                   |
| American Samoa    | Did Not Answer Questionnaire.                                                                                                     |

25. How is enforcement of supervision achieved? Please explain.

|             |                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | --                                                                                                                                                                                                                                                                                                                                                                                       |
| Alaska      | --                                                                                                                                                                                                                                                                                                                                                                                       |
| Arizona     | By verbal or written order, or by civil court action if required.                                                                                                                                                                                                                                                                                                                        |
| Arkansas    | Any "person" who violates any provision of Act 81 of 1957 is subject to a penalty of not more than \$500 a day for each day of such violation.                                                                                                                                                                                                                                           |
| California  | Action may be brought by petition in Superior Court, alleging the violation or threatened violation and praying for relief by mandamus or injunction (article 5, Division 3 of the Water Code). The services of the Attorney General's office are generally used. A violator is guilty of a misdemeanor and is punishable by fine or imprisonment (Chapter 8, Division 3 of Water Code). |
| Colorado    | Denial of storage -- very effective -- \$200 per day fine for refusal to comply. Injunctions asked for at trial for fine.                                                                                                                                                                                                                                                                |
| Connecticut | By statute, the owner of an unsafe dam may be ordered to repair or remove the structure.                                                                                                                                                                                                                                                                                                 |
| Delaware    | N/A                                                                                                                                                                                                                                                                                                                                                                                      |
| Florida     |                                                                                                                                                                                                                                                                                                                                                                                          |
| DNR         | --                                                                                                                                                                                                                                                                                                                                                                                       |
| DPC         | Maintenance unadequacies found by the Department can be handled by "Letters of Warnings," "Letters of Violation," or "Notice and Orders."                                                                                                                                                                                                                                                |
| Georgia     | --                                                                                                                                                                                                                                                                                                                                                                                       |
| Hawaii      | --                                                                                                                                                                                                                                                                                                                                                                                       |
| Idaho       | Normal inspections indicate whether or not problems have been allowed to develop. Owner is then required to correct problems. In some cases, the department requires periodic reports of conditions.                                                                                                                                                                                     |
| Illinois    | --                                                                                                                                                                                                                                                                                                                                                                                       |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indiana       | (Chapter 84 Acts of 1961 Section 3) "The -- Commission shall, ---, have jurisdiction and supervision over the --- maintenance and repair of dams, levees, dikes, floodwalls and appurtenant works ----- and shall exercise care to see that such structures and appurtenances are maintained in a good and sufficient state of repair and/or operating condition to fully perform their intended purposes. The - Commission is authorized ---- to make, adopt and disseminate such rules, regulations and standards for maintenance and/or operation as may be necessary ---."                          |
| Iowa          | Under the authority of 455A.33, the Council has the authority to maintain an action in equity to enjoin any person from constructing a dam, other than a dam constructed and operated under the provisions of Chapter 469, for which a permit has not been granted, and, further, has the power to remove or eliminate any dam in any floodway which adversely affects the efficiency of or unduly restricts the capacity of the floodway. In the case of milldams, Chapter 469 authorizes fines for noncompliance with its provisions and also provides for abatement of dams proven to be a nuisance. |
| Kansas        | A condition of the permit issued by the Chief Engineer is as follows: The Chief Engineer reserves the right to require such changes in the maps, plans, profiles, and specifications as may be considered necessary, and further reserves the right to suspend or revoke this permit at any time, should such action be deemed necessary in the interest of public safety, or to prevent serious damage to property.                                                                                                                                                                                    |
| Kentucky      | Penalty of up to \$1,000 per day for each day of a violation of KRS 151.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Louisiana     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Maine         | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Maryland      | Structures are inspected by our staff when in the vicinity of the projects. Special inspections are made as the situation warrants.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Massachusetts | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                |                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Michigan       | By litigation.                                                                                                                                                                                                                                                                                                                            |
| Minnesota      | Through courts as a last result. First, owners or applicants are usually contacted and the necessity for State supervision is explained.                                                                                                                                                                                                  |
| Mississippi    | Upon Board action. Must be initiated by a complaint of water rights holder.                                                                                                                                                                                                                                                               |
| Missouri       | --                                                                                                                                                                                                                                                                                                                                        |
| Montana        | If upon examination the Department finds that the reservoir is unsafe, it notifies the county attorney of the county in which the reservoir is located, set forth its findings, and the county attorney shall immediately take necessary steps to abate the danger and make the structure safe.                                           |
| Nebraska       | --                                                                                                                                                                                                                                                                                                                                        |
| Nevada         | If a hazardous situation develops, the State Engineer may issue a formal order regarding operation and maintenance. If there is insufficient time for the issuance of an order, he may lower the water level of the reservoir, completely drain the reservoir or take such other steps as may be necessary to safeguard life or property. |
| New Hampshire  | Court action if required.                                                                                                                                                                                                                                                                                                                 |
| New Jersey     | By direct contact with the owners and application of NJSA58:4-5.                                                                                                                                                                                                                                                                          |
| New Mexico     | --                                                                                                                                                                                                                                                                                                                                        |
| New York       | N/A                                                                                                                                                                                                                                                                                                                                       |
| North Carolina | Requirement is to maintain minimum flows - monitored by stream gaging by Water Quality Division.                                                                                                                                                                                                                                          |
| North Dakota   | N/A                                                                                                                                                                                                                                                                                                                                       |
| Ohio           | Orders are issued by the Chief, Division of Water. Where the construction permit has been issued and the work is not being performed in accordance with approved                                                                                                                                                                          |



|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ohio (Continued) | plans, the Chief may order immediate compliance and suspension of all other work until compliance is effected. If the owner fails to comply, the permit may be revoked and the bond forfeited. The Chief may prohibit the retention of water behind any dam built in violation of Section 1521.06 and the Attorney General may bring an action for an injunction against any person to enforce an order. Under inspection of existing dams, the Chief may order the owner to perform such repairs, maintenance, or other remedial measures as may be necessary to safeguard life, health and property. There is a statutory provision for the State to remove or correct any unsafe structures and have the cost placed on the owner's tax duplicate by the County Auditor. |
| Oklahoma         | Every person shall be guilty of a misdemeanor who violates any of the provisions of the law or of any order, rule, or regulation of the Board issued pursuant thereto, where a copy of the order, rule, or regulation has been served upon said persons by certified mail and said person fails to comply therewith within the time herein provided, or within ten (10) days of such service if not otherwise provided. In the event of a continuing violation, each day that the violation continues constitutes a separate and distinct offense.                                                                                                                                                                                                                          |
| Oregon           | By persuasion, order of the State Engineer or decree of the Court if appealed. Some violations are by criminal charges.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Pennsylvania     | Permit requires that construction be under constant supervision of Design Engineer. Permittee must submit names and qualification of inspection personnel for State approval prior to start of construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Rhode Island     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| South Carolina   | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| South Dakota     | No general requirements on operation and maintenance other than water rights standpoint, except for Watershed District structures which have an annual inspection and maintenance requirement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

25 (Continued)

|                   |                                                                                                                                                                                                                                                                                      |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tennessee         | Periodic Inspections.                                                                                                                                                                                                                                                                |
| Texas             | Maintenance and other deficiencies are brought to permittee's attention and corrective action is directed.                                                                                                                                                                           |
| Utah              | Loss of storage permission.                                                                                                                                                                                                                                                          |
| Vermont           | Compliance with orders and conditions in permits.                                                                                                                                                                                                                                    |
| Virginia          | N/A                                                                                                                                                                                                                                                                                  |
| Washington        | State has responsibility to assure that dams are safely operated and maintained. If not, structures may be abated as a public nuisance.                                                                                                                                              |
| West Virginia     | Continuous or periodic inspection of all dams under construction.                                                                                                                                                                                                                    |
| Wisconsin         | By law as provided in 1973 Wisconsin Statutes.                                                                                                                                                                                                                                       |
| Wyoming           | The State Engineer has the authority to stop construction work, limit the amount of storage, drain the reservoir, or breach the dam if the safety of the structure is questioned, repair work is needed or improper construction techniques are used in construction or repair work. |
| Puerto Rico       | Through the structure of the Puerto Rico Water Resources Authority, Engineering and Construction Division.                                                                                                                                                                           |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                         |
| Guam              | N/A                                                                                                                                                                                                                                                                                  |
| Truse Territories | Standard Operations and Maintenance procedures established by Headquarters Public Works.                                                                                                                                                                                             |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                         |

26. Is there a requirement that design of any dam under the regulations shall be done by a registered professional engineer?

|               |     |
|---------------|-----|
| Alabama       | No  |
| Alaska        | --  |
| Arizona       | Yes |
| Arkansas      | No  |
| California    | Yes |
| Colorado      | Yes |
| Connecticut   | Yes |
| Delaware      | Yes |
| Florida       |     |
| DNR           | No  |
| DPC           | Yes |
| Georgia       | --  |
| Hawaii        | --  |
| Idaho         | Yes |
| Illinois      | --  |
| Indiana       | Yes |
| Iowa          | Yes |
| Kansas        | No  |
| Kentucky      | Yes |
| Louisiana     | No  |
| Maine         | No  |
| Maryland      | Yes |
| Massachusetts | Yes |
| Michigan      | Yes |

26 (Continued)

|                |     |
|----------------|-----|
| Minnesota      | Yes |
| Mississippi    | No  |
| Missouri       | No  |
| Montana        | No  |
| Nebraska       | No  |
| Nevada         | Yes |
| New Hampshire  | No  |
| New Jersey     | Yes |
| New Mexico     | Yes |
| New York       | Yes |
| North Carolina | Yes |
| North Dakota   | No  |
| Ohio           | Yes |
| Oklahoma       | Yes |
| Oregon         | Yes |
| Pennsylvania   | Yes |
| Rhode Island   | Yes |
| South Carolina | No  |
| South Dakota   | No  |
| Tennessee      | Yes |
| Texas          | Yes |
| Utah           | Yes |
| Vermont        | Yes |
| Virginia       | No  |

26 (Continued)

|                   |                              |
|-------------------|------------------------------|
| Washington        | Yes                          |
| West Virginia     | Yes                          |
| Wisconsin         | No                           |
| Wyoming           | Yes                          |
| Puerto Rico       | Yes                          |
| Virgin Islands    | Did Not Answer Questionnaire |
| Guam              | Yes                          |
| Trust Territories | Yes                          |
| American Samoa    | Did Not Answer Questionnaire |



27. Are there any exceptions to the above requirements? If yes, what are the circumstances?

Alabama --

Alaska --

Arizona Yes. Engineers from Federal agencies doing work for local assistance programs on dams subject to State jurisdiction are not required to be registered.

Arkansas No

California Yes. In the case of a Federal agency acting on behalf of an owner, otherwise subject to the jurisdiction of the State.

Colorado No

Connecticut No

Delaware No

Florida

DNR

DPC

--

Yes. (a) The improvement of or otherwise affecting property legally owned by applicant when no special environmental engineering or professional assistance is necessary to prevent pollution unless such practice involves a public utility or the public health, safety, or welfare. (b) Applicant is officer or engineer of the Government of the United States engaged in the practice of professional engineering solely for the United States Government. (c) Applicant engage in execution of work designed by registered professional engineer. (d) Applicant acting as public officer employed by the State, a county, a municipality or other Governmental unit of the State only on work where the total cost is less than \$10,000. (e) In any other situation where professional engineering is not required by Florida Statutes.

Georgia --

Hawaii --

Idaho Yes. Plans and specifications prepared by professional engineer required only when dam is more than 20 feet in height or capable of storing 100 acre-feet or more of water.

27 (Continued)

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Illinois      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Indiana       | Yes. Projects costing less than \$10,000.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Iowa          | Yes. A person preparing plans for submission to the Resources Council does not have to be a registered professional engineer if such a person is a full time employee of a corporation doing work for that corporation or if he is working for the U.S. Government (Chapter 114, Code of Iowa).                                                                                                                                                                                                                                                                                                                        |
| Kansas        | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Kentucky      | Yes. Employees and Officers of the U.S. Government while engaged in engineering for the Government.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Louisiana     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Maine         | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Maryland      | Yes. Small dams.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Massachusetts | Yes. Soil Conservation Service designed dams. The Department accepts the position taken by the State Conservation Engineer of the Soil Conservation Service (U.S. Department of Agriculture) that engineers in the Federal service are not bound by the requirements pertaining to registered professional engineer in the Commonwealth, as provided in Chapter 112, Section 81R(e), Massachusetts General Laws. Accordingly, the Department foregoes its requirements that proposed dams shall be designed by a registered professional engineer whose stamp and signature shall appear on all submittals for review. |
| Michigan      | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Minnesota     | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Mississippi   | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Missouri      | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Montana       | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Nebraska      | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

27 (Continued)

|                |                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nevada         | No                                                                                                                                                                                                                                                                                                                                                                    |
| New Hampshire  | No                                                                                                                                                                                                                                                                                                                                                                    |
| New Jersey     | No                                                                                                                                                                                                                                                                                                                                                                    |
| New Mexico     | Yes. Dams constructed by the United States.                                                                                                                                                                                                                                                                                                                           |
| New York       | Yes. Soil Conservation Service farm ponds may not always be designed by a professional engineer.                                                                                                                                                                                                                                                                      |
| North Carolina | Yes. Section 143-215.26 of the Dam Safety Law permits design by a contractor, but we have not had a case of design by a contractor.                                                                                                                                                                                                                                   |
| North Dakota   | No                                                                                                                                                                                                                                                                                                                                                                    |
| Ohio           | No                                                                                                                                                                                                                                                                                                                                                                    |
| Oklahoma       | Yes. Plans and specifications shall be prepared by a Registered Professional Engineer or by an engineer of any United States Governmental agency acting in his official capacity. However, if the board finds that a project does not concern or involve the public welfare or the safeguarding of life, health or property, this requirement may be waived by Board. |
| Oregon         | Yes. Except: (1) Any dam less than 10 feet high or impounding less than 3,000,000 gallons of water; (2) splash dams used for driving logs; (3) farm dikes constructed by individuals on own property; and (4) ditches carrying less than 5.0 c.f.s.                                                                                                                   |
| Pennsylvania   | Yes. If depth of water impounded is less than 10 feet or if failure of dam would not imperil life or property.                                                                                                                                                                                                                                                        |
| Rhode Island   | Yes. The professional engineer require is waived for Federal agencies according to State law.                                                                                                                                                                                                                                                                         |
| South Carolina | No.                                                                                                                                                                                                                                                                                                                                                                   |
| South Dakota   | --                                                                                                                                                                                                                                                                                                                                                                    |
| Tennessee      | Yes. Designed by engineers of a Federal agency.                                                                                                                                                                                                                                                                                                                       |

27 (Continued)

|                   |                                                                                                                                                                                                                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Texas             | Yes. A dam or reservoir constructed on his own property to impound or contain not more than 200 acre-feet of water for domestic and livestock purposes. Also exceptions are made for small structures with insignificant impoundments.                                                                          |
| Utah              | No                                                                                                                                                                                                                                                                                                              |
| Vermont           | Yes. Federal, State and municipal projects.                                                                                                                                                                                                                                                                     |
| Virginia          | No                                                                                                                                                                                                                                                                                                              |
| Washington        | No                                                                                                                                                                                                                                                                                                              |
| West Virginia     | No                                                                                                                                                                                                                                                                                                              |
| Wisconsin         | Yes. Most dams are designed by a registered professional engineer; although, at present, a property owner may design or have a non-professional design a dam to be placed on his property. This question is being studied with the goal of requiring the dam be designed by a registered professional engineer. |
| Wyoming           | Yes. Policy that dams greater than 35 feet in height or reservoirs with a capacity of 100 acre-feet and greater shall have preconstruction plans certified by a registered professional engineer.                                                                                                               |
| Puerto Rico       | No                                                                                                                                                                                                                                                                                                              |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                                                    |
| Guam              | Yes. For projects of a very minor nature the Building Official may waive the requirement for plans. However, for a project such as a dam this would be highly unlikely.                                                                                                                                         |
| Trust Territories | No                                                                                                                                                                                                                                                                                                              |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                                                    |

28. Are design criteria prescribed by the State and available in printed form? If yes, give title and date of latest revision or edition of such design criteria document.

|             |                                                                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                    |
| Alaska      | --                                                                                                                                                    |
| Arizona     | No                                                                                                                                                    |
| Arkansas    | No                                                                                                                                                    |
| California  | No                                                                                                                                                    |
| Colorado    | No                                                                                                                                                    |
| Connecticut | No                                                                                                                                                    |
| Delaware    | No                                                                                                                                                    |
| Florida     | No                                                                                                                                                    |
| DNR         | Yes. Chapter 17-9 F.A.C., "Minimum Requirements for                                                                                                   |
| DPC         | Earthen Dams Phosphate Mining," Supplement No. 57 (undated).                                                                                          |
| Georgia     | --                                                                                                                                                    |
| Hawaii      | --                                                                                                                                                    |
| Idaho       | Yes. "Rules and Regulations for Safety of Dams,"<br>November 1970.                                                                                    |
| Illinois    | No                                                                                                                                                    |
| Indiana     | No. Only instructions as to items to be incorporated<br>in the design and specifications.                                                             |
| Iowa        | No. Hydrologic design criteria is distributed upon<br>request or otherwise made available to prospective<br>applicants for dam construction projects. |
| Kansas      | -- Design criteria are prescribed by the State but are<br>not available in printed form.                                                              |
| Kentucky    | Yes. DOW-Rg-2, "Design Criteria for Dams and Associated<br>Structures," April 5, 1972.                                                                |
| Louisiana   | No                                                                                                                                                    |
| Maine       | No                                                                                                                                                    |



28 (Continued)

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Maryland       | Yes. Water Resources Administration Rules and Regulations 08.05.03.01-08.05.03.07.                                          |
| Massachusetts  | No. Instructions and Addenda to Chapter 595 application.                                                                    |
| Michigan       | No                                                                                                                          |
| Minnesota      | No                                                                                                                          |
| Mississippi    | No                                                                                                                          |
| Missouri       | No                                                                                                                          |
| Montana        | No                                                                                                                          |
| Nebraska       | No                                                                                                                          |
| Nevada         | Yes. "Laws and Regulations Pertaining to Dams," 1970.                                                                       |
| New Hampshire  | No                                                                                                                          |
| New Jersey     | Yes. "Information for Applicants for Construction, Alteration or Repair of Dams" 1958.                                      |
| New Mexico     | No                                                                                                                          |
| New York       | Yes. Rules and regulations and Guidelines for Design of Small Earth Dams.                                                   |
| North Carolina | No                                                                                                                          |
| North Dakota   | No                                                                                                                          |
| Ohio           | Yes. Basic design criteria are included in the Administration Rules adopted by Division of Water, effective April 15, 1972. |
| Oklahoma       | No. Under consideration.                                                                                                    |
| Oregon         | No                                                                                                                          |
| Pennsylvania   | Yes. Construction or Repair of Dams - 1970.                                                                                 |
| Rhode Island   | No                                                                                                                          |
| South Carolina | No                                                                                                                          |

28 (Continued)

|                   |                                                                                                                                                                                                       |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| South Dakota      | No                                                                                                                                                                                                    |
| Tennessee         | No                                                                                                                                                                                                    |
| Texas             | No. Reference is made to other established criteria -- Soil Conservation Service, Bureau of Reclamation, and Corps of Engineers; Common criteria is equally acceptable for large structures in Texas. |
| Utah              | Yes. Requirements for Dam Construction in Utah, 1965.                                                                                                                                                 |
| Vermont           | No                                                                                                                                                                                                    |
| Virginia          | No                                                                                                                                                                                                    |
| Washington        | Yes. Minimum Design Criteria, Earthfill Dams in Washington, Revised 1954.                                                                                                                             |
| West Virginia     | Yes. After October 1973.                                                                                                                                                                              |
| Wisconsin         | No                                                                                                                                                                                                    |
| Wyoming           | No                                                                                                                                                                                                    |
| Puerto Rico       | Yes. Bureau of Reclamation design criteria for Loa Vaca Dam.                                                                                                                                          |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                          |
| Guam              | No                                                                                                                                                                                                    |
| Trust Territories | No                                                                                                                                                                                                    |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                          |

29. Are plans and designs reviewed by the State in preliminary form?

|               |                                                                                                                                                                                                   |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama       | --                                                                                                                                                                                                |
| Alaska        | --                                                                                                                                                                                                |
| Arizona       | Yes                                                                                                                                                                                               |
| Arkansas      | No                                                                                                                                                                                                |
| California    | Yes                                                                                                                                                                                               |
| Colorado      | Yes                                                                                                                                                                                               |
| Connecticut   | Yes                                                                                                                                                                                               |
| Delaware      | Yes                                                                                                                                                                                               |
| Florida       |                                                                                                                                                                                                   |
| DNR           | Yes                                                                                                                                                                                               |
| DPC           | -- Plans and designs in preliminary form are not normally reviewed. However, preliminary information is needed for large projects of sizeable environmental impact.                               |
| Georgia       | --                                                                                                                                                                                                |
| Hawaii        | --                                                                                                                                                                                                |
| Idaho         | Yes                                                                                                                                                                                               |
| Illinois      | Yes                                                                                                                                                                                               |
| Indiana       | Yes                                                                                                                                                                                               |
| Iowa          | Yes                                                                                                                                                                                               |
| Kansas        | -- In some instances.                                                                                                                                                                             |
| Kentucky      | Yes                                                                                                                                                                                               |
| Louisiana     | No                                                                                                                                                                                                |
| Maine         | No                                                                                                                                                                                                |
| Maryland      | Yes                                                                                                                                                                                               |
| Massachusetts | Yes. Preliminary plans are reviewed occasionally as a courtesy; however, the Commissioner's approval, if granted subsequently depends on review of final construction drawings and specifications |

29 (Continued)

|                |                                           |
|----------------|-------------------------------------------|
| Michigan       | No. Not required.                         |
| Minnesota      | Yes. Usually.                             |
| Mississippi    | No                                        |
| Missouri       | No                                        |
| Montana        | No                                        |
| Nebraska       | No. Occasionally.                         |
| Nevada         | Yes                                       |
| New Hampshire  | Yes                                       |
| New Jersey     | Yes                                       |
| New Mexico     | Yes                                       |
| New York       | Yes                                       |
| North Carolina | Yes                                       |
| North Dakota   | No                                        |
| Ohio           | Yes                                       |
| Oklahoma       | Yes                                       |
| Oregon         | Yes                                       |
| Pennsylvania   | Yes                                       |
| Rhode Island   | Yes                                       |
| South Carolina | No                                        |
| South Dakota   | No. Generally. Yes. Watershed structures. |
| Tennessee      | Yes                                       |
| Texas          | Yes                                       |
| Utah           | Yes                                       |
| Vermont        | Yes                                       |

|                   |                                    |
|-------------------|------------------------------------|
| Virginia          | No                                 |
| Washington        | No                                 |
| West Virginia     | Yes                                |
| Wisconsin         | Yes. Sometimes.                    |
| Wyoming           | Yes                                |
| Puerto Rico       | Yes                                |
| Virgin Islands    | Did Not Answer Questionnaire       |
| Guam              | Yes, if submitted - not mandatory. |
| Trust Territories | Yes                                |
| American Samoa    | Did Not Answer Questionnaire       |



30. Are contract plans and specifications reviewed by the State?

|               |                                                                                                                                          |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama       | --                                                                                                                                       |
| Alaska        | --                                                                                                                                       |
| Arizona       | Yes                                                                                                                                      |
| Arkansas      | Yes                                                                                                                                      |
| California    | Yes                                                                                                                                      |
| Colorado      | Yes                                                                                                                                      |
| Connecticut   | Yes                                                                                                                                      |
| Delaware      | Yes                                                                                                                                      |
| Florida       |                                                                                                                                          |
| DNR           | No                                                                                                                                       |
| DPC           | -- The degree of review of contract plans and specifications is variable and depends upon the environmental significance of the project. |
| Georgia       | --                                                                                                                                       |
| Hawaii        | --                                                                                                                                       |
| Idaho         | Yes. Actual construction contract not reviewed.                                                                                          |
| Illinois      | No                                                                                                                                       |
| Indiana       | Yes                                                                                                                                      |
| Iowa          | No                                                                                                                                       |
| Kansas        | Yes                                                                                                                                      |
| Kentucky      | Yes                                                                                                                                      |
| Louisiana     | No                                                                                                                                       |
| Maine         | No                                                                                                                                       |
| Maryland      | Yes                                                                                                                                      |
| Massachusetts | Yes                                                                                                                                      |

|                |                                           |
|----------------|-------------------------------------------|
| Michigan       | Yes                                       |
| Minnesota      | No                                        |
| Mississippi    | No                                        |
| Missouri       | No                                        |
| Montana        | No                                        |
| Nebraska       | Yes                                       |
| Nevada         | Yes                                       |
| New Hampshire  | Yes                                       |
| New Jersey     | Yes. Specifications only.                 |
| New Mexico     | Yes                                       |
| New York       | Yes                                       |
| North Carolina | No                                        |
| North Dakota   | Yes                                       |
| Ohio           | Yes                                       |
| Oklahoma       | Yes                                       |
| Oregon         | Yes                                       |
| Pennsylvania   | Yes                                       |
| Rhode Island   | Yes                                       |
| South Carolina | No                                        |
| South Dakota   | No. Generally. Yes. Watershed structures. |
| Tennessee      | Yes                                       |
| Texas          | Yes                                       |
| Utah           | Yes                                       |
| Vermont        | Yes                                       |

|                   |                              |
|-------------------|------------------------------|
| Virginia          | No                           |
| Washington        | Yes                          |
| West Virginia     | Yes                          |
| Wisconsin         | Yes                          |
| Wyoming           | Yes. In special cases.       |
| Puerto Rico       | Yes                          |
| Virgin Islands    | Did Not Answer Questionnaire |
| Guam              | Yes                          |
| Trust Territories | Yes                          |
| American Samoa    | Did Not Answer Questionnaire |

31. Is there a requirement that they later be replaced and verified with final as constructed drawings?

|             |                                                                                                                                                                                                                                                                                            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                                                                         |
| Alaska      | --                                                                                                                                                                                                                                                                                         |
| Arizona     | Yes                                                                                                                                                                                                                                                                                        |
| Arkansas    | Yes                                                                                                                                                                                                                                                                                        |
| California  | Yes                                                                                                                                                                                                                                                                                        |
| Colorado    | Yes. When necessary.                                                                                                                                                                                                                                                                       |
| Connecticut | Yes                                                                                                                                                                                                                                                                                        |
| Delaware    | No                                                                                                                                                                                                                                                                                         |
| Florida     |                                                                                                                                                                                                                                                                                            |
| DNR         | No                                                                                                                                                                                                                                                                                         |
| DPC         | -- There is a requirement that the engineer of record's retention be continued for the inspection of construction of the project. Upon completion the engineer shall inspect for conformity to construction permit applications and submit a report of inspection the DPC regional office. |
| Georgia     | --                                                                                                                                                                                                                                                                                         |
| Hawaii      | --                                                                                                                                                                                                                                                                                         |
| Idaho       | No                                                                                                                                                                                                                                                                                         |
| Illinois    | No                                                                                                                                                                                                                                                                                         |
| Indiana     | No                                                                                                                                                                                                                                                                                         |
| Iowa        | No. The Resources Council does not usually require final as constructed plans, but does require certification that the construction was accomplished in accordance with the approved plans.                                                                                                |
| Kansas      | No                                                                                                                                                                                                                                                                                         |
| Kentucky    | Yes                                                                                                                                                                                                                                                                                        |

31 (Continued)

|                |                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Louisiana      | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Maine          | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Maryland       | Yes                                                                                                                                                                                                                                                                                                                                                                                       |
| Massachusetts  | No. There is no requirement that the approved plans and specifications be replaced at the completion of the dam and verified or labeled "As Built," provided there are no changes during construction. If changes or major alterations are proposed the applicant or his engineer is required to submit them to the Commissioner for review and approval before said changes can be made. |
| Michigan       | Yes. Statute requires that the Engineer certify that the dam was constructed in accordance with approved plans and specifications.                                                                                                                                                                                                                                                        |
| Minnesota      | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Mississippi    | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Missouri       | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Montana        | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Nebraska       | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Nevada         | Yes                                                                                                                                                                                                                                                                                                                                                                                       |
| New Hampshire  | Depends upon condition of permit.                                                                                                                                                                                                                                                                                                                                                         |
| New Jersey     | Yes                                                                                                                                                                                                                                                                                                                                                                                       |
| New Mexico     | Yes                                                                                                                                                                                                                                                                                                                                                                                       |
| New York       | Yes                                                                                                                                                                                                                                                                                                                                                                                       |
| North Carolina | No                                                                                                                                                                                                                                                                                                                                                                                        |
| North Dakota   | No                                                                                                                                                                                                                                                                                                                                                                                        |
| Ohio           | Yes                                                                                                                                                                                                                                                                                                                                                                                       |
| Oklahoma       | Yes                                                                                                                                                                                                                                                                                                                                                                                       |



|                   |                              |
|-------------------|------------------------------|
| Oregon            | Yes                          |
| Pennsylvania      | Yes                          |
| Rhode Island      | No                           |
| South Carolina    | No                           |
| South Dakota      | No                           |
| Tennessee         | Yes                          |
| Texas             | Yes                          |
| Utah              | Yes                          |
| Vermont           | No                           |
| Virginia          | No                           |
| Washington        | Yes                          |
| West Virginia     | Yes                          |
| Wisconsin         | Yes                          |
| Wyoming           | Yes                          |
| Puerto Rico       | Yes                          |
| Virgin Islands    | Did Not Answer Questionnaire |
| Guam              | No                           |
| Trust Territories | Yes                          |
| American Samoa    | Did Not Answer Questionnaire |

32. Are dam designs required to meet specific criteria relating to special hazards such as spillway design, floods or earthquakes, or location above densely populated areas? If yes, explain.

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Alaska      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Arizona     | Yes. The degree of severity and the scope of the criteria required are directly related to the hazard potential of the proposed dam.                                                                                                                                                                                                                                                                                                                                                         |
| Arkansas    | Yes. Must have adequate spillway design and/or capacity for location above populated areas.                                                                                                                                                                                                                                                                                                                                                                                                  |
| California  | Yes. However these requirements are not formalized or codified or published for use outside the Department.                                                                                                                                                                                                                                                                                                                                                                                  |
| Colorado    | Yes. Earthquakes not strongly considered in Colorado. Spillway design for probable maximum precipitation (PMP) or standard project floods (SPF) above densely populated areas are mandatory.                                                                                                                                                                                                                                                                                                 |
| Connecticut | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Delaware    | Yes. Generally the Department of Natural Resources and Environmental Control does not review the structural details of a dam project. The professional engineer designing the project is held responsible. However, the Department of Natural Resources and Environmental Control may be assisted by other State agencies which have structural engineering expediture. However, Department of Natural Resources and Environmental Control will review flood hazards, spillway designs, etc. |
| Florida     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DNR         | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| DPC         | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Georgia     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Hawaii      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Idaho       | Yes. 100 year flow frequency used for spillway design. Freeboard must be 2 feet plus wave height during spillway design flow.                                                                                                                                                                                                                                                                                                                                                                |

|               |                                                                                                                                                                                                                                             |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Illinois      | Yes. Must be capable of passing design frequency flood without overtopping.                                                                                                                                                                 |
| Indiana       | Yes. Instructions for Making Application of Construction in a Floodway requires that data necessary for the Commission to determine the effect of the proposed construction upon a floodway and on flood control in the State be furnished. |
| Iowa          | Yes. Hydrologic design criteria is commensurate with the downstream hazard. The design of a dam located above a densely populated area is to be based upon probable maximum precipitation.                                                  |
| Kansas        | Yes. Design criteria becomes more stringent as the hazard to human life and property increases.                                                                                                                                             |
| Kentucky      | Yes. Criteria in DOW-Reg-2, Design Criteria for Dams and Associated Structures.                                                                                                                                                             |
| Louisiana     | No                                                                                                                                                                                                                                          |
| Maine         | No                                                                                                                                                                                                                                          |
| Maryland      | Yes. Rules and Regulations requires that design data be furnished before a permit can be issued.                                                                                                                                            |
| Massachusetts | Yes. Design standards equal to or greater than those contained in the text "Design of Small Dams" U.S. Department of the Interior, Bureau of Reclamation.                                                                                   |
| Michigan      | No                                                                                                                                                                                                                                          |
| Minnesota     | No. No specific criteria.                                                                                                                                                                                                                   |
| Mississippi   | No                                                                                                                                                                                                                                          |
| Missouri      | No                                                                                                                                                                                                                                          |
| Montana       | No                                                                                                                                                                                                                                          |
| Nebraska      | Yes. Spillway design based on hazard by Construction Agency and checked by State.                                                                                                                                                           |
| Nevada        | Yes. All dams must have an emergency spillway. The minimum capacity is determined by the location of the dam and existing downstream development.                                                                                           |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New Hampshire  | Yes. Dams classified as menace dams must safely pass a 100-year storm frequency.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| New Jersey     | Yes. The latest policy is that the dam pass 100-year design flood over normal spillway or drop inlet with freeboard or before emergency spillway operates.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| New Mexico     | Yes. Depending upon location the dam is given a hazard classification and design is required to meet that classification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| New York       | Yes. Rules and regulations and Guidelines for Design of Small Earth Dams.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| North Carolina | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| North Dakota   | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Ohio           | Yes. Dams are classified according to hazard conditions. Each class has certain minimum design requirements. Proposed dams are divided into five classes under Division of Water Administrative Rule NRd-13-01. Class I dams require the highest design standards. Small, low-hazard dams placed in Class V are then exempt from further permit requirements and are also exempt from periodic inspection.                                                                                                                                                                                                                                                                                                                                                                                         |
| Oklahoma       | <p>Yes. Minimum performance standards expressed as magnitude of spillway design flood and minimum freeboard are assigned to various size and hazard potential classification. The discharge capacity and/or storage capacity of the project should be capable of passing the spillway design flood without infringing on the minimum freeboard requirements.</p> <p>Regardless of size, all reservoirs which are constructed across definite streams and all reservoirs which have dams higher than twenty-five feet or storage greater than 50 acre-feet are required to be provided with a gate or valve operated outlet conduit of sufficient capacity to prevent interference with natural stream flow through the reservoir to the injury of downstream appropriators and domestic users.</p> |
| Oregon         | Yes. Minimum safety requirements are reviewed and refined dependent upon size and location of project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

32 (Continued)

|                   |                                                                                                                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pennsylvania      | Yes. Spillway capacity must meet established criterion as noted on Curve C. This curve is result obtained by plotting recorded maximum discharges on various drainage areas throughout the State. |
| Rhode Island      | Yes. New dams must safely pass or store a 100-year 24-hour frequency storm.                                                                                                                       |
| South Carolina    | No                                                                                                                                                                                                |
| South Dakota      | No                                                                                                                                                                                                |
| Tennessee         | Yes. Dams will be classified as to "damage potential." More stringent design criteria will be required of high damage potential classified dams.                                                  |
| Texas             | Yes. Soil Conservation Service criteria is suggested for small structures.                                                                                                                        |
| Utah              | Yes. State requirements.                                                                                                                                                                          |
| Vermont           | Yes. Individual evaluation for each case according to class of dams and other conditions.                                                                                                         |
| Virginia          | No                                                                                                                                                                                                |
| Washington        | Yes. Spillway design flood based on 100-year flood frequency.                                                                                                                                     |
| West Virginia     | Yes. Soil Conservation Service criteria or latest updated material.                                                                                                                               |
| Wisconsin         | Yes. Spillway capacity is designed to handle floods of 100-year frequency.                                                                                                                        |
| Wyoming           | No. No specific criteria but designs are reviewed for spillway and outlet adequacy.                                                                                                               |
| Puerto Rico       | Yes. Designs of dams are prepared by nationally recognized private engineering firms or Federal agencies such as Bureau of Reclamation, under the general supervision of Authority engineers.     |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                      |
| Guam              | No                                                                                                                                                                                                |
| Trust Territories | No                                                                                                                                                                                                |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                      |



33. Is there a requirement for geologic, soils and hydrologic data to be filed with application for permit?

|             |                                                                                                                                                                                                                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                                                                                 |
| Alaska      | --                                                                                                                                                                                                                                                                                                 |
| Arizona     | Yes. These basic items are usually required to be prepared by a competent engineer and submitted with the application.                                                                                                                                                                             |
| Arkansas    | Yes. Hydrologic data.                                                                                                                                                                                                                                                                              |
| California  | Yes                                                                                                                                                                                                                                                                                                |
| Colorado    | Yes. Required for approval, do not issue permits.                                                                                                                                                                                                                                                  |
| Connecticut | No                                                                                                                                                                                                                                                                                                 |
| Delaware    | Yes                                                                                                                                                                                                                                                                                                |
| Florida     |                                                                                                                                                                                                                                                                                                    |
| DNR         | No                                                                                                                                                                                                                                                                                                 |
| DPC         | Yes. The engineer of record must contact the local USDA, Soil Conservation Service relative to acceptability of soil where evaporation -- percolation ponds are involved. It is the engineer of record's responsibility to assure that soil, geologic, and hydrologic considerations are adequate. |
| Georgia     | --                                                                                                                                                                                                                                                                                                 |
| Hawaii      | --                                                                                                                                                                                                                                                                                                 |
| Idaho       | Yes. Spillway hydrology calculations reviewed with plans. Log of holes along axis of dam submitted for review with plans.                                                                                                                                                                          |
| Illinois    | Yes. Hydrologic data only.                                                                                                                                                                                                                                                                         |
| Indiana     | Yes                                                                                                                                                                                                                                                                                                |
| Iowa        | Yes. The extent of data required is dependent upon flood damage potential, embankment size, etc.                                                                                                                                                                                                   |
| Kansas      | Yes. On the major structures.                                                                                                                                                                                                                                                                      |
| Kentucky    | Yes. For Class "B" and "C" structures.                                                                                                                                                                                                                                                             |

|                |                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------|
| Louisiana      | No                                                                                                                               |
| Maine          | No                                                                                                                               |
| Maryland       | Yes                                                                                                                              |
| Massachusetts  | Yes                                                                                                                              |
| Michigan       | Yes. If deemed necessary by the Department of Natural Resources.                                                                 |
| Minnesota      | Yes                                                                                                                              |
| Mississippi    | No                                                                                                                               |
| Missouri       | No                                                                                                                               |
| Montana        | No                                                                                                                               |
| Nebraska       | Yes                                                                                                                              |
| Nevada         | Yes. Logs of any borings or test pits must be submitted and the location of each shown on the plan view of the site.             |
| New Hampshire  | Yes, depending on classification of structure and staff recommendations.                                                         |
| New Jersey     | Yes                                                                                                                              |
| New Mexico     | Yes                                                                                                                              |
| New York       | Yes                                                                                                                              |
| North Carolina | Yes                                                                                                                              |
| North Dakota   | No                                                                                                                               |
| Ohio           | Yes. In both the Preliminary Report and the Final Design Report.                                                                 |
| Oklahoma       | Yes. As required by Section 390.8 Rules and Regulations.                                                                         |
| Oregon         | Yes                                                                                                                              |
| Pennsylvania   | Yes. Soil and foundation report (stability analysis, etc.) on important dams. Hydrologic studies also are required on many dams. |

|                   |                                                                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Rhode Island      | Yes                                                                                                                                        |
| South Carolina    | No                                                                                                                                         |
| South Dakota      | No                                                                                                                                         |
| Tennessee         | Yes                                                                                                                                        |
| Texas             | Yes. As needed for staff analysis.                                                                                                         |
| Utah              | Yes                                                                                                                                        |
| Vermont           | Yes. As applicable.                                                                                                                        |
| Virginia          | Yes. Only for dams within the State whose purpose is the generation of hydro-electric power for sale or use in public service.             |
| Washington        | Yes                                                                                                                                        |
| West Virginia     | Yes                                                                                                                                        |
| Wisconsin         | Yes                                                                                                                                        |
| Wyoming           | -- Hydrologic data in special cases. Geologic and soils data not required.                                                                 |
| Puerto Rico       | Yes                                                                                                                                        |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                               |
| Guam              | Yes. Building Officials may require soil engineering and engineer geology reports with plans. No specific requirement for hydrologic data. |
| Trust Territories | No                                                                                                                                         |
| American Samoa    | Did Not Answer Questionnaire                                                                                                               |

34. Are there any requirements for special instrumentation in interest of dam safety? What kind? Please explain.

|             |                                                                                                                                                                                                |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                             |
| Alaska      | --                                                                                                                                                                                             |
| Arizona     | Yes. May require settlement monuments, piezometers or observation wells, extensometer points, and other instrumentation.                                                                       |
| Arkansas    | No                                                                                                                                                                                             |
| California  | Yes. These requirements are not codified; however, any type of instrumentation may be required as necessary to demonstrate the safety of a given dam, as judged in an individual circumstance. |
| Colorado    | Yes. On high dams -- piezometers                                                                                                                                                               |
| Connecticut | No                                                                                                                                                                                             |
| Delaware    | No                                                                                                                                                                                             |
| Florida     |                                                                                                                                                                                                |
| DNR         | No                                                                                                                                                                                             |
| DPC         | -- At the discretion of the DPC regional office, special instrumentation in the interest of dam safety may be required.                                                                        |
| Georgia     | --                                                                                                                                                                                             |
| Hawaii      | --                                                                                                                                                                                             |
| Idaho       | No                                                                                                                                                                                             |
| Illinois    | No                                                                                                                                                                                             |
| Indiana     | No. Only if necessary in case of potential problem.                                                                                                                                            |
| Iowa        | No                                                                                                                                                                                             |
| Kansas      | No                                                                                                                                                                                             |
| Kentucky    | No                                                                                                                                                                                             |
| Louisiana   | No                                                                                                                                                                                             |
| Maine       | No                                                                                                                                                                                             |

34 (Continued)

|                |                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------|
| Maryland       | --We can require instrumentation as a condition of permit. Regulation do not require instrumentation.                  |
| Massachusetts  | No. None required to date.                                                                                             |
| Michigan       | No                                                                                                                     |
| Minnesota      | No. Not usually                                                                                                        |
| Mississippi    | No                                                                                                                     |
| Missouri       | No                                                                                                                     |
| Montana        | No                                                                                                                     |
| Nebraska       | Yes. Settlement indicators and toe drains required on large dams.                                                      |
| Nevada         | No                                                                                                                     |
| New Hampshire  | No                                                                                                                     |
| New Jersey     | No                                                                                                                     |
| New Mexico     | No                                                                                                                     |
| New York       | No                                                                                                                     |
| North Carolina | No                                                                                                                     |
| North Dakota   | No                                                                                                                     |
| Ohio           | Yes. A construction permit for a dam may require apecial instrumentation, such as settlement plants, piezometers, etc. |
| Oklahoma       | Yes. As required by Section 390.15 Rules and Regulations.                                                              |
| Oregon         | Yes. Depending on size and hazards; as required to insure safe operation.                                              |
| Pennsylvania   | Yes. On critical structures, piezometers, etc have been installed.                                                     |
| Rhode Island   | No                                                                                                                     |



|                   |                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| South Carolina    | No                                                                                                                                                                                                  |
| South Dakota      | No                                                                                                                                                                                                  |
| Tennessee         | Yes. Not specific. May be required.                                                                                                                                                                 |
| Texas             | Yes. Commission Rule 820.7 specifies that a permanent reference mark be established near but independent of the structure. Other devices, piezometers, etc. are installed at the larger structures. |
| Utah              | Yes. Special problems are considered.                                                                                                                                                               |
| Vermont           | No                                                                                                                                                                                                  |
| Virginia          | No                                                                                                                                                                                                  |
| Washington        | No                                                                                                                                                                                                  |
| West Virginia     | Yes. If so required by Director of Department of Natural Resources.                                                                                                                                 |
| Wisconsin         | Yes. If conditions warrant, instrumentation can be required.                                                                                                                                        |
| Wyoming           | No                                                                                                                                                                                                  |
| Puerto Rico       | N/A                                                                                                                                                                                                 |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                        |
| Guam              | No                                                                                                                                                                                                  |
| Trust Territories | No                                                                                                                                                                                                  |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                        |

35. Based on past experience, do current regulations fully meet the present needs of the State? If no, what areas appear in need of change?

|             |                                                                                                                                                                                                                                         |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                      |
| Alaska      | --                                                                                                                                                                                                                                      |
| Arizona     | Yes                                                                                                                                                                                                                                     |
| Arkansas    | No. Requirement that dam be designed by registered engineer. Requirement for soils and geologic data. Requirement that design criteria be prescribed by State. Requirement that dams constructed prior to January 1, 1957 be inspected. |
| California  | Yes                                                                                                                                                                                                                                     |
| Colorado    | Yes                                                                                                                                                                                                                                     |
| Connecticut | Yes                                                                                                                                                                                                                                     |
| Delaware    | No. Promulgation and implementation of law required.                                                                                                                                                                                    |
| Florida     | No. Design Criteria, Operations Procedures and Inspections                                                                                                                                                                              |
| DNR         |                                                                                                                                                                                                                                         |
| DPC         | Yes                                                                                                                                                                                                                                     |
| Georgia     | --                                                                                                                                                                                                                                      |
| Hawaii      | --                                                                                                                                                                                                                                      |
| Idaho       | No. Perhaps more emphasis of what the downstream improvements are is needed when setting design, construction and maintenance criteria. The present law does not distinguish between high and low hazard areas.                         |
| Illinois    | Yes. The present permit system appears to be quite adequate for such structures in Illinois.                                                                                                                                            |
| Indiana     | No. Need regulation to require bond by the builder and/or owner. Presently require certification by registered engineer that dam was built in accordance with plans and specifications.                                                 |
| Iowa        | Yes                                                                                                                                                                                                                                     |

|               |                                                                                                                                                                                                                                                                                  |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kansas        | No. The following additional authorities would be helpful in protecting the public interest: (1) Right of access on private property by authorized personnel for inspection purposes and (2) Legal authority to compel repair or removal of a structure determined to be unsafe. |
| Kentucky      | No. Requirement for operation and maintenance are needed.                                                                                                                                                                                                                        |
| Louisiana     | No. There is a need for formulation of a safety program for dams and involves legislation in regard to State supervision and regulation.                                                                                                                                         |
| Maine         | No. We need a complete program for safety inspection and control.                                                                                                                                                                                                                |
| Maryland      | Yes                                                                                                                                                                                                                                                                              |
| Massachusetts | Yes                                                                                                                                                                                                                                                                              |
| Michigan      | No. (a) Regular inspection program of existing dams is needed and (b) Rules and regulations covering minimum design and construction standards are needed.                                                                                                                       |
| Minnesota     | Yes                                                                                                                                                                                                                                                                              |
| Mississippi   | No. The State should review plans and specifications before a dam is constructed and make sure that construction is completed in accordance with plans.                                                                                                                          |
| Missouri      | No                                                                                                                                                                                                                                                                               |
| Montana       | No. The State needs a law giving the State supervision over the design, construction, operation and maintenance of dams within the State.                                                                                                                                        |
| Nebraska      | Yes                                                                                                                                                                                                                                                                              |
| Nevada        | Yes                                                                                                                                                                                                                                                                              |
| New Hampshire | No. Dam classifications and requirements. Design guidelines for each classification.                                                                                                                                                                                             |
| New Jersey    | Yes                                                                                                                                                                                                                                                                              |
| New Mexico    | Yes                                                                                                                                                                                                                                                                              |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New York       | Yes                                                                                                                                                                                                                                                                                                                                                                                                                  |
| North Carolina | Yes                                                                                                                                                                                                                                                                                                                                                                                                                  |
| North Dakota   | No. Dam safety criteria developed for design, operation and maintenance.                                                                                                                                                                                                                                                                                                                                             |
| Ohio           | No. There is no penalty section in the permit law for dealing with violations. The inspection law is difficult to enforce in the case of dams owned by governmental agencies, such as municipalities.                                                                                                                                                                                                                |
| Oklahoma       | No. A definite schedule of inspections, design criteria and performance records completed before present requirements passed.                                                                                                                                                                                                                                                                                        |
| Oregon         | Yes. More money for more frequent inspections.                                                                                                                                                                                                                                                                                                                                                                       |
| Pennsylvania   | No. Should extend jurisdiction to all impoundments that imperil life (oil, silt, etc.).                                                                                                                                                                                                                                                                                                                              |
| Rhode Island   | No. Need official definition of terms, design criteria, construction standards, and a continuously staffed inspection program.                                                                                                                                                                                                                                                                                       |
| South Carolina | No. Comprehensive dam control legislation is needed.                                                                                                                                                                                                                                                                                                                                                                 |
| South Dakota   | No. Specific legislation aimed at dam inspection and safety regulation regardless of program or purpose for which it is constructed.                                                                                                                                                                                                                                                                                 |
| Tennessee      | Yes                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Texas          | Yes                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Utah           | No. Closer inspection.                                                                                                                                                                                                                                                                                                                                                                                               |
| Vermont        | No. Clarification of jurisdiction over offstream impoundments and special impoundments such as lagoons for domestic and industrial waste water.                                                                                                                                                                                                                                                                      |
| Virginia       | No. Regulation of the State Corporation Commission has been very limited, due to the fact that few of the many dams in Virginia are used for the generation of hydroelectricity. Thus, the vast majority of dams constructed in the post-World War II period, a great need exists for the enactment of legislation by the State Legislature which would allow for a State Bureau of Licensing and Regulation of non- |

35 (Continued)

|                   |                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Washington        | No. Regulations should be expanded to provide a complete program similar to that embodied in the USCOLD model law. The State must then respond with adequate financing and staffing to implement a through program. |
| West Virginia     | --This law recently passed and we need time in evaluation.                                                                                                                                                          |
| Wisconsin         | Yes. Regulations are constantly being reviewed and revised to meet changing conditions.                                                                                                                             |
| Wyoming           | Yes. Laws should be rewritten for clarity and finer definition.                                                                                                                                                     |
| Puerto Rico       | Yes                                                                                                                                                                                                                 |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                                        |
| Guam              | Yes. At present the only dams built, except for one Navy reservoir, are small structures constructed by the Government for water supply diversion. No private development is anticipated in the near future.        |
| Trust Territories | Yes                                                                                                                                                                                                                 |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                        |



36. Are there any active plans under consideration to modify existing regulations? If so, what?

|             |                                                                                                                                                                                                                                                                                      |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No                                                                                                                                                                                                                                                                                   |
| Alaska      | --                                                                                                                                                                                                                                                                                   |
| Arizona     | Yes. Recent legislation to increase jurisdictional size and storage of dams has been revised accordingly and became effect July 26, 1973.                                                                                                                                            |
| Arkansas    | Yes. Regulations are in the process of being drafted.                                                                                                                                                                                                                                |
| California  | No                                                                                                                                                                                                                                                                                   |
| Colorado    | Yes. We will shortly issue stricter regulations.                                                                                                                                                                                                                                     |
| Connecticut | No                                                                                                                                                                                                                                                                                   |
| Delaware    | Yes. As a result of amendments to 7 Delaware Code, the new Chapter 60 establishes broad authority within Department of Natural Resources and Environmental Control to regulate any activity which has an impact on environment. The revised regulations will follow the new mandate. |
| Florida     |                                                                                                                                                                                                                                                                                      |
| DNR         | Yes. Adoption of new rules to implement Chapter 373, Florida Statutes.                                                                                                                                                                                                               |
| DPC         | No                                                                                                                                                                                                                                                                                   |
| Georgia     | --                                                                                                                                                                                                                                                                                   |
| Hawaii      | --                                                                                                                                                                                                                                                                                   |
| Idaho       | --                                                                                                                                                                                                                                                                                   |
| Illinois    | No                                                                                                                                                                                                                                                                                   |
| Indiana     | No                                                                                                                                                                                                                                                                                   |
| Iowa        | No                                                                                                                                                                                                                                                                                   |
| Kansas      | No                                                                                                                                                                                                                                                                                   |
| Kentucky    | No                                                                                                                                                                                                                                                                                   |
| Louisiana   | No                                                                                                                                                                                                                                                                                   |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maine         | Yes. Comprehensive legislation modeled on the USCOLD proposal is being submitted to the Special Session of the Legislature in January, 1974.                                                                                                                                                                                                                                                                                                                    |
| Maryland      | Yes. A review of regulations is planned.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Massachusetts | No. Although there are no active plans under consideration to modify existing regulations, there is the possibility that changes may be made in conjunction with the transfer of jurisdiction over dams to some other State agency because of current discussions and legislative hearings on the matter of the State Reorganization Plan. No specific remarks can be made at this time because of the uncertainty of any phase of the reorganization proposal. |
| Michigan      | Yes. In the near future, we plan to formulate rules and regulations covering minimum design standards and construction practices.                                                                                                                                                                                                                                                                                                                               |
| Minnesota     | No. No changes expected to the statutes; however, administrative guidelines and regulations are now being prepared.                                                                                                                                                                                                                                                                                                                                             |
| Mississippi   | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Missouri      | Yes. Legislation has been introduced in the Missouri Assembly during at least 2 previous sessions, but failed in both instances. Further, stronger efforts can be expected after the results of the present inventory are available.                                                                                                                                                                                                                            |
| Montana       | Yes. A Dam Safety Law has been introduced in the last two legislative sessions. It passed the House in the last session but failed in the Senate. It will be reintroduced in the next session. It is modeled after the USCOLD Model Law.                                                                                                                                                                                                                        |
| Nebraska      | Yes. Will modify inspection to meet Federal requirements.                                                                                                                                                                                                                                                                                                                                                                                                       |
| Nevada        | No                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| New Hampshire | Yes. Plan to adopt new dam regulation using U. S. Committee on Large Dams Model Law as guide.                                                                                                                                                                                                                                                                                                                                                                   |

36 (Continued)

|                |                                                                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| New Jersey     | No                                                                                                                                               |
| New Mexico     | No                                                                                                                                               |
| New York       | No                                                                                                                                               |
| North Carolina | No                                                                                                                                               |
| North Dakota   | No                                                                                                                                               |
| Ohio           | Yes. A draft bill would correct the items indicated in Question 35 and would modify (increase) the fee requirements.                             |
| Oklahoma       | No. Modified 1973.                                                                                                                               |
| Oregon         | No                                                                                                                                               |
| Pennsylvania   | Yes. Proposed legislation patterned after USCOLD Model is being drafted.                                                                         |
| Rhode Island   | No. Drafts of recommended additions and charges are being prepared.                                                                              |
| South Carolina | Yes. The South Carolina Water Commission is presently drafting comprehensive dam control legislation to replace common law regulations now used. |
| South Dakota   | No. State Section, American Society of Civil Engineers taking initial steps to consider Dam Safety Legislation.                                  |
| Tennessee      | No                                                                                                                                               |
| Texas          | No                                                                                                                                               |
| Utah           | Yes. The regulations are subject to modification to keep them up to date.                                                                        |
| Vermont        | Yes. Changes in Question 35 to be effected through legislative process.                                                                          |
| Virginia       | Yes. Plans are being formulated which call for the introduction of legislation to the 1974 Virginia                                              |

36 (Continued)

|                      |                                                                                                                                                                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virginia (Continued) | General Assembly, which, if passed, would empower the Bureau of Water Control Management of the State Water Conservation Board to require licensing and regulation of all dams constructed in the Commonwealth, not covered under the already existing legislation. |
| Washington           | Yes. Regulations along lines of USCOLD model law have been drafted. Further action depend upon Corps recommendations for a national safety of dams program.                                                                                                         |
| West Virginia        | No                                                                                                                                                                                                                                                                  |
| Wisconsin            | Yes. Regulations are constantly being reviewed and revised to meet changing conditions.                                                                                                                                                                             |
| Wyoming              | Yes. Manual of Regulations being revised at this time.                                                                                                                                                                                                              |
| Puerto Rico          | No                                                                                                                                                                                                                                                                  |
| Virgin Islands       | Did Not Answer Questionnaire                                                                                                                                                                                                                                        |
| Guam                 | No                                                                                                                                                                                                                                                                  |
| Trust Territories    | No                                                                                                                                                                                                                                                                  |
| American Samoa       | Did Not Answer Questionnaire                                                                                                                                                                                                                                        |

37. What is the approximate annual budget for the current fiscal year to the office or staff directly related to dam and reservoir supervision? In dollars? In man-years?

|             | <u>In Dollars</u>                                                                       | <u>In Man-Years</u> |
|-------------|-----------------------------------------------------------------------------------------|---------------------|
| Alabama     | 0                                                                                       | 0                   |
| Alaska      | --                                                                                      | --                  |
| Arizona     | 120,000                                                                                 | 6                   |
| Arkansas    | 25,000                                                                                  | 2                   |
| California  | 1,347,550                                                                               | 53                  |
| Colorado    | 167,000                                                                                 | 8                   |
| Connecticut | Information not readily available.                                                      |                     |
| Delaware    | Information not readily available.                                                      |                     |
| Florida     |                                                                                         |                     |
| DNR         | None                                                                                    | --                  |
| DPC         | Not Available.                                                                          |                     |
| Georgia     | --                                                                                      | --                  |
| Hawaii      | --                                                                                      | --                  |
| Idaho       | 18,500                                                                                  | 2                   |
| Illinois    | --                                                                                      | --                  |
| Indiana     | 38,000                                                                                  | 2.25                |
| Iowa        | 20,000                                                                                  | 1.5                 |
| Kansas      | 50,000                                                                                  | 2.6                 |
| Kentucky    | 75,000                                                                                  | 6                   |
| Louisiana   | None                                                                                    | None                |
| Maine       | N/A                                                                                     |                     |
| Maryland    | Dam and reservoir supervision are not in a separate section therefore no annual budget. |                     |



## 37 (continued)

|                |                                                                             |                          |
|----------------|-----------------------------------------------------------------------------|--------------------------|
| Massachusetts  | 131,000                                                                     | 5 to 10                  |
| Michigan       | 35,000                                                                      | 2                        |
| Minnesota      | 5,000                                                                       | 0.25                     |
| Mississippi    | --                                                                          | --                       |
| Missouri       | --                                                                          | --                       |
| Montana        | 30,000                                                                      | 2                        |
| Nebraska       | 100,000                                                                     | 5                        |
| Nevada         | 7,000                                                                       | 0.5                      |
| New Hampshire  | 50,000                                                                      | 4                        |
| New Jersey     | 25,000                                                                      | 1                        |
| New Mexico     | 15,000                                                                      | 0.75                     |
| New York       | 25,000                                                                      | 2                        |
| North Carolina | 6,425 + (14,334<br>Consultant Cost)                                         | 0.35                     |
| North Dakota   | 50,000                                                                      | 3.5                      |
| Ohio           | 240,000                                                                     | 14                       |
| Oklahoma       | 80,000 (Contract<br>with Corps of<br>Engineers)                             | -- (8 month<br>contract) |
| Oregon         | 100,000                                                                     | 4                        |
| Pennsylvania   | 55,000                                                                      | 3                        |
| Rhode Island   | 4,000                                                                       | 0.4                      |
| South Carolina | None                                                                        | None                     |
| South Dakota   | No specific appropriation, included in the general<br>agency appropriation. |                          |
| Tennessee      | 60,000                                                                      | 4                        |

## 37 (continued)

|                   |                                                        |               |
|-------------------|--------------------------------------------------------|---------------|
| Texas             | 400,000                                                | 30            |
| Utah              | No separate budget.                                    |               |
| Vermont           | 10,000                                                 | 1             |
| Virginia          | 406,570                                                | Not Available |
| Washington        | 11,000                                                 | 0.5           |
| West Virginia     | 100,000                                                | --            |
| Wisconsin         | 360,000                                                | 18            |
| Wyoming           | 13,000                                                 | 1             |
| Puerto Rico       | 118,000                                                | Not Available |
| Virgin Islands    | Did Not Answer Questionnaire                           |               |
| Guam              | 70,000                                                 | 4             |
| Trust Territories | Incorporated into Trust Territory Public Works Budget. |               |
| American Samoa    | Did Not Answer Questionnaire.                          |               |

38. What is the State policy with respect to dams now in operation which were constructed prior to present requirements for a permit?

|                       |                                                                                                                                                                                                                       |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alabama               | N/A                                                                                                                                                                                                                   |
| Alaska                | --                                                                                                                                                                                                                    |
| Arizona               | Dams built prior to present requirements are jurisdictional and require a permit but no fee is required.                                                                                                              |
| Arkansas              | Dams constructed prior to January 1, 1957 do not require a permit and; therefore, are not inspected.                                                                                                                  |
| California            | The department shall require owners (of such dams) to perform at their expense such work or tests as necessary --- to safeguard life and property. (Section 6381, of the Water Code).                                 |
| Colorado              | We inspect for safety and set storage depths. When the structure deteriorates, we order repairs and maintenance together with "as built" and new plans for the repair.                                                |
| Connecticut           | Periodic inspections.                                                                                                                                                                                                 |
| Delaware              | State policy not formulated at present.                                                                                                                                                                               |
| Florida<br>DNR<br>DPC | None at this time.<br>All phosphate industry dams must comply with Chapter 17-9 F.A.C. Any inadequate dams are subject to any upgradings as needed to insure compliance with Chapter 17-3 F.A.C.                      |
| Georgia               | --                                                                                                                                                                                                                    |
| Hawaii                | --                                                                                                                                                                                                                    |
| Idaho                 | Visual inspections are made and if definite hazards exist, the department requires that they be corrected. The department does not really try to have all existing facilities conform completely to present criteria. |
| Illinois              | The law relating to permits for structures in public waters in Illinois was enacted June 10, 1911 and no major revisions have been made thereto relative to the construction of dams to this time.                    |

38 (Continued)

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indiana       | Once a year inspection for proper maintenance to check for any problems. If problems observed, institute procedure for correction.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Iowa          | No permit is required unless a material change is made in dam embankment, spillway storage, etc., or unless the structure is proven to be a public nuisance.                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Kansas        | Structures are allowed to remain. Any changes or additions are subject to the statutory requirements for a permit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Kentucky      | The pre-permit structure can be inspected under authority of KRS 151.290.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Louisiana     | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Maine         | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Maryland      | Section 17 of the law brings all dams under review and action by the State if found unsafe.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Massachusetts | Prior to transfer of jurisdiction to the Commissioner of the Massachusetts Department of Public Works, the County Commissioners were responsible for the review and approval of proposed dams, as well as the inspection of existing dams. At present the Commissioner does not have any specific policy with respect to dams previously constructed. Each dam requires inspection at least once every two years according to the statute. The current condition of each dam is evaluated, based upon visual inspection, and appropriate directives are indicated to the owner or caretaker. |
| Michigan      | These dams fall under authority of Section 2c of Act 184. Public Acts of 1963, as amended.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Minnesota     | Where the structure is of concern, the Department will take appropriate action to insure that unsafe features are corrected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Mississippi   | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Missouri      | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

38 (Continued)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Montana        | The State will go and inspect a reservoir upon a request to do so or if the State feels an inspection is warranted.                                                                                                                                                                                                                                                                                                                                                                                                     |
| Nebraska       | We will include them as located.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Nevada         | They are being inspected as time permits or when complaints are received. Any hazardous conditions are required to be remedied at owners expense, and in compliance with the present statutes.                                                                                                                                                                                                                                                                                                                          |
| New Hampshire  | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| New Jersey     | Every municipality, corporation or person owning and maintaining or having control of any reservoir or dam shall upon written request therefor, furnish to the commission as full true and particular description of the reservoir or dam as may be practicable, and shall, when so requested by the commission, cause to be made such surveys, plans and drawings of the reservoir or dam as may be necessary to give sufficient information for the determination of its safety as may be required by the commission. |
| New Mexico     | If notified of an unsafe condition, an inspection will be made and if an unsafe condition is found, an order will be issued to the owner to perform corrective measures.                                                                                                                                                                                                                                                                                                                                                |
| New York       | We do not extend jurisdiction over such dams until such time as they require reconstruction or modification. We do, however inspect all existing dams under Department ownership and control.                                                                                                                                                                                                                                                                                                                           |
| North Carolina | Inspect as necessary - for example subject to availability of funds we are currently inspecting mine-tailings dams selected by State Mining Engineer.                                                                                                                                                                                                                                                                                                                                                                   |
| North Dakota   | No policy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Ohio           | These will be dealt with under provisions of Section 1521.062 of the Ohio Revised Code requiring periodic inspections of existing dams. Dams declared potentially hazardous will require such modifications necessary to render them non-hazardous.                                                                                                                                                                                                                                                                     |



38 (Continued)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oklahoma       | Have inspection responsibilities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Oregon         | They are inspected on the same basis as those constructed after current laws and if found lacking, the necessary modifications are requested and if necessary ordered.                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Pennsylvania   | Since permit requirements extend back to 1913, those constructed prior to that date were and are considered to have permit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Rhode Island   | They must be maintained in safe condition, regardless of age.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| South Carolina | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| South Dakota   | All dams subject to same inspection and request for inspection procedures.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Tennessee      | Must apply for Certificate of Approval and Safety. A safety inspection will be made and rehabilitation required if deemed necessary for the issuance of a certificate.                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Texas          | Upgrade hazardous structures.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Utah           | They are inspected but allowed to be used until repairs are needed. Then plans and specifications are required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Vermont        | No action unless inspections indicates it is unsafe or there is a request for action by the appropriate officials.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Virginia       | For dams already constructed prior to enactment of this legislation, Section 12 of Chapter 424 of the Acts of 1928, approved March 24, 1928, as amended by Chapter 346 of the Acts of 1932, approved March 26, 1932, codified as Section 3581 of the Michie Code of 1942 and Section 62-88 of the Code of Virginia of 1950, relating to water-power developments constructed or acquired after 1928 remains in effect. In addition dams constructed after July 1, 1921, without license, must be licensed and permitted to do so by Commission to convert to or be utilized for generating electricity. |

38 (Continued)

|                 |                                                                                                                                                                                                                     |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Washington      | Periodic inspection for safety. Issue orders to upgrade. Take abatement action if non-complying.                                                                                                                    |
| West Virginia   | The Director of the Department of Natural Resources shall give notice to file an application for a Certificate of Approval to every owner of a dam which was completed prior to the effective date of July 1, 1973. |
| Wisconsin       | All dams with a potential of 750 HP or more are inspected annually; others are inspected upon request or complaint.                                                                                                 |
| Wyoming         | No defined State policy -- the State Engineer may require field investigations and/or stability analyses in any case where the safety of the structure is questioned.                                               |
| Puerto Rico     | The Commonwealth of Puerto Rico plans, constructs and operates all water supply facilities through such agencies of the Government as the Governor and the legislature consider appropriate.                        |
| Virgin Islands  | Did Not Answer Questionnaire                                                                                                                                                                                        |
| Guam            | The only structures in existence are small structures which are not considered to be hazardous except for the Navy dam at Fena Lake. The Government of Guam does not have access to Fena Lake.                      |
| Trust Territory | No requirement for a permit.                                                                                                                                                                                        |
| American Samoa  | Did Not Answer Questionnaire                                                                                                                                                                                        |

39. Where construction and/or performance records are missing or inadequate does the State require field investigations and stability analysis to now be undertaken? If yes, explain.

|             |                                                                                                                                     |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Alabama     | No.                                                                                                                                 |
| Alaska      | --                                                                                                                                  |
| Arizona     | Yes. The State requires such investigations and analyses where there is a definite need to evaluate the safe operation of the dam.  |
| Arkansas    | No.                                                                                                                                 |
| California  | Yes. As found necessary on an individual basis.                                                                                     |
| Colorado    | Yes. If it appears conditions warrant.                                                                                              |
| Connecticut | Occasionally, if structure presents extremely great hazard.                                                                         |
| Delaware    | No.                                                                                                                                 |
| Florida     |                                                                                                                                     |
| DNR         | No.                                                                                                                                 |
| DPC         | -- If there is a potential pollution threat to waters of the State, field investigations and stability analyses may be requested.   |
| Georgia     | --                                                                                                                                  |
| Hawaii      | --                                                                                                                                  |
| Idaho       | No. This would only be required in a situation where a hazardous condition is suspected that requires such information to evaluate. |
| Illinois    | No.                                                                                                                                 |
| Indiana     | Yes. Only if a problem occurs or potential problem seems to be imminent.                                                            |
| Iowa        | No.                                                                                                                                 |
| Kansas      | No.                                                                                                                                 |
| Kentucky    | Yes. Field investigations for more complete data in inventory of structures                                                         |

39 (continued)

|                |                                                                                                                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Louisiana      | No.                                                                                                                                                                                                                                   |
| Maine          | No.                                                                                                                                                                                                                                   |
| Maryland       | Yes. We can. In regard to mine refuse banks and dams, the only structures are related to wastewater treatment facilities and are covered under permits for that purpose.                                                              |
| Massachusetts  | No. The Department's safety-inspection program has been in effect for only 3 years, since October 27, 1970. Stability analyses have not yet been incorporated into the program because of insufficient funds for such an undertaking. |
| Michigan       | No.                                                                                                                                                                                                                                   |
| Minnesota      | No.                                                                                                                                                                                                                                   |
| Mississippi    | No.                                                                                                                                                                                                                                   |
| Missouri       | No.                                                                                                                                                                                                                                   |
| Montana        | No.                                                                                                                                                                                                                                   |
| Nebraska       | No.                                                                                                                                                                                                                                   |
| Nevada         | No. When the budget will permit, field investigation equipment will be purchased to permit soils tests on dam embankments and determination of emergency spillway capacities on dams with missing or inadequate records.              |
| New Hampshire  | Yes. Depending on circumstances and condition of dam.                                                                                                                                                                                 |
| New Jersey     | Yes. Whete it is reported that a dam is unsafe, inspection is made and measures to rectify the situation are undertaken.                                                                                                              |
| New Mexico     | No.                                                                                                                                                                                                                                   |
| New York       | No.                                                                                                                                                                                                                                   |
| North Carolina | Yes. By consultant subject to availability of funds.                                                                                                                                                                                  |

39 (continued)

|                |                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| North Dakota   | No.                                                                                                                                                                               |
| Ohio           | Yes. This can be ordered under the authority of Section 1521.062.                                                                                                                 |
| Oklahoma       | Yes. Only upon complaint by other parties.                                                                                                                                        |
| Oregon         | Yes. Any structure upon which a question is raised as to safety, State Engineer requires stability analyses that he and his staff feel is justified and will answer the question. |
| Pennsylvania   | Yes. If conditions warrant, we require owner to retain competent engineer to analyze safety of dam.                                                                               |
| Rhode Island   | No.                                                                                                                                                                               |
| South Carolina | No.                                                                                                                                                                               |
| South Dakota   | No.                                                                                                                                                                               |
| Tennessee      | Yes. These may be required if a routine safety inspection is not considered sufficient.                                                                                           |
| Texas          | Yes. When staff investigations indicate a hazardous situation, the owner is directed to take appropriate action through his consulting engineer.                                  |
| Utah           | No.                                                                                                                                                                               |
| Vermont        | Yes. State has program of special investigation and reports on these dams.                                                                                                        |
| Virginia       | No.                                                                                                                                                                               |
| Washington     | No.                                                                                                                                                                               |
| West Virginia  | Depending on conditions. If concern for safety is of prime factor.                                                                                                                |
| Wisconsin      | Yes. If conditions warrant.                                                                                                                                                       |
| Wyoming        | No. The State Engineer may require field investigations and/or stability analyses in any case where the safety of the structure is questioned.                                    |



39 (continued)

|                   |                                                                                                                                                                                                                                                                                                                                                           |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Puerto Rico       | Yes. Puerto Rico Water Resources Authority and Aqueduct and Sewer Authority on behalf of the Commonwealth of Puerto Rico undertakes the necessary action to make field investigations, stability analysis or any other study to keep the safety dam. These investigations are carried out with the assistance of specialist of the Bureau of Reclamation. |
| Virgin Islands    | Did Not Answer Questionnaire.                                                                                                                                                                                                                                                                                                                             |
| Guam              | No.                                                                                                                                                                                                                                                                                                                                                       |
| Trust Territories | No.                                                                                                                                                                                                                                                                                                                                                       |
| American Samoa    | Did Not Answer Questionnaire.                                                                                                                                                                                                                                                                                                                             |

40. General Remarks.

Alabama --

Alaska --

Arizona The Arizona Water Commission assumed responsibility for supervision of the safety or jurisdictional dams in April 1971. Previously this function was administered by the State Highway Department since 1929. The Highway Department was hampered in their supervision of this function because of limited operating funds and personnel. Their function was of necessity, combined with other required Highway responsibilities; consequently, they were unable to devote full time to the supervision of dams program.

The Arizona Water Commission has a permanent staff of registered engineers who have considerable experience in the design, construction and operation of dams. Their function is solely devoted to the supervision of dam safety program under the statutory regulations.

Arkansas --

California --

Colorado (1) We do not issue permits. (2) The owner must have approval of plans and specifications prior to construction. Failure to comply may result in no storage or partial storage only, at most. (3) We find that restriction of storage is sufficient to bring about prompt compliance with repair and maintenance orders.

Connecticut --

Delaware --

Florida The Water Resources Act of 1972 was amended by the 1973 Legislature giving the Department of Natural Resources (DNR) or Governing Board(s) of the five major water management districts, covering the land and water area of the State of Florida, authority to delineate areas within the district(s) wherein permits may be required for construction, alteration and operation of dams. In those cases where permits are

Florida (Continued) required the Department or District(s) are required to make, at their expense, periodic inspections annually, or more frequently as deemed necessary. At the present time the Department or water management districts do not have a program of supervision of dams.

The Department of Pollution Control (DPC) has a program of inspections for phosphate sludge area levees and dam under the regulatory powers authorized for the Department of Pollution Control under the Department of Florida Air and Water Pollution Control Act, 403.061 (25), and rules of the Department of Pollution Control, Chapter 17-4, Permits, and Chapter 17-9, Minimum Requirements for Earthen, Dams Phosphate Mining and Processing Operations.

Georgia Georgia has no regulatory agency or law governing the construction or maintenance of impoundments. The State Geological Survey are sometimes asked for geologic data to be incorporated for design purposes but have no further input.

Hawaii In Hawaii, construction of dams as well as other types of structures are regulated by local ordinances which are administered by County agencies. As to the specific function of dam supervision, there is no State office or agency assigned this responsibility. The counties do not have any programs, regulations, legislation or policy for the supervision of dams.

Idaho --

Illinois --

Indiana Chapter 318, Acts of 1945 and Chapter 84, Acts of 1961 refer to the Indiana Flood Control and Water Resources Commission. In 1965 this commission, the Conservation Department and two other small agencies were combined into a new Department of Natural Resources and all duties, responsibilities, powers and authority were vested into the new Natural Resources Commission.

Iowa In considering an application for a permit to construct a dam, the Resources Council evaluates the submitted plans and associated information to determine whether

Iowa (Continued)

the design is in accordance with sound engineering practices. If there is any doubt as to the adequacy of the design, additional information may be requested or the applicant may be required to install monitoring equipment, keep construction records etc.

In the case of post-statutory unauthorized dams, the owner can be required to supply the necessary engineering information needed to determine whether or not such a dam is a nuisance and should be repaired or abated. A nuisance created by a pre-statutory dam can be abated upon proof by the Resources Council that a nuisance is being created.

Budget limitations preclude the carrying out of a sound inspection program of even the Council approved structures, let alone the many pre-statutory structures in Iowa.

Kansas

--

Kentucky

--

Louisiana

--

Maine

Our present lack of control is of concern to us. Twice previously the Legislature has been asked to consider a program of dam safety legislation. Such legislation passed both houses in 1973, but failed for lack of funding.

Maryland

The burden of maintaining a dam in a safe condition is placed upon the owner. Inspections are made by State personnel; however, these have been made at irregular intervals.

Permits issued by the State normally include a set of conditions which are agreed to by the applicant prior to the issuance of the permit. In issuing a permit in this manner, the permit is tailor made to the specific problems of any one dam.

Massachusetts

--

Michigan

--

Minnesota

--

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mississippi    | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Missouri       | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Montana        | <p>The State has initiated an inspection program for its own dams. One engineer has been designated as Dam Safety Engineer whose primary responsibility is to inspect State dams. New safety equipment has been purchased to make the inspections safer. The State is starting to get some of the repairs made that have been noted during the inspections of its own dams.</p> <p>The State inventory of dams has recently been updated to the current known data. The inventory has been put on computer with all known data.</p> |
| Nebraska       | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Nevada         | <p>Rules and regulations relating to dam construction and dam safety are granted to the State Engineer under NRS 533.120(1) "The state engineer is empowered to make such reasonable rules and regulations as may be necessary for the proper and order execution of the powers conferred by law."</p>                                                                                                                                                                                                                              |
| New Hampshire  | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| New Jersey     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| New Mexico     | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| North Carolina | <p>In 1970 we reviewed our Dam Safety Law in comparison with a dam safety model law prepared by the U. S. Committee on Large Dams and also consulted with several members of the USCOLD Committee which drew up the model law.</p>                                                                                                                                                                                                                                                                                                  |
| North Dakota   | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Ohio           | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Oklahoma       | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Oregon         | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |



Pennsylvania

Plans are underway to introduce legislation patterned after USCOLD Model Law. Recent history of silt dam failure and other semi-liquid impoundment problems have made it necessary to include them within jurisdiction.

Of the approximately 2,700 dams within our jurisdiction, approximately 500 are considered as major structures, i.e., their failure could imperil life or property.

Rhode Island

--

South Carolina

At the present, South Carolina has, with few exceptions, only common law regulation of dams and reservoirs. These statutory exceptions pertain, for the most part, to obstruction of the free migration of fish and the resulting requirement for sluices. Other than nuisance remedies under common law, there are no statutory provisions requiring safety in the design, construction, operation and maintenance of dams.

Indirectly, however, several State agencies have some non-safety oriented control over dams and reservoirs, either through permit procedures in Corps of Engineers projects or through the quality of water withheld or discharged.

The South Carolina Water Resources Commission is presently drafting comprehensive dam and reservoir legislation. The Commission's draft is calculated to cover all phases of safety oriented regulation.

The South Carolina Water Resources Commission will soon complete and Inventory of Lakes for the State which are ten acres in surface area or larger.

South Dakota

--

Tennessee

The Tennessee law and inspection program is completely new. No previous work on dam supervision and/or safety inspection has been carried out. An inventory of all existing non-Federal dams is being conducted. Safety inspections will be initiated after the inventory data is reviewed and proper planning can be carried out. Inspection requirements of the Corps of Engineers are needed prior to full development of the State plan.

40 (Continued)

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Texas             | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Utah              | Some dams included in our count are of minimal height and capacity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Vermont           | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Virginia          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Washington        | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| West Virginia     | West Virginia Senate Bill 2057 was passed April 14, 1973 in effect July 1, 1973.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Wisconsin         | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Wyoming           | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Puerto Rico       | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Virgin Islands    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Guam              | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Trust Territories | Much of the Trust Territory Governmental pattern does not fit the convential United State pattern. Thus virtually all construction except private buildings is planned, financed, and operated by the Trust Territory using funds appropriated by the U. S. Congress. This includes all dams and reservoirs. The design of all dams built so far (since World War II) have been prepared by architectural/engineering consulting firms, and reviewed by Director of Public Works. There is only one dam in operation (Ghimel, on the Island of Babelthuap in Palau District), and two under construction (Gitam in Yap, and a dam on the Namil River in Ponape). |
| American Samoa    | Did Not Answer Questionnaire                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |









APPENDIX B

RESPONSES TO QUESTIONNAIRE ON  
SUPERVISION OF DAMS BY FEDERAL AGENCIES

| Contents                      | Page |
|-------------------------------|------|
| 1. Questionnaire              | B-3  |
| 2. Responses to Questionnaire | B-10 |

A survey of the Federal agency's capabilities, practices and regulations regarding the design, construction, operation and maintenance of dams was conducted by furnishing the Federal agencies having jurisdiction over dams the attached questionnaire on Supervision of Dams by Federal Agencies. The responses from each Federal agency to each of the questions contained in the questionnaire are tabulated on pages B-10 through B-73.

NATIONAL PROGRAM FOR INSPECTION OF DAMS

QUESTIONNAIRE

SUPERVISION OF DAMS

BY FEDERAL AGENCIES

AGENCY \_\_\_\_\_

DATE      MO      YR     

1. Does your agency exercise control over dams and reservoirs with respect to:

- |                  |                   |                  |
|------------------|-------------------|------------------|
| a. Design?       | <u>    </u> / YES | <u>    </u> / NO |
| b. Construction? | <u>    </u> / YES | <u>    </u> / NO |
| c. Operation?    | <u>    </u> / YES | <u>    </u> / NO |
| d. Maintenance?  | <u>    </u> / YES | <u>    </u> / NO |

2. As of the latest count, how many dams are under supervision of your agency? Give their number \_\_\_\_\_ (as of \_\_\_\_\_).

DATE

3. Is a roster of such dams readily available to Public?      / YES      / NO  
Please give latest date of such roster \_\_\_\_\_.

4. Is the function of dam supervision performed by a separate identifiable office, division or bureau of your agency?      / YES      / NO

\_\_\_\_\_

\_\_\_\_\_

5. Is the supervisory function required to be directed by an engineer registered under state law?      / YES      / NO  
Or are registered engineers required in the organizational unit or activity?      / YES      / NO

If so, name organizational unit.

\_\_\_\_\_

\_\_\_\_\_

6. Full title and address of office administering regulations; and name and title of official to whom inquiries and application should be made.

7. Name of any other agencies consulted before the construction of a dam is undertaken. Indicate extent of their interest.

8. Authority, legislation or other basic instrument citing responsibility for dam safety. Give original date and date of latest amendment. Please summarize and inclose copy if available.

9. Are printed regulations and/or instructions relating to safety of dams available to the public? ☐ YES ☐ NO

If yes, give title and latest revision date. Inclose copy if available.

10. Please state any limitations or exceptions, as to size, type, capacity, off-stream location of dams (or reservoirs) subject to supervision.

11. Are special agencies, such as irrigation districts, cities, etc.,  
exempt from your inspection requirements? ☐ YES ☐ NO  
If so, specify.

12. Under the regulations of your agency, please give definition of "Height  
of Dam" and "Reservoir Capacity."

13. What approvals are required to commence construction of dam.

14. Do you inspect dams other than those constructed or owned by your  
agency?

15. Upon completion of a dam, is there a requirement for the issuance  
of a certificate or other authorization before commencement of storage  
in reservoir? ☐ YES ☐ NO

16. Is there any requirement for periodic renewal of certificate or other  
authorization to continue a dam in service? ☐ YES ☐ NO  
If yes, for what period \_\_\_\_\_



17. Is special authority required for enlargement, modification or repair of dam? ☐ YES ☐ NO

If yes, under what circumstances?

---

---

---

18. Is on-site inspection provided by your agency during construction? ☐ YES ☐ NO

19. Are there any requirements for record keeping during the construction and operation of such dam or reservoir? ☐ YES ☐ NO

If yes, what type of record is required, and what data are recorded?

---

---

---

---

20. What is done with the data accumulated?

---

---

21. Are periodic inspections for safety purposes made after completion of dam? ☐ YES ☐ NO

If yes, is there a definite schedule of inspections? ☐ YES ☐ NO

If so, explain.

---

---

---

22. Who does the inspection and at whose expense?

---

---

---

23. Are there any other conditions, for example on complaint, under which inspections are made? ☐ YES ☐ NO

If yes, what are these conditions, and to what official is request made?

24. Are there any agency - prescribed requirements for operation and maintenance? ☐ YES ☐ NO

Do these include continuous surveillance or monitoring?

☐ YES ☐ NO

25. Are written regulations available where dams are operated and maintained by other than agency personnel? ☐ YES ☐ NO

Explain.

26. Is there a requirement that design of any dam under the regulations shall be done by a registered professional engineer? ☐ YES ☐ NO

27. Are there any exemptions to the above requirements? ☐ YES ☐ NO  
If yes, what are the circumstances?

28. Are design criteria prescribed by your agency and available in printed form? ☐ YES ☐ NO

If yes, give the title and date of latest revision or edition of such design criteria document.

29. Are plans and designs reviewed by any authority outside of your agency in preliminary form? ☐ YES ☐ NO

30. Are contract plans and specifications reviewed by any authority outside of your agency? ☐ YES ☐ NO

31. Is there a requirement that final as-constructed drawings be filed with any other agency? ☐ YES ☐ NO

32. Are dam designs, including spillway capacities, required to meet specific criteria relating to special hazards such as floods, earthquakes, or location above densely populated areas? ☐ YES ☐ NO

If yes, explain?

---

---

---

---

33. Is there a requirement for geologic, soils and hydrologic data to be filed with drawings? ☐ YES ☐ NO

---

---

34. Are there any requirements for special instrumentation in interest of dam safety? ☐ YES ☐ NO

What kind? Please explain.

---

---

---

---

35. Based on past experience, do the current regulations fully meet the present needs of your agency? ☐ YES ☐ NO

If no, what areas appear in need of change?

---

---

---

---

36. Are there any active plans under consideration to modify existing regulations? ☐ YES ☐ NO

If so, what?

---

---

---

---

37. What is the approximate annual budget for the current fiscal year to the office or staff directly related to dam and reservoir supervision?

In Dollars \_\_\_\_\_ In Man-Years \_\_\_\_\_

38. What is your agency's policy with respect to dams now in operation which were constructed prior to present requirements?

---

---

---

---

39. Where construction and/or performance records are missing or inadequate, does your agency require field investigations and stability analyses to now be undertaken? ☐ YES ☐ NO

If yes, explain.

---

---

40. General remarks and expanded replies.

1. Does your agency exercise control over dams and reservoirs with respect to: a. Design? b. Construction? c. Operation? d. Maintenance?

|                                              | <u>DESIGN</u>                                                                                                                                                                                                               | <u>CONSTRUCTION</u> | <u>OPERATION</u> | <u>MAINTENANCE</u> |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------|--------------------|
| USDA                                         |                                                                                                                                                                                                                             |                     |                  |                    |
| Forest Service                               | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Soil Conservation Service                    | The Soil Conservation Service provides technical assistance and financial support to local sponsors for the design and construction of dams. The local sponsors are responsible for operation and maintenance. maintenance. |                     |                  |                    |
| Corps of Engineers                           |                                                                                                                                                                                                                             |                     |                  |                    |
| Civil Works                                  | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Regulatory Functions                         | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| USDI                                         |                                                                                                                                                                                                                             |                     |                  |                    |
| Bureau of Indian Affairs                     | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Bureau of Land Management                    | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Bureau of Reclamation                        | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Bureau of Sport Fisheries and Wildlife       | Yes                                                                                                                                                                                                                         | Yes*                | Yes              | Yes                |
| Geological Survey                            | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Mining Enforcement and Safety Administration | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Federal Power Commission                     | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| International Boundary and Water Commission  | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |
| Tennessee Valley Authority                   | Yes                                                                                                                                                                                                                         | Yes                 | Yes              | Yes                |

\*14 dams in Region 2 were designed and constructed by the Corps of Engineers



2. As of the latest count, how many dams are under supervision of your agency? Give their number (as of date).

|                                                 | <u>NUMBER</u>                                                                                                                                                                                                                                                                                                                                               | <u>DATE</u>      |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| USDA                                            |                                                                                                                                                                                                                                                                                                                                                             |                  |
| Forest Service                                  | 14,175                                                                                                                                                                                                                                                                                                                                                      | Spring, 1973     |
| Soil Conservation Service                       | None                                                                                                                                                                                                                                                                                                                                                        |                  |
| Corps of Engineers                              |                                                                                                                                                                                                                                                                                                                                                             |                  |
| Civil Works                                     | 486                                                                                                                                                                                                                                                                                                                                                         | 1 March 1974     |
| Regulatory Functions                            | 45                                                                                                                                                                                                                                                                                                                                                          | 1 January 1974   |
| USDI                                            |                                                                                                                                                                                                                                                                                                                                                             |                  |
| Bureau of Indian Affairs                        | 152                                                                                                                                                                                                                                                                                                                                                         | September 1973   |
| Bureau of Land Management                       | 599                                                                                                                                                                                                                                                                                                                                                         | 1 August 1973    |
| Bureau of Reclamation                           | 488*                                                                                                                                                                                                                                                                                                                                                        | 30 June 1973     |
|                                                 | *343 storage dams<br>and dikes; 145<br>diversion dams.                                                                                                                                                                                                                                                                                                      |                  |
| Bureau of Sport Fisheries and<br>Wildlife       | 257                                                                                                                                                                                                                                                                                                                                                         | December 1973    |
| Geological Survey                               | 7                                                                                                                                                                                                                                                                                                                                                           | 6 August 1973    |
| Mining Enforcement and Safety<br>Administration | 451*                                                                                                                                                                                                                                                                                                                                                        | 15 June 1973     |
|                                                 | *290 Coal, 261 Noncoal                                                                                                                                                                                                                                                                                                                                      |                  |
| Federal Power Commission                        | 1,015 Approx.*                                                                                                                                                                                                                                                                                                                                              | 1 September 1973 |
|                                                 | *There are approximately 1015 dams under license<br>and pending applications for license. The reason<br>for the approximation is that the number of projects<br>consist of several small diversion dams, forebay dams,<br>for stream regulation, etc. These are parts of an<br>integrated power generation system and not all are<br>recorded individually. |                  |
| International Boundary and Water<br>Commission  | 7*                                                                                                                                                                                                                                                                                                                                                          | 1 June 1973      |
|                                                 | *1 Domestic, 6 International                                                                                                                                                                                                                                                                                                                                |                  |
| Tennessee Valley Authority                      | 45                                                                                                                                                                                                                                                                                                                                                          | 27 July 1973     |

3. Is the roster of such dams readily available to the public? Please give the latest date of such roster.

USDA

Forest Service No

Soil Conservation Service N/A

Corps of Engineers

Civil Works Yes. Annual Report of Chief of Engineers 1974

Regulatory Functions No \*

USDI

Bureau of Indian Affairs No

Bureau of Land Management No

Bureau of Reclamation Yes. June 30, 1973

Bureau of Sport Fisheries and Wildlife Yes. December 1973

Geological Survey No

Mining Enforcement and Safety Administration Yes. For coal June 15, 1972;  
No. For noncoal.

Federal Power Commission No. The FPC Annual Report, available from GPO, lists all major licenses; however, one license may have more than one dam.

International Boundary and Water Commission Yes. N/A

Tennessee Valley Authority Yes. Technical Monograph No. 55, Volume 1, August 1954, and subsequent supplements (latest May 1969).

\*A partial list could be made available from District Engineer.

4. Is the function of dam supervision performed by a separate identifiable office, division or bureau of your agency?

USDA

|                |     |
|----------------|-----|
| Forest Service | Yes |
|----------------|-----|

|                           |     |
|---------------------------|-----|
| Soil Conservation Service | N/A |
|---------------------------|-----|

Corps of Engineers

|             |                                                                                                                         |
|-------------|-------------------------------------------------------------------------------------------------------------------------|
| Civil Works | Yes. The District Engineers are responsible for the dams located within the geographical boundaries of their Districts. |
|-------------|-------------------------------------------------------------------------------------------------------------------------|

|                      |                                            |
|----------------------|--------------------------------------------|
| Regulatory Functions | Yes. U.S. Army Corps of Engineers District |
|----------------------|--------------------------------------------|

USDI

|                          |                                                                        |
|--------------------------|------------------------------------------------------------------------|
| Bureau of Indian Affairs | Yes. Office of Trust Responsibilities, Division of Trust Facilitation. |
|--------------------------|------------------------------------------------------------------------|

|                           |                                                                           |
|---------------------------|---------------------------------------------------------------------------|
| Bureau of Land Management | No. Function performed jointly by Divisions of Watershed and Engineering. |
|---------------------------|---------------------------------------------------------------------------|

|                       |                                           |
|-----------------------|-------------------------------------------|
| Bureau of Reclamation | Yes. The Engineering and Research Center. |
|-----------------------|-------------------------------------------|

|                                        |                               |
|----------------------------------------|-------------------------------|
| Bureau of Sport Fisheries and Wildlife | Yes. Division of Engineering. |
|----------------------------------------|-------------------------------|

|                   |                            |
|-------------------|----------------------------|
| Geological Survey | Yes. Conservation Division |
|-------------------|----------------------------|

|                                              |                                                                             |
|----------------------------------------------|-----------------------------------------------------------------------------|
| Mining Enforcement and Safety Administration | Yes. Coal Mine Health and Safety and Metal and Nonmetal Mine Health Safety. |
|----------------------------------------------|-----------------------------------------------------------------------------|

|                          |                                                                                          |
|--------------------------|------------------------------------------------------------------------------------------|
| Federal Power Commission | Yes. Division of Licensed Projects and five regional offices within the Bureau of Power. |
|--------------------------|------------------------------------------------------------------------------------------|

|                                             |                                          |
|---------------------------------------------|------------------------------------------|
| International Boundary and Water Commission | Yes. Operation and Maintenance Division. |
|---------------------------------------------|------------------------------------------|

|                            |                                                                                |
|----------------------------|--------------------------------------------------------------------------------|
| Tennessee Valley Authority | No. Inspection function is assigned to Office of Engineering and Construction. |
|----------------------------|--------------------------------------------------------------------------------|

5. Is the supervisory function required to be directed by an engineer registered under State law? Or are registered engineers required in the organizational unit or activity? If so, name organizational unit.

USDA

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Forest Service | No. Registration is not a Federal requirement. However, our Regional Engineers and many of the Staff Engineers are registered. |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|

|                           |     |
|---------------------------|-----|
| Soil Conservation Service | N/A |
|---------------------------|-----|

Corps of Engineers

|             |                                                                                                                                                              |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Civil Works | No. However, engineering personnel of this agency are required to meet standards for educational and experience established by the Civil Service Commission. |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |    |
|----------------------|----|
| Regulatory Functions | No |
|----------------------|----|

USDI

|                          |    |
|--------------------------|----|
| Bureau of Indian Affairs | No |
|--------------------------|----|

|                           |    |
|---------------------------|----|
| Bureau of Land Management | No |
|---------------------------|----|

|                       |                                                                                           |
|-----------------------|-------------------------------------------------------------------------------------------|
| Bureau of Reclamation | No. However, most of the engineers having supervisory functions are registered engineers. |
|-----------------------|-------------------------------------------------------------------------------------------|

|                                        |    |
|----------------------------------------|----|
| Bureau of Sport Fisheries and Wildlife | No |
|----------------------------------------|----|

|                   |    |
|-------------------|----|
| Geological Survey | No |
|-------------------|----|

|                                              |    |
|----------------------------------------------|----|
| Mining Enforcement and Safety Administration | No |
|----------------------------------------------|----|

|                          |                                                                                                |
|--------------------------|------------------------------------------------------------------------------------------------|
| Federal Power Commission | No. Although not required, most of the engineers in the dam inspection program are registered. |
|--------------------------|------------------------------------------------------------------------------------------------|

|                                             |    |
|---------------------------------------------|----|
| International Boundary and Water Commission | No |
|---------------------------------------------|----|

|                            |    |
|----------------------------|----|
| Tennessee Valley Authority | No |
|----------------------------|----|

6. Full title and address of office administering regulations; and name and title to whom inquiries and application should be made.

USDA

Forest Service

Mr. John R. McGuire, Chief - Forest Service,  
USDA, Washington, D. C. 20250

Soil Conservation Service

N/A

Corps of Engineers

Civil Works

Chief Engineering Division, Civil Works  
Directorate, Office of the Chief of Engineers,  
Department of the Army, Washington, D.C. 20314

Regulatory Functions

Inquires to Chief of Construction - Operation  
Division of the District Office - Application  
made to District Engineer.

USDI

Bureau of Indian Affairs

Martin E. Seneca, Jr., Director; Office of  
Trust Responsibilities; Bureau of Indian  
Affairs; 1951 Constitution Avenue; Washington,  
D.C.

Bureau of Land Management

R. E. Brown, Chief, Division of Engineering,  
USDI, Bureau of Land Management, Washington,  
D. C. 20240

Bureau of Reclamation

For operational dams: K. K. Kober, Chief,  
Division of Water Operation and Maintenance  
For dams being designed or constructed:  
H. G. Arthur, Director of Design and Construction  
Address: Engineering and Research Center,  
Bureau of Reclamation, Denver Federal Center,  
Denver, Colorado.

Bureau of Sport Fisheries and  
Wildlife

Water L. West, Chief, Branch of Design and  
Construction; Division of Engineering; U.S.  
Dept of Interior; 18th and C Sts. N.W.,  
Washington, D. C. 20240

Geological Survey

Russel G. Wayland; Chief, Conservation Division,  
U.S. Geological Survey; National Center; Reston,  
Virginia 22092



6. (Continued)

USDI (Cont'd)

|                                              |                                                                                                                                                                                      |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mining Enforcement and Safety Administration | Assistant Administrator - Coal Mine Health and Safety. Assistant Administrator - Metal and Nonmetal Mine Health and Safety. Department of Interior Building, Washington, D. C. 20240 |
| Federal Power Commission                     | Secretary, Federal Power Commission, 825 N. Capitol Street, N.E., Washington, D.C. 20426                                                                                             |
| International Boundary and Water Commission  | Commissioner Joseph F. Friedkin, International Boundary and Water Commission, United States Section, P. O. Box 1859, El Paso, Texas 79950                                            |
| Tennessee Valley Authority                   | George H. Kimmons, Manager, Office of Engineering Design and Construction 607 Union Building, Knoxville, Tennessee 37902                                                             |

7. Name of any other agencies consulted before the construction of a dam is undertaken. Indicate extent of their interest.

USDA

|                |                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------|
| Forest Service | USDI, Fish and Wildlife Service; State Fish and Wildlife and USDI, Historical and Archeological. |
|----------------|--------------------------------------------------------------------------------------------------|

|                           |                                                                                        |
|---------------------------|----------------------------------------------------------------------------------------|
| Soil Conservation Service | All Federal and State agencies that may have jurisdiction or associated project works. |
|---------------------------|----------------------------------------------------------------------------------------|

Corps of Engineers

|             |                                                                                     |
|-------------|-------------------------------------------------------------------------------------|
| Civil Works | All local State and Federal agencies having jurisdiction or interest are consulted. |
|-------------|-------------------------------------------------------------------------------------|

|                      |                                                                        |
|----------------------|------------------------------------------------------------------------|
| Regulatory Functions | All Federal, State and local agencies having jurisdiction or interest. |
|----------------------|------------------------------------------------------------------------|

USDI

|                          |                                                                                          |
|--------------------------|------------------------------------------------------------------------------------------|
| Bureau of Indian Affairs | Bureau of Reclamation, Corps of Engineers, Soil Conservation Service, Geological Survey. |
|--------------------------|------------------------------------------------------------------------------------------|

|                           |      |
|---------------------------|------|
| Bureau of Land Management | None |
|---------------------------|------|

|                       |                                                                                               |
|-----------------------|-----------------------------------------------------------------------------------------------|
| Bureau of Reclamation | Appropriate local, State and Federal agencies having interest and reviewing responsibilities. |
|-----------------------|-----------------------------------------------------------------------------------------------|

|                                        |                                                                                      |
|----------------------------------------|--------------------------------------------------------------------------------------|
| Bureau of Sport Fisheries and Wildlife | Corps of Engineers generally although State is involved under certain circumstances. |
|----------------------------------------|--------------------------------------------------------------------------------------|

|                   |                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Geological Survey | Agency having jurisdiction over surface. In most cases, Bureau of Land Management and Forest Service. Their extent of interest is surface use. |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------|

|                                              |      |
|----------------------------------------------|------|
| Mining Enforcement and Safety Administration | None |
|----------------------------------------------|------|

|                          |                                                                                                                                                          |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal Power Commission | Federal, State and local governmental agencies when the interests of the agency are effected or project effects the agencies responsibilities or duties. |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

7. (Continued)

International Boundary and Water  
Commission

All Governmental, State and local agencies concerned with flood control and conservation of international streams along the United States and Mexico border. All international structures are joint undertakings with Mexico during all phases of planning, design, construction, operation and maintenance.

Tennessee Valley Authority

Environmental Protection Agency.

8. Authority, legislation or other basic instrument citing responsibility for dam safety. Give original date and date of latest amendment. Please summarize and inclose copy if available.

#### USDA

|                |                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------|
| Forest Service | 30 Stat. 34, Amm. 16 USC 473, 474-482, 551;<br>33 Stat. 628, 16 USC 524; 74 Stat. 215,<br>16 USC 528-531 |
|----------------|----------------------------------------------------------------------------------------------------------|

|                           |     |
|---------------------------|-----|
| Soil Conservation Service | N/A |
|---------------------------|-----|

#### Corps of Engineers

|             |                                                                                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Civil Works | Basic authorizations for construction, operation and maintenance (including responsibility for dam safety) are contained in Authorization Acts applicable to individual projects. |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                |
|----------------------|------------------------------------------------|
| Regulatory Functions | Section 9 of the River and Harbor Act of 1899. |
|----------------------|------------------------------------------------|

#### USDI

|                          |                                                                                           |
|--------------------------|-------------------------------------------------------------------------------------------|
| Bureau of Indian Affairs | 55 BIAM 4-1-1G, Date Released 11/14/70. The Area Directors is responsible for dam safety. |
|--------------------------|-------------------------------------------------------------------------------------------|

|                           |                                                                                                                                                                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Land Management | 43 USC conveys authority and responsibility to construct, maintain and reduce possible hazards for improvements on Natural Resources Lands implying responsibility for dam safety. No instrument gives BLM expressed responsibility for dam safety. |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                                                                                                                                                                                                 |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Reclamation | Basic Reclamation Laws, Authorization Acts, and Appropriation Acts. Current responsibilities and delegation of authority are presented in the Executive Manual, Reclamation Instructions, which is available in the Office of the Commissioner. |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                        |                                                                                                          |
|----------------------------------------|----------------------------------------------------------------------------------------------------------|
| Bureau of Sport Fisheries and Wildlife | Fish and Wildlife Engineering Handbook, April 24, 1959, Section 300.1, 300.2(2) and 303 Amendment No. 9. |
|----------------------------------------|----------------------------------------------------------------------------------------------------------|

|                   |                                                                                                                                                                                                                                                                                     |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Geological Survey | Basic GS authority stems from delegated authority to supervise operations conducted on Federal and Indian Lands pursuant to Mineral Leasing Act of 1930 (30 U.S.C. 181 et. seq.), the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351-359), Reorganization Plan No. 3 of 1946 |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

8. (Continued)

USDI (Cont'd)

Geological Survey (Cont'd) (60 Stat. 1099), and various laws pertaining to the leasing of Indian lands in Title 25, CFR. Departmental regulations for mining operations are in the Title 30, CFR, Chapter II - no specific responsibility for dam safety contained in this authority.

Mining Enforcement and Safety Administration Federal Coal Mine Health and Safety Act of 1969 - 12/30/69 and Federal Metal and Nonmetal Mine Safety Act - 9/16/66.

Federal Power Commission Part 1, Sections 9 and 10 of the Federal Power Act and Part 12 of the Commission's Regulations under the Federal Power Act.

International Boundary and Water Commission Authority by intendment only - Treaty Series 994 (Treaty Between the United States of America and Mexico, February 3, 1944)

Tennessee Valley Authority TVA Code VII, Office of Engineering Design and Construction, March 11, 1965.



9. Are printed regulations and/or instructions relating to safety of dams available to the public? If yes, give title and revision date. Inclose copy if available.

USDA

|                |                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Forest Service | Yes. Forest Service Manual, Title 7500, Water Storage and Transmission. Instructions are kept current - latest revision is November 1970. Regions add supplement as required. |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                           |     |
|---------------------------|-----|
| Soil Conservation Service | N/A |
|---------------------------|-----|

Corps of Engineers

|             |                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------|
| Civil Works | Yes. ER 1110-2-100, Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures, 26 February 1973. |
|-------------|--------------------------------------------------------------------------------------------------------------------------|

|                        |                                                                                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Regulatory Functions 0 | Only those regulations pertaining to the processing of an application are available - 33 CFR Part 209.120 published in the Federal Register on 3 April 1974. |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

USDI

|                          |    |
|--------------------------|----|
| Bureau of Indian Affairs | No |
|--------------------------|----|

|                           |    |
|---------------------------|----|
| Bureau of Land Management | No |
|---------------------------|----|

|                       |                                                     |
|-----------------------|-----------------------------------------------------|
| Bureau of Reclamation | Yes. Application parts of Reclamation Instructions. |
|-----------------------|-----------------------------------------------------|

|                                        |    |
|----------------------------------------|----|
| Bureau of Sport Fisheries and Wildlife | No |
|----------------------------------------|----|

|                   |    |
|-------------------|----|
| Geological Survey | No |
|-------------------|----|

|                                              |                                                                                                                                                                           |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mining Enforcement and Safety Administration | Yes. 30 CFR 1.1 Chapter 1, Subchapter N, Part 55, Section 55.20-10 and Part 57, Section 57.20-10. 30 CFR 1.1 Chapter I, Subchapter I, Part 77, Subpart C, Section 77.216. |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                          |    |
|--------------------------|----|
| Federal Power Commission | No |
|--------------------------|----|

|                                             |    |
|---------------------------------------------|----|
| International Boundary and Water Commission | No |
|---------------------------------------------|----|

|                            |    |
|----------------------------|----|
| Tennessee Valley Authority | No |
|----------------------------|----|

10. Please state any limitations or exceptions, as to size, type, capacity, off-stream location of dams (or reservoirs) subject to supervision.

USDA

Forest Service                      Not Answered.

Soil Conservation Service           N/A

Corps of Engineers

Civil Works                      None. Corps of Engineers Civil Works structures whose failure or partial failure would endanger the lives of the public or cause substantial property damage are continuously evaluated to insure their structural safety and stability, and operational adequacy.

Regulatory Functions              Section 9 of the River and Harbor Act of 1899 prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the waterbody lie wholly within the limits of a single State, the structure may be built under authority of the legislature of that State if the location and plans or any modification thereof are approved by the Chief of Engineers and by the Secretary of the Army.

USDI

Bureau of Indian Affairs           None

Bureau of Land Management        None

Bureau of Reclamation            None

Bureau of Sport Fisheries and  
Wildlife                              None

Geological Survey                  Our concern is for impoundments on Federal or Indian lands leased under various Mineral Leasing Acts. No limitations or exceptions specified in laws or regulations administered.

Mining Enforcement and Safety  
Administration                      None

10. (Continued)

Federal Power Commission

There is no limitation as to size or capacity of a project if the Commission has jurisdiction and has issued a license. The Commission has jurisdiction if the project: (1) Utilizes surplus water from a Government dam; (2) Occupies public lands or reservoirs; (3) Is located on a navigable stream; and (4) if the energy is transmitted across State lines, thus affecting interstate commerce.

International Boundary and Water  
Commission

Locations limited to limitrophe sections of international streams on United States - Mexico border. No limitations as to size, type or capacity.

Tennessee Valley Authority .

None

11. Are special agencies, such as irrigation districts, cities, etc., exempt from your inspection requirements? If so, specify.

USDA

Forest Service

Yes. Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, Federal Power Commission and approved cooperators.

Soil Conservation Service

N/A

Corps of Engineers

Civil Works

No. For those projects constructed by the Corps of Engineers and then operated by others, the operating entity is informed of inspection and observations considered appropriate and arrangements made for Corps of Engineers participation. However, the responsibility for inspection and observations is that of the operating entity.

Regulatory Functions

Yes. The Federal Power Act of 1920, as amended, authorizes the Federal Power Commission (FPC) to issue licenses for the construction, operation and maintenance of dams, water conduits, reservoirs, powerhouses, transmission lines, and other physical structures of the power project. A separate permit under Section 9 of the River and Harbor Act of 1899 is not required for licenses issued by the FPC.

USDI

Bureau of Indian Affairs

No

Bureau of Land Management

Yes. No inspection requirements for other agencies.

Bureau of Reclamation

No

Bureau of Sport Fisheries and Wildlife

Yes. Only dams on lands controlled by this agency are subject to inspection.

11. (Continued)

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Geological Survey                            | N/A. Such agencies are not mineral lease holders.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Mining Enforcement and Safety Administration | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Federal Power Commission                     | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| International Boundary and Water Commission  | Yes. That nothing contained in the treaty or protocol shall be construed as authorizing the Secretary of State of the United States, the Commissioner of the United States Section of the International Boundary and Water Commission, or the United States Section of said Commission directly or indirectly to alter or control the distribution of water to users within the territorial limits of any of the individual States. (Paragraph 8, Section "C" - Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande-Treaty Between The United States of America and Mexico-February 3, 1944) |
| Tennessee Valley Authority                   | No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



12. Under the regulations of your agency, please give definition of "Height of Dam" and "Reservoir Capacity."

USDA

Forest Service

Height of Dam - The maximum vertical dimension of the dam, measured through the dam centerline, above the elevation of the natural streambed. Design Reservoir Stage - The highest elevation of the water surface in the reservoir determined by routing the emergency spillway design hydrograph through the reservoir.

Soil Conservation Service

Not defined by regulation, but the height is generally considered to be the difference in elevation between the settled top of the fill and the lowest point of the natural ground on the centerline of the dam. The reservoir capacity is considered to be the original capacity of the reservoir at the elevation of the crest of the uncontrolled emergency spillway.

Corps of Engineers

Civil Works

Height of earth dams is from riverbed to top of embankment. Height of concrete dams is from lowest point of foundation to top of dam exclusive of parapet or other projections. Reservoir capacity is the space available to store water up to the "normal full pool" level as established to accomplish functional objectives; surcharge storage above the "normal full pool" level during major floods is not included in design storage capacity figures.

Regulatory Functions

None

12. (Continued)

USDI

|                                              |                                                                                                                                                                                                                                                                                                |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Indian Affairs                     | <u>Height of Dam</u> - Difference in elevation between top of dam and toe of downstream slope. <u>Reservoir Capacity</u> - Amount of water impounded at maximum water storage elevation.                                                                                                       |
| Bureau of Land Management                    | <u>Height of Dam</u> - Measured from lowest centerline elevation prior to construction to top (crest) of dam. <u>Reservoir Capacity</u> - Capacity to reservoir high-water line when emergency spillway is flowing at design depth.                                                            |
| Bureau of Reclamation                        | <u>Structural height</u> is vertical distance between the lowest point in foundation and nominal crest of dam. <u>Reservoir capacity</u> is total reservoir storage to highest controlled water storage.                                                                                       |
| Bureau of Sport Fisheries and Wildlife       | <u>Height of Dam</u> - Vertical distance from low point of original channel to top of dam. <u>Reservoir Capacity</u> - Volume in acre-feet measured to spillway crest for uncontrolled or top of freeboard if controlled.                                                                      |
| Geological Survey                            | No regulations.                                                                                                                                                                                                                                                                                |
| Mining Enforcement and Safety Administration | None                                                                                                                                                                                                                                                                                           |
| Federal Power Commission                     | <u>Height of dam</u> is considered to be the vertical distance from the lowest elevation of the natural streambed at the downstream toe to the maximum water storage elevation under zero flow condition. <u>Gross storage capacity</u> is the maximum possible water impounded at zero spill. |

12. (Continued)

International Boundary and Water  
Commission

3  
4

Height of Dam - Vertical distance  
from streambed to crest. Reservoir  
Capacity - Total capacity consist-  
ing of silt retention, conserva-  
tion storage and flood control  
capacities.

Tennessee Valley Authority

Height of dam is from foundation  
on axis to deck level. Reservoir  
capacity is volume of reservoir  
when water is at maximum level.

13. What approvals are required to commence construction of dam.

USDA

|                |                                                     |
|----------------|-----------------------------------------------------|
| Forest Service | Varies according to hazard, size and qualification. |
|----------------|-----------------------------------------------------|

|                           |                                                                                                                           |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Soil Conservation Service | Compliance with State and local regulations and project agreement for operation and maintenance signed by local sponsors. |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------|

Corps of Engineers

|             |                                                                                                                                                                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Civil Works | Project must be authorized and funds appropriated by Congress. It is required that major features of design be approved by the Division Engineer and Office of the Chief of Engineers. Final plans and specifications must be approved by the Division Engineer. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Regulatory Functions | Section 9 of the River and Harbor Act of 1899 prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the waterbody be wholly within the limits of a single State, the structure may be built under authority of the legislature of that State, if the location and plans or any modification thereof are approved by the Chief of Engineers and the Secretary of the Army. |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

USDI

|                          |                                                               |
|--------------------------|---------------------------------------------------------------|
| Bureau of Indian Affairs | Approval of landowners, Bureau, Department, EPA and Congress. |
|--------------------------|---------------------------------------------------------------|

13. (Continued)

|                                              |                                                                                                                                                                                                                                                                                         |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Land Management                    | Only internal approval required if Bureau of Land Management constructed on Bureau of Land Management land. Others require approval of a withdrawal (Bureau of Reclamation or Corps of Engineers) or a right of way, special land use permit, or Section 4 (Taylor Grazing Act) permit. |
| Bureau of Reclamation                        | Regional Directors, Engineering and Research Center, and Commissioner of the Bureau of Reclamation; Secretary of Interior; appropriate State offices; other Federal agencies having direct interests and responsibilities; Office of Management and Budget; and the Congress.           |
| Bureau of Sport Fisheries and Wildlife       | <u>Federal</u> : Fish and Wildlife Service, Washington, D.C.; Corps of Engineers if placed on waterways or navigable waters. <u>State</u> : Various agencies having dam control and/or water appropriation or rights laws.                                                              |
| Geological Survey                            | Included in approval of mining operating plan by Mining Supervisor.                                                                                                                                                                                                                     |
| Mining Enforcement and Safety Administration | None                                                                                                                                                                                                                                                                                    |
| Federal Power Commission                     | A license by FPC which requires the licensee's compliance with all applicable State laws.                                                                                                                                                                                               |
| International Boundary and Water Commission  | Approval of the United States and Mexican governments.                                                                                                                                                                                                                                  |
| Tennessee Valley Authority                   | Governmental.                                                                                                                                                                                                                                                                           |



14. Do you inspect dams other than those constructed or owned by your agency?

USDA

Forest Service

Yes. Those under permit or Department of the Interior easement.

Soil Conservation Service

No

Corps of Engineers

Civil Works

Yes. Where ownership of major elements of a project is divided between the Corps of Engineers and other organizations. The Corps of Engineers inspects those features of the non-Corps elements that would endanger the stability, safety or operation of the Corps-owned portion of the project. The Corps of Engineers has no specific responsibility for the adequacy of non-Federal dams. However, where appropriate representatives of the Corps office concerned visit the non-Federal project to ascertain whether the Federal interest in flood control would be involved by the suspected dam, in collaboration with the State, to offer such assistance to the owner of the project as may be necessary.

Regulatory Functions

No. Other than to insure that proper techniques are being applied on dams authorized by Section 9 of the River and Harbor Act of 1899.

USDI

Bureau of Indian Affairs

No (with the exception of Fort Peck Dam in Montana).

Bureau of Land Management

No, except when constructed under a Section 4 permit. These would be inspected for conformity to the specifications and for stipulations of the permit.

14. (Continued)

|                                              |                                                                                                                                                                                                                                             |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Reclamation                        | Yes. Dams financed under Reclamation loan programs; dams for which we are responsible through special arrangements for rehabilitation, operation and ownership; and, when requested, dams for other agencies of the Department of Interior. |
| Bureau of Sport Fisheries and Wildlife       | Yes. Dams constructed by other agencies which are funded by Fish and Wildlife Federal Aid Programs.                                                                                                                                         |
| Geological Survey                            | Yes. Inspection is made only of dams on mineral leases.                                                                                                                                                                                     |
| Mining Enforcement and Safety Administration | Yes, as a regular part of mine inspection.                                                                                                                                                                                                  |
| Federal Power Commission                     | All dams that are licensed by FPC or have application for license pending are inspected.                                                                                                                                                    |
| International Boundary and Water Commission  | No                                                                                                                                                                                                                                          |
| Tennessee Valley Authority                   | No                                                                                                                                                                                                                                          |

15. Upon completion of a dam, is there a requirement for the issuance of a certificate or other authorization before commencement of storage in a reservoir?

USDA

|                           |     |
|---------------------------|-----|
| Forest Service            | Yes |
| Soil Conservation Service | N/A |

Corps of Engineers

|                      |    |
|----------------------|----|
| Civil Works          | No |
| Regulatory Functions | No |

USDI

|                                              |     |
|----------------------------------------------|-----|
| Bureau of Indian Affairs                     | No  |
| Bureau of Land Management                    | No  |
| Bureau of Reclamation                        | Yes |
| Bureau of Sport Fisheries and Wildlife       | Yes |
| Geological Survey                            | No  |
| Mining Enforcement and Safety Administration | No  |

|                          |                                                                                              |
|--------------------------|----------------------------------------------------------------------------------------------|
| Federal Power Commission | No. On specific projects, authorization is required before initial filling of the reservoir. |
|--------------------------|----------------------------------------------------------------------------------------------|

|                                             |    |
|---------------------------------------------|----|
| International Boundary and Water Commission | No |
|---------------------------------------------|----|

|                            |     |
|----------------------------|-----|
| Tennessee Valley Authority | No. |
|----------------------------|-----|

16. Is there any requirement for periodic renewal of certificate or other authorization to continue a dam in service? If yes, for what period.

USDA

Forest Service No

Soil Conservation Service N/A

Corps of Engineers

Civil Works No

Regulatory Functions No. However, any permit issued will contain stipulations as to proper maintenance and operation.

USDI

Bureau of Indian Affairs No

Bureau of Land Management No

Bureau of Reclamation Yes. The condition of dams are examined biennially (triennially for a few) to determine condition and safety of dam.

Bureau of Sport Fisheries and Wildlife no

Geological Survey No

Mining Enforcement and Safety Administration No

Federal Power Commission Yes. License period is limited to a maximum of 50 years by the Federal Power Act.

International Boundary and Water Commission No

Tennessee Valley Authority No

17. Is special authority required for enlargement, modification or repair of dam? If yes, under what circumstances?

USDA

Forest Service

Yes. Enlargement and modification would require additional consideration and evaluation. Repairs would require no additional authority.

Soil Conservation Service

Yes. Any dam constructed with SCS cost-sharing must have SCS concurrence for enlargement or modification.

Corps of Engineers

Civil Works

Yes. Enlargement or major modification must be authorized by Congress. Authority for modification invested in Division Engineer and Office of the Chief of Engineers. Final plans and specifications must be approved by Division Engineer.

Regulatory Functions

Yes. Any change would require separate authorization in the form of an amendment to the original permit.

USDI

Bureau of Indian Affairs

Yes. For major changes approval of landowners, Bureau, Department, EPA and Congress required.

Bureau of Land Management

No

Bureau of Reclamation

Yes. Authorization is required from Bureau supervisory offices, and from Secretary of Interior, Office of Management and Budget, and the Congress.

Bureau of Sport Fisheries and  
Wildlife

Yes. Contract work in excess of \$10,000 requires Washington Fish and Wildlife approval. In some States where water rights control agencies and adjudications administered by local courts.



17. (Continued)

|                                              |                                                                                                                                                                                                                   |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Geological Survey                            | Yes. Mining Supervisor must grant approval.                                                                                                                                                                       |
| Mining Enforcement and Safety Administration | No                                                                                                                                                                                                                |
| Federal Power Commission                     | Yes. Except under emergency conditions, no substantial alteration shall be made without approval by the Commission and those under emergency conditions are subject to modification as the Commission may direct. |
| International Boundary and Water Commission  | Yes. Congressional authority and concurrence of Mexico is required for enlargement or modification. None required for nominal maintenance repairs.                                                                |
| Tennessee Valley Authority                   | No                                                                                                                                                                                                                |

18. Is on-site inspection provided by your agency during construction?

USDA

Forest Service Yes

Soil Conservation Service Yes

Corps of Engineers

Civil Works Yes

Regulatory Functions Yes. Periodic inspections are made to insure that permit conditions are being met.

USDI

Bureau of Indian Affairs Yes

Bureau of Land Management Yes. Only when constructed by Bureau of Land Management.

Bureau of Reclamation Yes

Bureau of Sport Fisheries and Wildlife Yes

Geological Survey Yes

Mining Enforcement and Safety Administration Yes

Federal Power Commission Yes

International Boundary and Water Commission Yes

Tennessee Valley Authority Yes

19. Are there any requirements for record keeping during construction and operation of such dam or reservoir? If yes, what type of record is required and what data is recorded?

USDA

Forest Service

Yes. (1) Forest Service project reports include location and description, comments on drawings and specifications, construction organization and methods, unusual conditions, actual costs, time required, and recommendations. (2) Daily inspection diary and a record of changes for as built drawings. Two copies of as built drawings furnished Forest Service.

Soil Conservation Service

Yes. Job diary, test reports, as-built plans and documentary photographs during construction.

Corps of Engineers

Civil Works

Yes. During construction: (a) construction reports, daily or for larger period; (b) test report on concrete, soils, etc. and (c) inspection reports. During operation: (a) Reservoir operating data, including reservoir levels, discharges, etc.; (b) Piezometric and settlement measurements for earth dams; (c) Deflection, uplift, temperature, strain measurement for high concrete dams; and (d) Unusual behavior such as seepage, junctioning of dams, etc.

Regulatory Functions

Yes. Limited to progress reports.

USDI

Bureau of Indian Affairs

Yes. During construction reports are required of contractor and inspector covering labor, materials, progress and compliance with specifications. Operational data required for irrigation structures is storage (quantity) and elevation by date.

19. (Continued)

|                                              |                                                                                                                                                                                                                                             |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Land Management                    | Yes. Complete project and contract files including test records and a contract log (Bureau construction only). No requirements for other agencies.                                                                                          |
| Bureau of Reclamation                        | Yes. Periodic records of: construction progress, quality control, and conditions; reservoir inflow, storage and outflow; structure conditions, maintenance and behavior.                                                                    |
| Bureau of Sport Fisheries and Wildlife       | Yes. Daily Construction Reports (log) - concrete tests, compaction, moisture, content, etc. Monthly Construction Reports - percent complete and dollar value. Monthly stream and reservoir gauge records. Annual water programs.            |
| Geological Survey                            | No                                                                                                                                                                                                                                          |
| Mining Enforcement and Safety Administration | Yes. Coal - If failure of a dam will create a hazard, the operator is required to inspect weekly and maintain inspection records. Non-Coal - If failure will create hazard, dam operator must inspect at regular intervals.                 |
| Federal Power Commission                     | Yes. To develop the legitimate cost of the project, unit quantities and costs are required except for State and municipal projects. Generation, plant data, such as hydraulic capacity, operating head, etc. are required for all projects. |
| International Boundary and Water Commission  | Yes. During construction, daily inspection records of construction performance and procedures are made. Operation - daily, weekly and monthly records of operational performance are kept.                                                  |

19. (Continued)

Tennessee Valley Authority

Yes. Complete construction records on methods, materials, and testing are kept for final published technical report. Operating records include daily headwater and tailwater elevations, inflow and discharge.



20. What is done with data accumulated?

USDA

Forest Service

Used for administration, operating and maintenance of the structure and operation of the reservoir.

Soil Conservation Service

Retained until disposed of in accordance with an established disposal schedule. Important information retained indefinitely at Federal Records Center, and copies are provided to local sponsors.

Corps of Engineers

Civil Works

Retained in District office or at dam site.

Regulatory Functions

Data becomes part of permit file maintained at U.S. Army Engineer District office.

USDI

Bureau of Indian Affairs

Used to determine compliance with law and specifications, and to pay contractors and consultants. Operational data is used to determine irrigation water supply.

Bureau of Land Management

Filed in field office responsible for operating and maintaining the structure.

Bureau of Reclamation

Data are compiled, summarized, documented, reviewed, and permanently filed.

Bureau of Sport Fisheries and Wildlife

Filed for use of water user agencies.

Geological Survey

Any data received is filed after study.

Mining Enforcement and Safety Administration

Data is reviewed by inspector for any evidence of instability.

20. (Continued)

Federal Power Commission

The data after review and evaluation by the Commission staff, is used in the preparation of various reports, such as costs of construction and operation and total power generation.

International Boundary and Water  
Commission

Data carefully analyzed, progressive during construction, and filed for future reference. Operation - records are reviewed and filed for reference.

Tennessee Valley Authority

Operating data are published annually.

21. Are periodic inspections for safety purposes made after completion of dam? If yes, is there a definite schedule of inspections? If so, explain.

USDA

Forest Service

Yes. All dams on National Forest lands are inspected. The schedule of inspection is dependent upon many factors and opportunities.

Soil Conservation Service

Responsibility of sponsors. Operation and maintenance agreement requires annual and special inspection by sponsor.

Corps of Engineers

Civil Works

Yes. Initial inspection upon completion of construction, second inspection made during reservoir filling with subsequent inspections made at one-year intervals for next two-year intervals for the following four years, then extended to each five years if warranted by the results of the previous inspections.

Regulatory Functions

No

USDI

Bureau of Indian Affairs

Yes. Inspections should be programmed at least once every two years.

Bureau of Land Management

Yes. For BLM constructed dams only. All detention dams are required to be inspected at least annually and after high intensity storms. Small retention structures are required to be inspected at a 3-year minimum interval.

Bureau of Reclamation

Yes. Examined by Reclamation Regional personnel at 2 or 3 year intervals. Joint examination with Engineering and Research Center representatives at 6 year intervals.

Bureau of Sport Fisheries and  
Wildlife

Yes. No definite schedule.

21. (Continued)

USDI (continued)

|                                              |                                                                                                                                                                                                                                                    |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Geological Survey                            | Yes. No definite schedule of inspections. Dams are inspected in connection with inspection of mining operations periodically.                                                                                                                      |
| Mining Enforcement and Safety Administration | Yes. Coal - four times a year. Non-Coal - one time a year.                                                                                                                                                                                         |
| Federal Power Commission                     | Yes. Inspections are made annually by FPC staff on all but smaller projects. Inspections are made every 5 years by qualified independent consultants engaged by the licensee if the project is subject to Part 12 of the Commission's Regulations. |
| International Boundary and Water Commission  | Yes. In accordance with operation and maintenance schedules.                                                                                                                                                                                       |
| Tennessee Valley Authority                   | Yes. At least every five years, more often when conditions indicate necessity.                                                                                                                                                                     |

22. Who does the inspection and at whose expense?

USDA

|                           |                                                                                            |
|---------------------------|--------------------------------------------------------------------------------------------|
| Forest Service            | Qualified personnel at the expense of the Federal Government.                              |
| Soil Conservation Service | Local sponsors - their expense. SCS participates for the first 3 years after construction. |

Corps of Engineers

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Civil Works | Inspection teams consist of individuals qualified by experience in the planning, design, construction, and operation of the project, and individuals with appropriate specialized knowledge in structural, mechanical, electrical, hydraulic and embankment design; geology; soil mechanics; concrete materials; and construction procedures. The District programs the funds for the periodic inspection and evaluation of the structures scheduled in each fiscal year. |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |     |
|----------------------|-----|
| Regulatory Functions | N/A |
|----------------------|-----|

USDI

|                                              |                                                                                                                                                              |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Indian Affairs                     | Bureau of Indian Affairs Area personnel, and on request Bureau of Reclamation or Corps of Engineers - at BIA expense.                                        |
| Bureau of Land Management                    | BLM personnel at BLM expense.                                                                                                                                |
| Bureau of Reclamation                        | Qualified engineers of the Bureau of Reclamation examine the dams at Government expense.                                                                     |
| Bureau of Sport Fisheries and Wildlife       | Regional engineers at Fish and Wildlife expense through Operation and Maintenance.                                                                           |
| Geological Survey                            | Mining supervisor or engineer under his supervisor during regular inspection of mining operations. The inspections are made at Federal Government's expense. |
| Mining Enforcement and Safety Administration | Federal mine inspectors at Federal expense.                                                                                                                  |



22. (Continued)

Federal Power Commission

Inspections under Part 12 of the Commission's Regulations are made by independent consultants engaged and paid by licensee, whereas all other inspections are made by FPC staff. The expense is included in the cost of administering Part 1 of the Federal Power Act. Nearly all of this cost is collected by the FPC.

International Boundary and Water  
Commission

Staff engineers assist the project engineers in periodic inspections and reports. Joint inspections are made with Mexican engineers on a regular basis and periodic joint reports are prepared. Technical advisors and consultants from both United States and Mexico are convened at the request of the Commissioners as need for special advice may arise. Expense is borne by U.S. Section, International Boundary and Water Commission.

Tennessee Valley Authority

TVA design engineers at TVA's expense.

23. Are there any other conditions, for example on complaint, under which inspections are made. If yes, what are these conditions, and to what official is request made?

USDA

Forest Service

Yes. Inspections are made when warranted - weather, earthquakes, fire, etc. Request made to Regional Foresters.

Soil Conservation Service

Yes. If conditions warrant and the sponsor so request, SCS will provide technical assistance in dealing with special operation or maintenance problems.

Corps of Engineers

Civil Works

Yes. District Engineer will investigate and inspect upon any report or complaint.

Regulatory Functions

Yes. In addition to responding to complaints, routine inspections are performed in connection with other duties.

USDI

Bureau of Indian Affairs

Yes. If conditions change during normal checking or emergencies develop, or any public complaint - Request is normally made to Project Engineer or Agency Superintendent or Area Director in charge.

Bureau of Land Management

Yes. Our 63 district offices make additional inspections when warranted due to unusual storms or due to complaints. Requests are made to District Managers.

Bureau of Reclamation

Yes. Upon development of unusual conditions, requests are made to the Regional Director or the Engineering and Research Center for special examinations.

Bureau of Sport Fisheries and  
Wildlife

Yes. Request made to Regional Director.

Geological Survey

Yes, when matters are brought to attention of Mining Supervisor which he determines warrant an inspection.

Mining Enforcement and Safety  
Administration

Yes. The Mining Enforcement and Safety Administration will investigate any complaint from any person concerning safety at mines - MESA maintains a "hot line" in Washington, DC, to receive any complaint.

23. (Continued)

Federal Power Commission

Yes. Special inspections are frequently made following accidents, floods, or complaints regarding almost any aspect of operation of a reservoir. Complaints may be made to the Regional Engineer; Chief, Bureau of Power; Secretary; or Chairman of FPC.

International Boundary and Water  
Commission

Yes. Inspection can be made at any time upon request to International Boundary and Water Commission, U.S. Section-Commissioner J. F. Friedkin.

Tennessee Valley Authority

Yes. When operating or maintenance personnel note unusual conditions, Division of Engineering Design's inspection coordinator is notified.

24. Are there any agency-prescribed requirements for operation and maintenance? Do these include continuous surveillance or monitoring?

USDA

|                |                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Forest Service | Yes. Continuous surveillance or monitoring not required; however, in some instances pool levels and minimum flow requirements are verified. |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|

|                           |                                                                                                                         |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Soil Conservation Service | Yes. Continuous surveillance or monitoring required if deemed essential to insure proper performance and public safety. |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------|

Corps of Engineers

|             |                                                                                                                      |
|-------------|----------------------------------------------------------------------------------------------------------------------|
| Civil Works | Yes. Operation and maintenance manuals prepared for each project. Continuous surveillance required by ER 1110-2-100. |
|-------------|----------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------|
| Regulatory Functions | No. Does not include continuous surveillance or monitoring except those that are developed while processing permit. |
|----------------------|---------------------------------------------------------------------------------------------------------------------|

USDI

|                          |                                                                     |
|--------------------------|---------------------------------------------------------------------|
| Bureau of Indian Affairs | Yes. Some operations require continuous monitoring - others do not. |
|--------------------------|---------------------------------------------------------------------|

|                           |                                                              |
|---------------------------|--------------------------------------------------------------|
| Bureau of Land Management | Yes. Does not include continuous surveillance or monitoring. |
|---------------------------|--------------------------------------------------------------|

|                       |                                                      |
|-----------------------|------------------------------------------------------|
| Bureau of Reclamation | Yes. Includes continuous surveillance or monitoring. |
|-----------------------|------------------------------------------------------|

|                                        |                                                                                                             |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Bureau of Sport Fisheries and Wildlife | No. Does not include continuous surveillance or monitoring, however, 3 Regions do maintenance continuously. |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------|

|                   |    |
|-------------------|----|
| Geological Survey | No |
|-------------------|----|

|                                              |    |
|----------------------------------------------|----|
| Mining Enforcement and Safety Administration | No |
|----------------------------------------------|----|

|                          |                                                                                                                                                                 |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal Power Commission | Yes. Special license requirements may include maximum or minimum releases, rate of flow, water levels, instrumentation to monitor performance of the structure. |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|

24. (Continued)

International Boundary and Water  
Commission

Yes. Includes continuous surveillance  
or monitoring.

Tennessee Valley Authority

Yes. Includes continuous surveillance  
or monitoring.



25. Are written regulations available where dams are operated and maintained by other than agency personnel? Explain.

USDA

Forest Service

Yes. Operational requirements are included in the authorizing instrument.

Soil Conservation Service

Yes. An operation and maintenance agreement for each dam which includes a plan for operation and maintenance by the local sponsors.

Corps of Engineers

Civil Works

Yes. The Flood Control Act of December 1944, Section 7, requires that any storage capacity for flood control and navigation construction by others and paid for from Federal funds will be operated in accordance with regulations prescribed by the Secretary of the Army and published in the Federal Register. Appropriate operation and maintenance manuals are furnished for Corps constructed reservoirs operated by others.

Regulatory Functions

Yes. Regulations may be prescribed for the operation and maintenance of dam to insure minimum flows for navigation, etc.

USDI

Bureau of Indian Affairs

No. We have no dams operated by other than agency personnel to our knowledge.

Bureau of Land Management

N/A. None so operated.

Bureau of Reclamation

Yes. Operating instructions in the forms of Designer's Operating Criteria and/or Standing Operating Procedures are prepared for all storage dams and reservoirs regardless of who operates the dam.

Bureau of Sport Fisheries and  
Wildlife

No

Geological Survey

No

Mining Enforcement and Safety  
Administration

Yes. All regulations are published in the Federal Register and mine operators must comply with them.

25. (Continued)

|                                                |                                        |
|------------------------------------------------|----------------------------------------|
| Federal Power Commission                       | No                                     |
| International Boundary and Water<br>Commission | N/A                                    |
| Tennessee Valley Authority                     | N/A. All TVA dams are operated by TVA. |

26. Is there a requirement that design of any dam under the regulations shall be done by a registered professional engineer?

USDA

Forest Service

No

Soil Conservation Service

Yes. Must comply with State law where dam is located.

Corps of Engineers

Civil Works

No

Regulatory Functions

No. The District Engineer would insure himself that the firm is properly qualified within the State as a matter of practice.

USDI

Bureau of Indian Affairs

No

Bureau of Land Management

No

Bureau of Reclamation

No.

Bureau of Sport Fisheries and  
Wildlife

No

Geological Survey

No

Mining Enforcement and Safety  
Administration

No

Federal Power Commission

No

International Boundary and Water  
Commission

No

Tennessee Valley Authority

No

27. Are there any exemptions to the above requirements? If yes, what are the circumstances?

USDA

Forest Service

No. The design of all dams must be reviewed for adequacy by a qualified engineer.

Soil Conservation Service

Yes. Registration is not required for Federal engineers. However, many SCS personnel at all levels are registered.

Corps of Engineers

Civil Works

No. While most Corps designs are accomplished by registered professional engineers, Corps employees are not required to be registered but must meet U.S. Civil Service Commission requirements.

Regulatory Functions

No

USDI

Bureau of Indian Affairs

Yes. Registered engineers are required for any design performed by consultants.

Bureau of Land Management

No

Bureau of Reclamation

No

Bureau of Sport Fisheries and  
Wildlife

Yes. If dam design is contracted outside the Government. The Federal Government is not subject to State registration laws to needlessly require registration.

Geological Survey

N/A

Mining Enforcement and Safety  
Administration

No

Federal Power Commission

No

International Boundary and Water  
Commission

No

Tennessee Valley Authority

No

28. Are design criteria prescribed by your agency and available in printed form? If yes, give title and date of latest revision or edition of such design criteria document.

USDA

|                |                                                                                         |
|----------------|-----------------------------------------------------------------------------------------|
| Forest Service | Yes. Forest Service Manual, Title 7500 - Water Storage and Transmission, November 1970. |
|----------------|-----------------------------------------------------------------------------------------|

|                           |                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------|
| Soil Conservation Service | Yes. Engineering Memorandum - 27 (Rev.) Supplement 7, February 4, 1972. Engineering Memorandum - 50, May 16, 1963. |
|---------------------------|--------------------------------------------------------------------------------------------------------------------|

Corps of Engineers

|             |                                                                                                           |
|-------------|-----------------------------------------------------------------------------------------------------------|
| Civil Works | Yes. Design criteria printed in a series of Engineering Manuals. Manuals revised and updated as required. |
|-------------|-----------------------------------------------------------------------------------------------------------|

|                      |    |
|----------------------|----|
| Regulatory Functions | No |
|----------------------|----|

USDI

|                          |                                                                                        |
|--------------------------|----------------------------------------------------------------------------------------|
| Bureau of Indian Affairs | Yes. Soil Conservation National Engineering Handbook, Bureau of Reclamation Standards. |
|--------------------------|----------------------------------------------------------------------------------------|

|                           |                                                                                                                                     |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Land Management | Yes. Was available when BLM was constructing a significant number of dams. New manual prescribing design criteria is in draft form. |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                                                                                                                                                                                                                                               |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Reclamation | Yes. Reclamation's Instructions Parts 131, 132, and 133; Design of Small Dams, Second Edition, 1973; Design Standards No. 2, Concrete Dams; Earth Manual, First Edition Revised, 1968; and Concrete Manual, Seventh Edition, 1963; and numerous other documents related to specific problems. |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                        |    |
|----------------------------------------|----|
| Bureau of Sport Fisheries and Wildlife | No |
|----------------------------------------|----|

|                   |    |
|-------------------|----|
| Geological Survey | No |
|-------------------|----|

|                                              |    |
|----------------------------------------------|----|
| Mining Enforcement and Safety Administration | No |
|----------------------------------------------|----|

|                          |    |
|--------------------------|----|
| Federal Power Commission | No |
|--------------------------|----|



28. (Continued)

International Boundary and Water  
Commission

Yes. Design criteria for specific projects are jointly adopted by International Boundary Water Commission, United States and Mexico, and are prepared by the design agency. The Commission has no general design manual.

Tennessee Valley Authority

Yes. General design criteria are given in Technical Report No. 24, Volume 1, Civil and Structural Design, of Hydro Plants, dated 1960. In addition, detailed design criteria for each project are prepared, using modern accepted criteria.

29. Are plans and designs reviewed by any authority outside your agency in preliminary form?

USDA

|                |                                                      |
|----------------|------------------------------------------------------|
| Forest Service | Yes. Depends upon State law -- If required by State. |
|----------------|------------------------------------------------------|

|                           |                                                                           |
|---------------------------|---------------------------------------------------------------------------|
| Soil Conservation Service | No. Not required by SCS but always furnished if other agencies want them. |
|---------------------------|---------------------------------------------------------------------------|

Corps of Engineers

|             |    |
|-------------|----|
| Civil Works | No |
|-------------|----|

|                      |    |
|----------------------|----|
| Regulatory Functions | No |
|----------------------|----|

USDI

|                          |     |
|--------------------------|-----|
| Bureau of Indian Affairs | Yes |
|--------------------------|-----|

|                           |    |
|---------------------------|----|
| Bureau of Land Management | No |
|---------------------------|----|

|                       |    |
|-----------------------|----|
| Bureau of Reclamation | No |
|-----------------------|----|

|                                        |     |
|----------------------------------------|-----|
| Bureau of Sport Fisheries and Wildlife | Yes |
|----------------------------------------|-----|

|                   |    |
|-------------------|----|
| Geological Survey | No |
|-------------------|----|

|                                              |    |
|----------------------------------------------|----|
| Mining Enforcement and Safety Administration | No |
|----------------------------------------------|----|

|                          |     |
|--------------------------|-----|
| Federal Power Commission | Yes |
|--------------------------|-----|

|                                             |     |
|---------------------------------------------|-----|
| International Boundary and Water Commission | Yes |
|---------------------------------------------|-----|

|                            |    |
|----------------------------|----|
| Tennessee Valley Authority | No |
|----------------------------|----|

30. Are contract plans and specifications reviewed by any authority outside of your agency?

USDA

Forest Service No

Soil Conservation Service Yes. When required by State or local law or when integrated into a plan involving other Federal agencies.

Corps of Engineers

Civil Works No

Regulatory Functions No

USDI

Bureau of Indian Affairs Yes

Bureau of Land Management No

Bureau of Reclamation No

Bureau of Sport Fisheries and Wildlife Yes

Geological Survey No

Mining Enforcement and Safety Administration No

Federal Power Commission No

International Boundary and Water Commission Yes

Tennessee Valley Authority No

31. Is there a requirement that final as-constructed drawings be filed with any other agency?

USDA

|                           |                         |
|---------------------------|-------------------------|
| Forest Service            | No                      |
| Soil Conservation Service | No. No SCS requirement. |

Corps of Engineers

|                      |    |
|----------------------|----|
| Civil Works          | No |
| Regulatory Functions | No |

USDI

|                                              |     |
|----------------------------------------------|-----|
| Bureau of Indian Affairs                     | Yes |
| Bureau of Land Management                    | No  |
| Bureau of Reclamation                        | No  |
| Bureau of Sport Fisheries and Wildlife       | No  |
| Geological Survey                            | No  |
| Mining Enforcement and Safety Administration | No  |

|                          |                                                                |
|--------------------------|----------------------------------------------------------------|
| Federal Power Commission | Yes. Only if changes are made in plans as originally approved. |
|--------------------------|----------------------------------------------------------------|

|                                             |     |
|---------------------------------------------|-----|
| International Boundary and Water Commission | Yes |
|---------------------------------------------|-----|

|                            |    |
|----------------------------|----|
| Tennessee Valley Authority | No |
|----------------------------|----|

32. Are dam designs including spillway capacities, required to meet specific criteria relating to special hazards such as floods, earthquakes, or location above densely populated areas? If yes, explain.

USDA

Forest Service

Yes. Spillways are designed using SCS or Bureau of Reclamation formulas. The extent of investigation is governed by the size of the dam, its location and purpose.

Soil Conservation Service

Yes. Hazard classification establishes hydrologic design criteria. Other special hazards such as earthquakes also considered in the design.

Corps of Engineers

Civil Works

Yes. Dams in regions subject to moderate or severe earthquakes are required to be designed to withstand earthquake forces. Spillways, freeboard, and related features are designed to avoid possible failure of the dam from overtopping or other causes where this would cause dangerous flood waves downstream, under maximum probable flood conditions.

Regulatory Functions

Yes. The design of a dam will be reviewed to insure that the structure is designed to meet local conditions.

USDI

Bureau of Indian Affairs

Yes. Where Department of Agriculture participate with funding, structures must meet their design criteria. Bureau of Reclamation standards apply when they are asked to participate.

Bureau of Land Management

No. Not under the criteria used in the past as few such sites existed under BLM jurisdiction. New criteria will include adequate provisions. However, it appears BLM will not again be involved in any significant dam construction program.



32. (Continued)

USDI

Bureau of Reclamation

Yes. Dam height and spillway capacity are sized to provide for safe passage of inflow design flood. Dams are designed to be safe during occurrence of maximum credible earthquake.

Bureau of Sport Fisheries  
and Wildlife

No. Not in the form of standard written directive. However, Bureau engineers design dams to meet flood hazards in the 25, 50 and 100 year occurrences, depending on downstream conditions.

Geological Survey

No

Mining Enforcement and Safety  
Administration

No

Federal Power Commission

Yes. In licensing a project the staff makes a safety and adequacy evaluation of the project for the Commission for their consideration in determining whether the project is best adapted to a comprehensive plan for development of the waterway.

International Boundary and  
Water Commission

Yes. Are required to meet the design criteria jointly adopted by the two Sections of the Commission.

Tennessee Valley Authority

Yes. Spillway capacity and top elevation determined by the maximum probable and maximum possible flood using transposable rains as determined by the National Weather Service Earthquake design load considered at susceptible sites.

33. Is there a requirement for geologic, soils, and hydrologic data to be filed with drawings?

USDA :

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Forest Service | The amount of preliminary investigation is dependent upon the size, hazard, etc. |
|----------------|----------------------------------------------------------------------------------|

|                           |     |
|---------------------------|-----|
| Soil Conservation Service | Yes |
|---------------------------|-----|

Corps of Engineers

|             |                                                                     |
|-------------|---------------------------------------------------------------------|
| Civil Works | Yes. All are filed either with the drawings or in separate reports. |
|-------------|---------------------------------------------------------------------|

|                      |     |
|----------------------|-----|
| Regulatory Functions | Yes |
|----------------------|-----|

USDI

|                          |     |
|--------------------------|-----|
| Bureau of Indian Affairs | Yes |
|--------------------------|-----|

|                           |                             |
|---------------------------|-----------------------------|
| Bureau of Land Management | Yes. BLM construction only. |
|---------------------------|-----------------------------|

|                       |     |
|-----------------------|-----|
| Bureau of Reclamation | Yes |
|-----------------------|-----|

|                                        |                                                                                                                                                                                       |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Sport Fisheries and Wildlife | No. Not in a directive. Some States and Corps of Engineers participating projects require this data. If monies are available and the project warrants, the Bureau requests this data. |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                   |    |
|-------------------|----|
| Geological Survey | No |
|-------------------|----|

|                                              |    |
|----------------------------------------------|----|
| Mining Enforcement and Safety Administration | No |
|----------------------------------------------|----|

|                          |                                                                                                                                                                                                                                                                                                                                          |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal Power Commission | Yes. Commission's Regulations require a statement of proposed project operation with respect to water supply, reservoir operating levels, water quality, etc., along with general design drawings, accompanied by sufficient geological and soils information to give full understanding of the project to be filed with the Commission. |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                             |     |
|---------------------------------------------|-----|
| International Boundary and Water Commission | Yes |
|---------------------------------------------|-----|

|                            |     |
|----------------------------|-----|
| Tennessee Valley Authority | Yes |
|----------------------------|-----|

34. Are there any requirements for special instrumentation in interest of dam safety? What kind? Please explain.

USDA

Forest Service

No. Such requirements may be developed during design or review of the plans prior to approval.

Soil Conservation Service

No. Instrumentation required only in cases when such is deemed necessary to assure dam safety.

Corps of Engineers

Civil Works

Yes. During design and construction basic structural safety instrumentation is provided to measure uplift, inflow in drainage system, displacement, deflection, tilting, strains, settlement, pore pressure, seepage and in geographical areas for significant seismic activity the response of the structure to earthquake forces. Whenever during the planning, design, construction or operation of a project physical conditions are encountered or expected to be encountered which would affect the stability of the structure, appropriate instrumentation is provided to detect, measure or observe their effect on the structure.

Regulatory Functions

No. However, special instrumentation may be required as a result of design review.

USDI

Bureau of Indian Affairs

No

Bureau of Land Management

No

Bureau of Reclamation

Yes. Varies with type and size of structure; may include: settlement, deflection, internal and foundation movement, temperature and pressures, seepage and seismic activity.

Bureau of Sport Fisheries  
and Wildlife

No

Geological Survey

No

Mining Enforcement and Safety  
Administration

No

34. (Continued)

Federal Power Commission

Yes. Special instrumentation is required on an ad hoc basis.

International Boundary and  
Water Commission

Yes. In major structures, settlement points, gauges and piezometers and other devices common to these facilities.

Tennessee Valley Authority

Yes. Survey monuments and electronic devices for measuring settlement and deflection, pore pressure meters, strain meters, stress meters, and joint meters. Types and number of instruments depend upon size and type of dam.

USDA

Yes. There are problems but the regulations and instructions are adequate.

Yes. SCS is not a regulatory agency but the technical and administrative requirements for the planning, design, construction and operation and maintenance are adequate.

Yes

No. Adoption of similar procedures for Inspection of Project Works With Respect to Safety of Structures are used by the Federal Power Commission.

Yes

No. Decentralization will require instructions to be issued as guidelines to the field offices responsible for issuing permit, rights of way, etc. to other agencies and individuals for dam construction to assure adequate safety standards.

Yes. Regulations are reviewed and revised as necessary.

No. There are no specific regulations concerning design, installation, operation or maintenance of any structure within the Bureau. Such funding should be adopted.

We have no regulations specifically applicable to dam construction and safety.

No

Yes

Yes

Yes



36. Are there any active plans under consideration to modify existing regulations? If so, what?

USDA

Forest Service                      Yes. To update authorities and correct inappropriate or outdated references.

Soil Conservation Service              Yes. Continuous consideration is given to changes that will keep programs current with developing technology and public priorities.

Corps of Engineers

Civil Works                              No

Regulatory Functions                      No. However, requirement for periodic inspection by permits and other requirements are under consideration.

USDI

Bureau of Indian Affairs              No

Bureau of Land Management              No

Bureau of Reclamation                      Yes. This is a continuing activity.

Bureau of Sport Fisheries  
and Wildlife                              No

Geological Survey                              No

Mining Enforcement and  
Safety Administration                      Yes. New regulations are being developed requiring submission of plans and safety certification for approval of MESA. Regulations will cover existing dams and new dams.

Federal Power Commission              No

International Boundary and  
Water Commission                              No

Tennessee Valley Authority              Yes. Design flood and earthquakes requirements are under review.

37. What is the approximate annual budget for the current fiscal year to the office and staff directly related to dam and reservoir supervision? In dollars? In man-years?

|                                                                                                                                                                                            | <u>In Dollars</u> | <u>In Man-Years</u> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------|
| USDA                                                                                                                                                                                       |                   |                     |
| Forest Service      Not Answered                                                                                                                                                           | --                | --                  |
| Soil Conservation Service      N/A                                                                                                                                                         | --                | --                  |
| Corps of Engineers                                                                                                                                                                         |                   |                     |
| Civil Works                                                                                                                                                                                | \$3,330,000       | 168.0               |
| Regulatory Functions      Not Identifiable                                                                                                                                                 | --                | --                  |
| USDI                                                                                                                                                                                       |                   |                     |
| Bureau of Indian Affairs                                                                                                                                                                   | \$2,500           | 0.24                |
| Bureau of Land Management                                                                                                                                                                  | None              | --                  |
| Bureau of Reclamation                                                                                                                                                                      | \$700,000*        | 30.0                |
| *Estimate includes Regional Offices and Engineering and Research Center; in addition, large but undetermined amounts of time and money are expended by project personnel on this activity. |                   |                     |
| Bureau of Sport Fisheries and Wildlife                                                                                                                                                     | -0-               | -0-                 |
| Geological Survey      No Budget                                                                                                                                                           | --                | --                  |
| Mining Enforcement and Safety Administration                                                                                                                                               | Not separable     | Not separable       |
| Federal Power Commission                                                                                                                                                                   | \$719,00          | 30.0                |
| These figures do not include the manpower or costs of processing applications or requests for modification of existing licenses.                                                           |                   |                     |
| International Boundary and Water Commission                                                                                                                                                | \$666,000         | 55.0                |
| Tennessee Valley Authority                                                                                                                                                                 | \$200,000         | 11.0                |

38. What is your agency's policy with respect to dams now in operation which were constructed prior to present requirements?

USDA

Forest Service                      All dams are inspected to assure adequacy.

Soil Conservation Service          This responsibility rests with local authorities.

Corps of Engineers

Civil Works                          All completed Civil Works projects whose failure or partial failure would endanger the levees of the public or cause substantial property damage are included in the inspection and evaluation program.

Regulatory Functions              The permittee has the responsibility to insure that the dam is maintained in a safe condition.

USDI

Bureau of Indian Affairs          We use them within their design capacities, with operations regulated to use outlet works rather than spillways. We comply with the laws and apply the best known Operation and Maintenance safety practices and procedures.

Bureau of Land Management        Inspect those having loss of life or property damage potential to insure adequate safety precautions taken and that adequate maintenance is performed within budgetary constraints.

Bureau of Reclamation            To review all such dams on basis of present criteria and technology and provide improvements as determined necessary.

Bureau of Sport Fisheries  
and Wildlife                          There is no direct Operation and Maintenance funding for dams or other storage related structures. Repair and/or inspections are made randomly, on complaint, or in an emergency basis if funds are available.

Geological Survey                  N/A

Mining Enforcement and  
Safety Administration              All dams are covered by regulations with no distinction made between new dams and those constructed prior to present requirements.

38. (Continued)

Federal Power Commission

No project licensed by the Commission should pose a hazard to life or property. If a project is judged to be hazardous, corrective action will be required of the licensee.

International Boundary and  
Water Commission

Dams constructed prior to 1953 are relatively small diversion structures. These structures are nonetheless frequently inspected as well as the major structures more recently built.

Tennessee Valley Authority

Old dams are to be strengthened and spillway capacities increased to meet present day TVA criteria.

39. Where construction and/or performance records are missing or inadequate, does your agency require field investigations and stability analysis to now be undertaken? If yes, explain.

USDA

|                           |     |
|---------------------------|-----|
| Forest Service            | No  |
| Soil Conservation Service | N/A |

Corps of Engineers

|                      |                                                                                                                                                                                                                                 |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Civil Works          | Yes. Stability of principal concrete and earth-work is reviewed based upon current criteria where the original design criteria were less conservative. Where needed, supplemental field exploration and analysis are performed. |
| Regulatory Functions | No                                                                                                                                                                                                                              |

USDI

|                                              |                                                                                                                                                                          |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bureau of Indian Affairs                     | Yes. We have requested studies and recommendations from outside agencies when necessary.                                                                                 |
| Bureau of Land Management                    | No. Left to the judgment of the district engineer and would depend upon actual field conditions.                                                                         |
| Bureau of Reclamation                        | Yes. As necessary to complete the reviews and investigations all such dams on basis of present criteria and technology and provide improvements as determined necessary. |
| Bureau of Sport Fisheries and Wildlife       | No. No funding available.                                                                                                                                                |
| Geological Survey                            | No                                                                                                                                                                       |
| Mining Enforcement and Safety Administration | No                                                                                                                                                                       |
| Federal Power Commission                     | Yes. Under Part 12 of the Commission's Regulations.                                                                                                                      |



International Boundary and  
Water Commission

--A complete file of detail construction records is available for all class under supervision of this agency, and a complete file of detailed performance records compiled since the beginning of the period of operation and each structure is also available.

Tennessee Valley Authority

Yes. On old dams purchased by TVA, investigations and stability analyses have been or are being made to determine their condition and safety.

#### 40. General Remarks

##### USDA

###### Forest Service

We have several dams (over one thousand) on National Forest lands which have structural deficiencies. Most of these dams were built by other, i.e. miners, cattlemen, etc., and have been abandoned. Some are sizeable structures, and though they are usually in remote areas, they do pose a threat to life and property. We are not adequately financed to do a thorough job of inspection including the necessary monitoring to determine more precisely, the structural condition. We have grossly inadequate financing for any needed repair work.

###### Soil Conservation Service

SCS is not a regulatory agency, therefore many of the above questions are not applicable.

##### Corps of Engineers

###### Civil Works

--

###### Regulatory Functions

--

##### USDI

###### Bureau of Indian Affairs

--

###### Bureau of Land Management

No BLM dams have gated outlet works and all dams reported here are generally small and barely meet the criteria for inclusion. Our dam construction program is currently at a standstill and it is unlikely that this status will change in the foreseeable future. Supervision is not necessary for BLM's structures except as a part of the overall maintenance program. We cannot identify the extent of funding and manpower devoted to supervision.

###### Bureau of Reclamation

--

###### Bureau of Sport Fisheries and Wildlife

--

###### Geological Survey

--

40. (Continued)

USDI

Mining Enforcement and  
Safety Administration

Bureau of Reclamation personnel have been providing MESA with technical assistance in evaluating the hazard potential of coal waste dams, recommending corrective measures, and reviewing plans for rehabilitation of existing dams and construction of new dams submitted by coal mine operators.

Federal Power Commission

--

International Boundary and  
Water Commission

--

Tennessee Valley Authority .

TVA utilizes the services of consulting engineers to evaluate major engineering decisions made by TVA during the design, construction and maintenance of its major dams.









**United States Committee On Large Dams  
of the  
International Commission On Large Dams**

**MODEL LAW  
FOR  
STATE SUPERVISION OF SAFETY  
OF  
DAMS AND RESERVOIRS**



This model law was prepared  
by the  
Committee on Model Legislation  
for Safety of Dams

Alfred R. Golzé, Chairman  
Nicholas L. Barbarossa  
L. Rees Brooks  
Wallace L. Chadwick  
Charles F. Corns  
Clifford J. Cortright  
Arthur P. Geuss  
Thomas G. Harton  
Clifford H. McConnell  
T. W. Mermel  
Karl V. Taylor  
M. Frank Thomas  
Philip C. Rutledge

Published by United States Committee on Large Dams

Reproduction in whole or in part is authorized  
provided proper credit is given to the United  
States Committee on Large Dams

Additional copies may be obtained at \$2.00 per  
copy from the United States Committee on Large  
Dams, 343 East 47th Street, New York, N.Y. 10017

## INTRODUCTION

### The United States Committee on Large Dams of the

### International Commission on Large Dams

has prepared as a public service for consideration of the Governors and Legislatures of the fifty States of the United States this Model Law for State Supervision of Safety of Dams and Reservoirs.

The objective of the Model Law is safety; protection of areas below a dam from the consequences of a failure of a dam and/or untimely release of its reservoir contents. Design and construction of a dam requires the highest degree of professional engineering performance. The foundation of the dam must be stable under all conditions and capable of carrying the weight of the structure. The dam must impound its reservoir water without undue strain and be safe under the application of external forces such as those resulting from earthquakes. The reservoir area must be water-retentive and free of the possibilities of dangerous slides. Dams and associated facilities must be maintained in excellent condition throughout their life. Operation and surveillance through the years must be conducted in such a manner that any change in the structure of the dam, including its foundation, can be detected promptly and corrections made. If abandoned at any time the dam must be removed or breached to eliminate any hazard to downstream areas. This Model Law provides a guide for states who wish to provide regulations to supervise these elements essential to safe dams and reservoirs.

In developing this Model Law advantage was taken of the forty years of experience with the California statutes enacted in

1929 following the failure of the St. Francis Dam with a heavy loss of life and major property damage. The original draft was prepared by a distinguished nationwide committee of professional engineers, experts in the design, construction and management of safe dams and reservoirs. It was submitted in draft form to the Governors of all fifty States for comment. Their comments and those of their staffs are reflected in this Model Law.

This Model Law has not been prepared with the expectation that it would be adopted without change by any state. Changes to meet constitutional and legal requirements, the organizational structure, and the financial system of the several states is to be expected. Supervision of dams in Federal ownership have been omitted from jurisdiction as the consent of Congress would be necessary to such supervision. In this connection see *Arizona v. California*, 283 U.S. 423.

Some states may prefer to put some of the requirements into administrative or technical rules or regulations rather than into the statute itself to provide more flexibility. Experience has shown that incorporation in the basic law removes the requirements from possible frequent changes by a succession of administrators. The definition of a dam subject to jurisdiction (Sect. 1002) is expected to vary, state by state, to meet each state's individual need. The fee schedule requirement (Chapter 6) likewise is optional by states. It is not intended to be of such magnitude as to make the supervision program self-supporting.



## TABLE OF CONTENTS

|                                                                                 | <u>Sections</u> |
|---------------------------------------------------------------------------------|-----------------|
| SUPERVISION OF SAFETY OF DAMS AND RESERVOIRS                                    | 1000-1210       |
| Chapter 1.    Definitions                                                       | 1000-1010       |
| Chapter 2.    General Provisions                                                | 1025-1033       |
| Chapter 3.    Administrative Provisions                                         | 1050-1052       |
| Chapter 4.    Powers of the Agency                                              | 1075-1085       |
| Article 1. Powers in General                                                    | 1075-1080       |
| 2. Investigations and Studies                                                   | 1081-1082       |
| 3. Action and Procedure to<br>Restrain Violations                               | 1083-1085       |
| Chapter 5.    Applications                                                      | 1100-1118       |
| Article 1. New Dams and Reservoirs or<br>Enlargements of Dams and<br>Reservoirs | 1100-1105       |
| 2. Repairs, Alterations, or<br>Removals                                         | 1106-1111       |
| 3. Approval of Applications                                                     | 1112-1118       |
| Chapter 6.    Fees                                                              | 1125-1133       |
| Chapter 7.    Inspection and Approval                                           | 1150-1173       |
| Article 1. New or Enlarged Dams and<br>Reservoirs                               | 1150-1152       |
| 2. Certificates of Approval                                                     | 1153-1155       |
| 3. Repaired or Altered Dams and<br>Reservoirs                                   | 1156-1158       |
| 4. Removal of Dams and Reservoirs                                               | 1159-1161       |
| 5. Complaints as to Unsafe<br>Conditions                                        | 1162-1165       |
| 6. Inspection During Progress of<br>Work                                        | 1166-1173       |
| Chapter 8.    Maintenance, Operation and<br>Emergency Work                      | 1174-1180       |
| Article 1. Maintenance and Operation                                            | 1174-1176       |
| 2. Emergency Work                                                               | 1177-1180       |

|                                                                                           | <u>Sections</u> |
|-------------------------------------------------------------------------------------------|-----------------|
| Chapter 9. Offenses and Punishment                                                        | 1185-1187       |
| Chapter 10. Dams and Reservoirs Existing<br>Prior to the Effective Date<br>of this Law    | 1200-1210       |
| Article 1. Dams and Reservoirs Completed<br>Prior to Effective Date of<br>this Law        | 1200-1206       |
| 2. Dams and Reservoirs Under<br>Construction Before Effective<br>Date of this Law         | 1207-1209       |
| 3. Fees for Dams or Reservoirs<br>Under Construction Before<br>Effective Date of this Law | 1210            |

MODEL LAW  
FOR  
STATE SUPERVISION OF SAFETY OF DAMS AND RESERVOIRS

Chapter 1. Definitions

1000. Unless the context otherwise requires, the definitions in this chapter govern the construction of this Act.

1001. "Agency" means that Agency, Department, Office, or other unit of State Government designated by State law to be responsible for implementation or direction of this Act. (This section to be replaced in enactment of the law by a reference to the State unit created or selected to implement and direct the Act which may be regular State employees or specialists and consultants, including consulting engineering firms or organizations, for any or all of the provisions of this Act.)

1002. Jurisdiction applies to any artificial barrier, herein called a "dam", including appurtenant works, which does or will impound or divert water, and which (a) is or will be 25 feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the dam, or from the lowest elevation of the outside limit of the dam, if it is not across a stream channel or watercourse, to the maximum water storage elevation or (b) has or will have an impounding capacity at maximum water storage elevation of 50 acre-feet or more.

1003. No obstruction in a canal used to raise or lower water therein shall be considered a dam. A fill or structure for highway or railroad use or for any other purpose, which does or may impound water, shall be subject to review by the Agency

and shall be considered a dam if the criteria of Section 1002 are found applicable.

1004. "Reservoir" means any basin which contains or will contain impounded water.

1005. "Owner" includes any of the following who own, control, operate, maintain, manage, or propose to construct a dam or reservoir:

(a) The State and its Departments, institutions, agencies, and political subdivisions.

(b) Every municipal or quasi-municipal corporation.

(c) Every public utility.

(d) Every district.

(e) Every person.

(f) The duly authorized agents, lessees, or trustees of any of the foregoing.

(g) Receivers or trustees appointed by any court for any of the foregoing.

"Owner" does not include any agency of the United States Government, including those who operate and maintain dams owned by the United States.

"Person" means any person, firm, association, organization, partnership, business trust, corporation, or company.

1006. "Alterations", "repairs", or either of them, mean only such alterations or repairs as may directly affect the safety of the dam or reservoir, as determined by the Agency.

1007. "Enlargement" means any change in or addition to

an existing dam or reservoir, which raises or may raise the water storage elevation of the water impounded by the dam.

1008. "Water storage elevation" means the maximum elevation of water surface which can be obtained by the dam or reservoir without encroaching on the approved freeboard at maximum design flood.

1009. "Days" used in establishing deadlines, means calendar days, including Sundays and holidays.

1010. "Appurtenant works" include, but are not limited to, such structures as spillways, either in the dam or separate therefrom; the reservoir and its rim; low level outlet works; and water conduits such as tunnels, pipelines or penstocks, either through the dam or its abutments.

## Chapter 2. General Provisions

1025. It is the intent of the Legislature by this Act to provide for the regulation and supervision of all dams and reservoirs exclusively by the State to the extent required for the protection of public safety.

1026. No city or county has authority, by ordinance enacted by the legislative body thereof or adopted by the people under the initiative power, or otherwise, to regulate, supervise, or provide for the regulation or supervision of any dams or reservoirs in this State, or the construction, maintenance, operation, or removal or abandonment thereof, nor to limit the size of dam or reservoir or the amount of water which may be stored therein, where such authority would conflict with the



powers and authority vested in the Agency by this Act. This Act shall not prevent a city or county from adopting ordinances regulating, supervising, or providing for the regulation or supervision of dams and reservoirs that (a) are not within the State's jurisdiction, (b) are not subject to regulation by another public agency or body, or apply only to appurtenances such as roads and fences not germane to the safety of the structure.

1027. All plans and specifications for initial construction, enlargement, alteration, repair or removal of dams and supervision of construction shall be in charge of a civil engineer, licensed by this State, experienced in dam design and construction, assisted by qualified engineering geologists and other specialists when necessary.

1028. No action shall be brought against the State or the Agency or its agents or employees for the recovery of damages caused by the partial or total failure of any dam or reservoir or through the operation of any dam or reservoir upon the ground that such defendant is liable by virtue of any of the following:

- (a) The approval of the dam or reservoir, or approval of flood handling plans during construction.

- (b) The issuance or enforcement of orders relative to maintenance or operation of the dam or reservoir.

- (c) Control and regulation of the dam or reservoir.

- (d) Measures taken to protect against failure during an emergency.

1029. Nothing in this Act shall be construed to relieve an owner or operator of a dam or reservoir of the legal duties,

obligations, or liabilities incident to the ownership or operation of the dam or reservoir.

1030. The findings and orders of the Agency and the certificate of approval of any dam or reservoir issued by the State are final and conclusive and binding upon all owners, and State agencies, regulatory or otherwise, as to the safety of design, construction, maintenance, and operation of any dam or reservoir.

1031. Nothing in this Act shall be construed to deprive any owner of such recourse to the courts as he may be entitled to under the laws of this State.

1032. All records of official actions of the Agency and its correspondence pertaining to the supervision of dams and reservoirs are public documents.

1033. All owners shall notify the Agency of any change in ownership of any dam or reservoir subject to this Act at the time the transfer of ownership occurs.

### Chapter 3. Administrative Provisions

1050. The Agency shall be administered and directed by a civil engineer, licensed by this State, experienced in the design and construction of dams and reservoirs, and it shall employ such clerical, engineering, and other assistants as are necessary for carrying on the work of dam and reservoir supervision in accordance with this Act.

1051. When the safety considerations pertaining to a certificate of approval, dam, reservoir, or plans and specifications require it, or when requested in writing to do so by the

owner, the Agency may appoint a consulting board of two or more consultants not previously associated with the structure, to report to the Agency on its proposed action with respect to these considerations.

1052. The cost and expense of a consulting board if appointed on the request of an owner shall be paid by the owner.

#### Chapter 4. Powers of the Agency

##### Article 1. Powers in General

1075. The Agency, under the police power of the State, shall review and approve the design, construction, enlargement, alteration, repair, maintenance, operation, and removal of dams and reservoirs for the protection of life and property as provided in this Act.

1076. All dams and reservoirs in the State are under the jurisdiction of the Agency, except those dams which are Federally owned.

1077. It is unlawful to construct, enlarge, repair, alter, remove, maintain, operate or abandon any dam or reservoir coming within the purview of this Act except upon approval of the Agency, provided that this section shall not be deemed to apply to routine maintenance and operation not affecting the safety of the structure.

1078. The Agency shall adopt and revise from time to time such rules and regulations and issue such general orders as may be necessary for carrying out, but not inconsistent with, the provisions of this Act.

1079. In making any investigation or inspection necessary to enforce or implement this Act, the Agency or its

representatives may enter upon such private property of the dam owner as may be necessary.

1080. In determining whether a dam or reservoir or proposed dam or reservoir constitutes or would constitute a danger to life or property, the Agency shall take into consideration the following conditions, not necessarily all inclusive: the possibility that the dam or reservoir might be endangered by overtopping, seepage, settlement, erosion, cracking, earth movement, earthquakes, failure of bulkheads, flashboard, gates and conduits, which exist or which might occur in any area in the vicinity of the dam or reservoir. Whenever the Agency deems that any conditions endanger a dam or reservoir, it shall order the owner to take such action as necessary to the satisfaction of the Agency to remove the resultant danger to life and property.

## Article 2. Investigations and Studies

1081. For the purpose of enabling it to make decisions as compatible with public safety and economy as possible, the Agency shall make or cause to be made such investigations and shall gather or cause to be gathered such data including advances made in safety practices elsewhere, as may be needed for a proper review and study of the various features of the design, construction, repair and enlargement of dams, reservoir, and appurtenances.

1082. The Agency shall also make or cause to be made from time to time such watershed investigations and studies as may be necessary to keep abreast of developments affecting stream run-off and as required to facilitate its decisions.



Article 3. Action and Procedure to  
Restrain Violations

1083. The Agency may take any legal action proper and necessary for the enforcement of this Act.

1084. An action or proceeding under this article may be commenced whenever any owner or any person acting as a director, officer, agent, or employee of any owner, or any contractor or agent or employee of such contractor is:

(a) Failing or omitting or about to fail or omit to do anything required of him by this Act or by any approval, order, rule, regulation, or requirement of the Agency under the authority of this Act, or

(b) Doing or permitting anything or about to do or permit anything to be done in violation of or contrary to this Act or any approval, order, rule, regulation, or requirement of the Agency under this Act.

1085. Any action or proceeding under this article shall be commenced in a court of appropriate jurisdiction in which (a) the cause or some part thereof arose, (b) the owner or person complained of has its principal place of business, or (c) the person complained of resides.

Chapter 5. Applications

Article 1. New Dams and Reservoirs or Enlargements  
of Dams and Reservoirs

1100. Construction of any new dam or reservoir or the enlargement of any dam or reservoir shall not be commenced until the owner has applied for and obtained from the Agency written approval of plans and specifications.



1101. A separate application for each reservoir and its dams shall be filed with the Agency upon forms to be provided by it.

1102. The application shall give the following information:

(a) The name and address of the owner.

(b) The location, type, size, and height of the proposed dam and reservoir and appurtenant works.

(c) The storage capacity and reservoir surface areas for normal pool and maximum high water.

(d) Plans for proposed permanent instrument installations in the dam.

(e) As accurately as may be readily obtained, the area of the drainage basin, rainfall and streamflow records and flood-flow records and estimates.

(f) Maps and general design drawings showing plans, elevations, and sections of all principal structures and appurtenant works or other features of the project in sufficient detail, including design analyses, to determine safety, adequacy and suitability of design.

(g) Such other pertinent information as the Agency requires, such as proposed time for commencement and completion of construction.

1103. The Agency shall, when in its judgment it is necessary, also require the following:

(a) Data concerning subsoil and rock foundation conditions and the materials entering into construction of the dam or reservoir.

(b) Investigations of, and reports on, subsurface conditions, involving such matters as exploratory pits, trenches and adits, drilling, coring, geophysical surveys, tests to determine leakage rates, and physical tests to measure in place and in the laboratory the properties and behavior of foundation materials at the dam or reservoir site.

(c) Investigations of, and reports on, the geology of the dam or reservoir site and its vicinity, possible geologic hazards, including seismic activity, faults, weak seams and joints, availability and quality of construction materials, and other pertinent features.

(d) Such other appropriate information as may be necessary in a given instance.

1104. In instances wherein the physical conditions involved and the size of the dam or reservoir are such as to render the above requirements as to drainage areas, rainfall, streamflow, floodflow, and drilling or prospecting of site unnecessary, the Agency may waive the requirements.

1105. The application shall set forth the purpose or purposes for which the impounded or diverted water is to be used.

## Article 2. Repairs, Alterations, or Removals

1106. Before commencing the repair, alteration or removal of a dam or reservoir, including the alteration or removal of a dam or reservoir so that it no longer constitutes a dam or reservoir as defined in this Act, the owner shall file an application and secure the written approval of the Agency, except as provided in this article. Repairs shall not be deemed to

apply to routine maintenance and operation not affecting the safety of the structure.

1107. The application shall give such pertinent information or data concerning the dam or reservoir, or both, as may be required by the Agency and such information as to other matters appropriate to a thorough consideration of the safety of such a change as may be required by the Agency.

1108. The application shall state the proposed time of commencement and of completion of remedial construction.

1109. The application shall give the name and address of applicant, shall adequately detail, with appropriate references to the existing dam or reservoir, the changes which it is proposed to effect, and shall be accompanied by maps and plans and specifications which shall be a part of the application and which shall be of such character and size and set forth such pertinent details and dimensions as the Agency may require. The Agency may waive any of the requirements of this section if found by it unnecessary.

1110. In case of an emergency where the Agency declares repairs or breaching of the dam are immediately necessary to safeguard life and property repairs or breaching shall be started immediately by the owner, or by the Agency at the owner's expense, if he fails to do so. The Agency shall be notified at once of proposed emergency repairs or breaching and of work under way when instituted by the owner.

1111. The proposed repairs, breaching and work shall be made to conform to such orders as the Agency issues.

### Article 3. Approval of Applications

1112. Upon receipt of an application the Agency shall give its consideration thereto and shall approve or disapprove the same within the time provided in Section 1114.

1113. If an application is defective, it shall be returned to the applicant for such action as necessary to correct the defects, endorsed so that in order to retain its validity, it must be corrected and returned to the Agency within 30 days or such further time as may be given by the Agency. If the application is not so returned, it shall be rejected.

1114. No applications shall be approved or disapproved in less than 30 days after the receipt of the fee required by Section 1125, but all applications shall be approved or disapproved as soon as practicable thereafter. At the discretion of the Agency hearings may be held on each application.

1115. Approvals shall be granted under terms, conditions, and limitations necessary to safeguard life and property.

1116. Actual construction shall be commenced within one year after date of approval; otherwise the approval becomes void.

1117. The Agency may, upon written application and for good cause shown, extend the time for commencing construction.

1118. Notice shall be given to the Agency at least ten days before construction is to be commenced and such other notices shall be given to the Agency as it may require.



## Chapter 6. Fees

1125. The application for a new dam and reservoir or enlargement shall set forth the estimated net cost, as defined in this chapter, of the dam and reservoir or enlargement and shall be accompanied by a filing fee based upon the estimated cost and according to the following schedule: (Schedule below will of necessity vary in each State.)

(a) For the first one hundred thousand dollars (\$100,000) a fee of 2 percent of the estimated cost.

(b) For the next four hundred thousand dollars (\$400,000) a fee of  $1\frac{1}{2}$  percent.

(c) For the next five hundred thousand dollars (\$500,000) a fee of 1 percent.

(d) For all costs in excess of one million dollars (\$1,000,000) a fee of one-half of 1 percent.

In no case, however, shall the fee be less than one hundred dollars (\$100) or more than fifty thousand dollars (\$50,000).

1126. One fee only shall be collected for an enlargement to be effected by flashboards, sandbags, earthen levees, gates, or other works, devices, or obstructions which are, from time to time, to be removed and replaced or opened and shut and thereby operated so as to vary the surface elevation of the impounded water.

1127. For the purposes of this Act, the estimated net cost of the dam and reservoir or enlargement involved shall include the following:



(a) The cost of all labor and materials entering into the construction of the dam and appurtenant works or reservoir, including right of way.

(b) The cost of preliminary investigations and surveys.

(c) The cost of the construction plant properly chargeable to the cost of the dam or reservoir.

(d) Any and all other items entering directly into the cost of the dam or reservoir.

1128. Excluded from the cost listed in Section 1127 shall be:

(a) Costs of right of way for other than the dam and reservoir.

(b) Detached or underground powerplants, including switchyards and substations.

(c) Electrical generating, or pump-generating machinery.

(d) Roads, railroads, heliports and landing strips affording access to the dam or reservoir.

1129. An application shall not be considered by the Agency until the filing fee is received. All or part of the filing fee may be returned to the applicant only if he withdraws or cancels the application any time prior to the start of construction. The amount of the refund will be determined by the Agency with due regard to funds actually expended by the Agency in consideration of the application.

1130. As soon as possible after giving the notice of completion required in Section 1150, the owner shall file an

affidavit with the Agency stating the actual cost of the dam and reservoir or enlargement thereof in such detail as the Agency requires to determine whether a further fee is due. In the event the owner of a new or enlarged dam or reservoir, because of loss of records, recent change of ownership, or other causes beyond his control, is unable to report the actual cost of construction or enlargement, he shall file an affidavit to this effect, stating the reasons therefor, within thirty days after receiving a written request therefor from the Agency. The Agency shall then make its own appraisal of the cost of construction or enlargement and determine what further fee, if any, is required.

1131. In the event the actual cost exceeds the estimated net cost by more than 15 percent, a further fee shall be required by the Agency computed under the schedule set forth in Section 1125 upon the actual cost, plus a penalty of 15 percent of the actual cost. No further fee shall be required, however, if such fee is to be computed at less than twenty dollars (\$20). Upon making a determination that a further fee is required, the Agency shall notify the owner by certified mail of the amount of such fee and shall notify the owner that he may appear within sixty days thereafter before an authorized representative of the Agency to protest the amount of the fee, in whole or in part, determined by the Agency to be required, and the sufficiency of the appraisal upon which such determination was based.

1132. All filing fees and other charges collected under the provisions of this Act shall be paid into a special fund in the State Treasury immediately after the Agency has certified

as to the correctness of the amounts received, to be available to the Agency for expenditure for the purposes authorized by this Act.

1133. The fees provided for in this article shall be required of all enumerated in the definition of owner in Chapter 1 of this Act.

## Chapter 7. Inspection and Approval

### Article 1. New or Enlarged Dams and Reservoirs

1150. Immediately upon completion of a new dam and reservoir or enlargement of a dam and reservoir the owner shall give a notice of completion to the Agency, and as soon thereafter as possible shall file with the Agency a certificate signed by the responsible engineer supervising construction for the owner, certifying that the project was constructed in conformance with approved plans and specifications, accompanied by supplementary drawings or descriptive matter showing or describing the dam or reservoir as actually constructed, which shall include but not be limited to the following:

(a) A record of all geological boreholes and grout holes and grouting.

(b) A record of permanent location points, benchmarks and instruments embedded in the structure.

(c) A record of tests of concrete or other material used in the construction of the dam and reservoir.

(d) A record of seepage flows and embedded instrument readings.

1151. In connection with the enlargement of a dam and reservoir, the supplementary drawings and descriptive matter need apply only to the new work.

1152. A certificate of approval shall be issued by the Agency upon a finding by the Agency that the dam and reservoir are safe to impound water within the limitations prescribed in the certificate. No water shall be impounded by the structure prior to issuance of the certificate.

## Article 2. Certificates of Approval

1153. Each certificate of approval issued by the Agency under this Act may contain such terms and conditions as the Agency may prescribe.

1154. The Agency may revoke or suspend any certificate of approval whenever it determines that the dam or reservoir constitutes a danger to life and property. Whenever it deems such action necessary to safeguard life and property, the Agency may also amend the terms and conditions of any such certificate by issuing a new certificate containing the revised terms and conditions.

1155. Before any certificate of approval is revoked by the Agency, the Agency shall hold a hearing. Written notice of the time and place of the hearing shall be mailed, at least twenty days prior to the date set for the hearing, to the holder of the certificate. Any interested persons may appear at the hearing and present their views and objections to the proposed action. Any petition to a court of appropriate jurisdiction to



inquire into the validity of action of the Agency revoking a certificate of approval shall be commenced within thirty days after service of notice of the revocation on the holder of the certificate.

Article 3.     Repaired or Altered  
                 Dams and Reservoirs

1156. Immediately upon completion of the repair or alteration of any dam or reservoir, the owner shall give notice of completion to the Agency and as soon thereafter as possible shall file with the Agency a certificate signed by the responsible engineer supervising the work for the owner that the repairs or alterations were completed in accordance with the approved plans and specifications, accompanied by supplementary drawings or descriptive matter showing or describing the dam or reservoir as actually repaired or altered together with such maps, data, records, and information pertaining to the dam or reservoir as repaired or altered as the Agency requires.

1157. A certificate of approval shall be issued by the Agency upon a finding by the Agency that the dam and reservoir are safe to impound water within the limitations prescribed in the certificate. Pending issuance of a new certificate of approval, the owner of the dam or reservoir shall not, through action or inaction, cause the dam or reservoir to impound water beyond the limitations prescribed in the existing certificate.

1158. The certificate of approval shall supersede any previous certificate of approval issued for the dam or reservoir so repaired or altered.



#### Article 4. Removal of Dams and Reservoirs

1159. Upon completion of the removal of a dam or complete drawdown of a reservoir such evidence as to the manner in which the work was performed and as to the conditions obtaining after the removal as the Agency requires shall be filed with the Agency.

1160. This evidence shall show that a sufficient portion of the dam has been removed to permit the safe passage of floods down the watercourse across which the dam was located, within flooding criteria required by the Agency, and that adequate provision has been made by the owner to prevent damage downstream from the remaining portion of the dam by subsequent flooding of downstream areas under such criteria.

1161. Before final approval of the removal of a dam or reservoir is issued, the Agency shall inspect the site of the work and determine that all danger to life and property as a result thereof has been eliminated.

#### Article 5. Complaints as to Unsafe Conditions

1162. Upon receipt of a written complaint alleging that the person or property of the complainant is endangered by the construction, enlargement, repairs, alterations, maintenance, or operation of any dam or reservoir the Agency shall cause an inspection to be made unless the data, records, and inspection reports on file with it are found adequate to make a determination whether the complaint is valid.

1163. If the Agency authorizes an inspection the complainant shall deposit with the Agency a sum estimated by it

to be sufficient to cover costs of the inspection. The Agency may utilize independent consultants of its selection to make the inspection and a report to the Agency.

1164. If it is found that an unsafe condition exists, the Agency shall notify the owner to take such action as is necessary to render or cause the condition to be rendered safe, including breaching or removal of any dam found beyond repair, and any money deposited to secure an inspection shall be returned.

1165. If, after an inspection is made on account of a complaint, the complaint is found by the Agency to have been without merit, the cost therefor shall be payable into the Special Fund in State Treasury from the money deposited, with any excess returned to the complainant. The complainant will be provided with a copy of the official report of the inspection.

#### Article 6. Inspection During Progress of Work

1166. During the construction, enlargement, repair, alteration, or removal of any dam or reservoir the Agency shall make either with its own engineers or by consulting engineers or engineering organizations, periodic inspections at State expense for the purpose of ascertaining compliance with the approved plans and specifications. The Agency shall require the owner to perform at his expense such work or tests as necessary, provide adequate supervision during construction by a civil engineer registered or licensed by the laws of this State, and to disclose information sufficient to enable the Agency to determine that conformity with the approved plans and specifications is being secured.

1167. If, after any inspections, investigations, or examinations, or at any time as the work progresses, or at any time prior to issuance of a certificate of approval it is found by the Agency that amendments, modifications, or changes are necessary to ensure safety, the Agency may order the owner to revise his plans and specifications, provided, however, the owner may, pursuant to Section 1051, request an independent consulting board to review the order of the Agency.

1168. If conditions are revealed which will not permit the construction of a safe dam or reservoir the Agency's approval shall be revoked.

1169. In the event that conditions imposed may be waived or made less burdensome in its judgment without sacrificing safety, the Agency may authorize an owner to revise the plans and specifications accordingly.

1170. If at any time during construction, enlargement, repair, or alterations of any dam or reservoir the Agency finds that the work is not being done in accordance with the provisions of the original approved plans and specifications or in accordance with the approved revised plans and specifications, it shall give a written notice thereof and order compliance by registered mail or by personal service to the owner.

1171. The notice and order shall state the particulars in which the original approved plans and specifications or the approved revised plans and specifications are not being or have not been complied with and shall order the immediate compliance with the original approved plans and specifications or with the

approved revised plans and specifications as the case may be.

1172. The Agency may order that no further work be done until such compliance has been effected and approved by the Agency.

1173. A failure to comply with the approval and approved plans and specifications shall render the approval subject to revocation by the Agency, if compliance is not made in accordance therewith after notice and order from the Agency as provided in this article. If compliance is not forthcoming in a reasonable time, the Agency may order the incomplete structure removed sufficiently to eliminate any safety hazard to life or property.

## Chapter 8. Maintenance, Operation and Emergency Work

### Article 1. Maintenance and Operation

1174. Supervision over the maintenance and operation of dams and reservoirs in this State, other than those owned by the Federal Government, insofar as necessary to safeguard life and property from injury by reason of the failure thereof is vested in the Agency.

1175. The Agency shall require owners or their agents to keep available and in good order records of original and any modification construction and to report annually with respect to maintenance, operation and engineering including piezometric data and geologic investigations. The Agency shall issue such rules and regulations and orders as necessary to secure adequate maintenance, operation and inspection by owners or their agents and shall require engineering and geologic investigations by owners or their agents which will safeguard life and property.



In addition, the owner of a dam or reservoir or his agent shall fully and promptly advise the Agency of any sudden or unprecedented flood or unusual or alarming circumstance or occurrence existing or anticipated which may affect the dam or reservoir.

1176. The Agency, from time to time, but not less often than once every five years, either with its own engineers, or by consulting engineers or engineering organizations, shall make inspections of dams and reservoirs at State expense for the purpose of determining their safety but shall require owners to perform at their expense such work as may reasonably be required to disclose information sufficient to enable the Agency to determine conditions of dams and reservoirs in regard to their safety and to perform at their expense other work which may reasonably be required, including installation of instruments necessary to secure maintenance and operation which will safeguard life and property.

## Article 2. Emergency Work

1177. The Agency shall be responsible for determining that an emergency exists and through normal disaster communication channels shall warn the public, immediately employing any remedial means necessary to protect life and property, if in its judgment either:

(a) The condition of any dam or reservoir is so dangerous to the safety of life or property as not to permit of time for the issuance and enforcement of an order relative to maintenance or operation.

(b) Passing or imminent floods or any other condition which threaten the safety of any dam or reservoir.



1178. In applying the remedial means provided for in this article, the Agency may in emergency with its own forces, or by other means at its disposal, do any of the following:

- (a) Take full charge and control of any dam or reservoir.
- (b) Lower the water level by releasing water from the reservoir.
- (c) Completely empty the reservoir.
- (d) Perform any necessary remedial or protective work at the site.
- (e) Take such other steps as may be essential to safeguard life and property.

1179. The Agency shall continue in full charge and control of such dam or reservoir, or both, and its appurtenances until they are rendered safe or the emergency occasioning the action has ceased and the owner is able to take back such operations. The Agency's take over will not operate to relieve the owner of a dam or reservoir of liability for any negligent acts of the owner or his agents.

1180. The cost and expense of the remedial means provided in this article, including cost of any work done to render a dam or reservoir or its appurtenances safe, shall be collected by presentation of bills to owners in the same manner as other debts to the State are recoverable, provided that if such bills are not promptly paid by the owners the cost shall be recovered by the State from the owner by action brought by the Agency in a court of appropriate jurisdiction.

## Chapter 9. Offenses and Punishment

1185. Every person who violates any of the provisions of this Act or of any approval, order, rule, regulation, or requirement of the Agency is guilty of a misdemeanor and punishable by a fine of not more than \_\_\_\_\_ (\$\_\_\_\_\_) or by imprisonment in \_\_\_\_\_. In the event of a continuing violation each day that the violation continues constitutes a separate and distinct offense.

1186. Any person who wilfully obstructs, hinders, or prevents the Agency or its agents or employees from performing the duties imposed by this Act or who wilfully resists the exercise of the control and supervision conferred by this Act upon the Agency or its agents or employees is guilty of a misdemeanor and punishable as provided in this article.

1187. Any owner or any person acting as a director, officer, agent, or employee of an owner, or any contractor or agent or employee of a contractor who engages in the construction, enlargement, repair, alteration, maintenance, or removal of any dam or reservoir, who knowingly does work or permits work to be executed on the dam or reservoir without an approval or in violation of or contrary to any approval as provided for in this Act, or any inspector, agent, or employee of the Agency who has knowledge of such work being done and who fails to immediately notify the Agency thereof is guilty of a misdemeanor and punishable as provided in this article.

Chapter 10. Dams and Reservoirs Existing Prior to  
the Effective Date of this Law

Article 1. Dams and Reservoirs Completed Prior  
to Effective Date of this Law

1200. Every owner of a dam or reservoir that falls within the definition of a dam or reservoir in this Act that was completed prior to the effective date of this Law shall immediately file an application with the Agency for the approval of such dam or reservoir.

1201. A separate application for each reservoir and its dams shall be filed with the Agency upon forms to be supplied by it and shall include or be accompanied by such appropriate information concerning the dams or reservoir as the Agency requires.

1202. The Agency shall give notice to file an application to owners of such dams or reservoirs who have failed to do so as required by this article, and a failure to file within thirty days after such notice shall be punishable as provided in this Act.

1203. The notice provided for in this article shall be given by certified mail to the owner at his last address of record in the office of the county assessor of the county in which the dam is located and such mailing shall constitute service.

1204. The Agency shall make inspections of such dams or reservoirs at State expense.

1205. The Agency shall require owners of such dams or reservoirs to perform at their expense such work or tests as

may reasonably be required to disclose information sufficient to enable the Agency to determine whether to issue certificates of approval or to issue orders directing further work at the owner's expense necessary to safeguard life and property. For this purpose, the Agency may require an owner to lower the water level of, or to empty, the reservoir.

1206. If, upon inspection or upon completion to the satisfaction of the Agency of all work that may be ordered, the Agency finds that the dam and reservoir are safe to impound water, a certificate of approval shall be issued. The owner of the dam or reservoir shall not, through action or inaction, cause the dam or reservoir to impound water following receipt by the owner of a written notice from the Agency that a certificate will not be issued because the dam or reservoir will not safely impound water. Before such notice is given by the Agency, the Agency shall hold a hearing. Written notice of the time and place of the hearing shall be mailed, at least twenty days prior to the date set for the hearing, to the owner of the dam or reservoir. Any interested persons may appear at the hearing and present their views and objections to the proposed action.

Article 2. Dams and Reservoirs Under  
Construction Before Effective  
Date of this Law

1207. Any dam or reservoir that falls within the definition of a dam or reservoir in this Act and which the Agency finds was under construction and based on its findings not 90 percent constructed on the effective date of this Law



shall, except as provided in Section 1208, be subject to the same provisions in this Act as a dam or reservoir commenced after that date. Every owner of such a dam or reservoir shall file an application with the Agency for the Agency's written approval of the plans and specifications of the dam or reservoir.

1208. Construction work on such a dam or reservoir may proceed, provided an application for approval of the plans and specifications therefor is filed, until a certificate of approval is received by the owner from the Agency approving the dam and reservoir or an order is received by the owner from the Agency specifying how the construction must be performed to render the dam or reservoir safe. After receipt of an order specifying how construction of the dam or reservoir must be performed, work thereafter must be in accordance with the order.

1209.. Such dams or reservoirs as are based on Agency findings 90 percent or more constructed on the effective date of this Law shall be subject to the same supervision as dams or reservoirs which were completed prior thereto.

Article 3. Fees for Dams or Reservoirs Under  
Construction Before Effective Date  
of this Law

1210. The owners of dams or reservoirs that, based on Agency findings, are 90 percent or more constructed on the effective date of this Act and that are subject to the provisions of this Act shall not be required to pay a fee but shall submit an application for approval and issuance of a State certificate as provided in Section 1209. Applications for the approval of dams and reservoirs that are made subject to this



Act that are found by the Agency to have been less than 90 percent constructed on the effective date of this Law shall be accompanied by fees as much less than provided for dams and reservoirs commenced after that date as the percentage of construction found by the Agency to have been completed on that date.

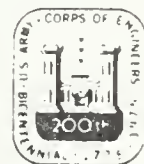






# recommended guidelines for safety inspection of DAMS

DEPARTMENT OF THE ARMY • OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON D C 20314







## PREFACE

The recommended guidelines for the safety inspection of dams were prepared to outline principal factors to be weighed in the determination of existing or potential hazards and to define the scope of activities to be undertaken in the safety inspection of dams. The establishment of rigid criteria or standards is not intended. Safety must be evaluated in the light of peculiarities and local conditions at a particular dam and in recognition of the many factors involved, some of which may not be precisely known. This can only be done by competent, experienced engineering judgement, which the guidelines are intended to supplement and not supplant. The guidelines are intended to be flexible, and the proper flexibility must be achieved through the employment of experienced engineering personnel.

Conditions found during the investigation which do not meet guideline recommendations should be assessed by the investigator as to their import from the standpoint of the involved degree of risk. Many deviations will not compromise project safety and the investigator is expected to identify them in this manner if that is the case. Others will involve various degrees of risk, the proper evaluation of which will afford a basis for priority of subsequent attention and possible remedial action.

The guidelines present procedures for investigating and evaluating existing conditions for the purpose of identifying deficiencies and hazardous conditions. The two phases of investigation outlined in the guidelines are expected to accomplish only this and do not encompass in scope the engineering which will be required to perform the design studies for corrective modification work.

It is recognized that some States may have established or will adopt inspection criteria incongruous in some respects with these guidelines. In such instances assessments of project safety should recognize the State's requirements as well as guideline recommendations.

The guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers. In reviewing two drafts of the guidelines they have contributed many helpful suggestions. Their contributions are deeply appreciated and have made it possible to evolve a document representing a consensus of the engineering fraternity. As experience is gained with use of the guidelines, suggestions for future revisions will be generated. All such suggestions should be directed to the Chief of Engineers, U.S. Army, DAEN-CWE-D, Washington, D.C. 20314.

RECOMMENDED GUIDELINES FOR  
SAFETY INSPECTION OF DAMS

TABLE OF CONTENTS

| <u>Paragraph</u> |                                                 | <u>Page</u> |
|------------------|-------------------------------------------------|-------------|
|                  | PREFACE                                         | D-3         |
|                  | CHAPTER 1 - INTRODUCTION                        |             |
| 1.1              | Purpose                                         | D-7         |
| 1.2              | Applicability                                   | D-7         |
| 1.3              | Authority                                       | D-7         |
|                  | CHAPTER 2 - GENERAL REQUIREMENTS                |             |
| 2.1              | Classification of Dams                          | D-8         |
| 2.1.1            | Size                                            | D-8         |
| 2.1.2            | Hazard Potential                                | D-8         |
| 2.2              | Selection of Dams to be Investigated            | D-9         |
| 2.3              | Technical Investigations                        | D-9         |
| 2.4              | Qualifications of Investigators                 | D-10        |
| 2.5              | Reports                                         | D-10        |
|                  | CHAPTER 3 - PHASE I INVESTIGATION               |             |
| 3.1              | Purpose                                         | D-11        |
| 3.2              | Scope                                           | D-11        |
| 3.3              | Engineering Data                                | D-11        |
| 3.4              | Field Inspections                               | D-11        |
| 3.5              | Evaluation of Hydraulic and Hydrologic Features | D-12        |
| 3.5.1            | Design Data                                     | D-12        |
| 3.5.2            | Experience Data                                 | D-13        |
| 3.6              | Evaluation of Structural Stability              | D-14        |
| 3.6.1            | Design and Construction Data                    | D-14        |
| 3.6.2            | Operating Records                               | D-14        |
| 3.6.3            | Post Construction Changes                       | D-15        |
| 3.6.4            | Seismic Stability                               | D-15        |

## CHAPTER 4 - PHASE II INVESTIGATION

|           |                                                |      |
|-----------|------------------------------------------------|------|
| 4.1       | Purpose                                        | D-16 |
| 4.2       | Scope                                          | D-16 |
| 4.3       | Hydraulic and Hydrologic Analysis              | D-16 |
| 4.3.1     | Maximum water Surface Based on SDF Peak Inflow | D-16 |
| 4.3.1.1   | Peak for 100 Year Flood                        | D-16 |
| 4.3.1.2   | Peak for PMF or Fraction thereof               | D-16 |
| 4.3.2     | Maximum Water Surface Based on SDF Hydrograph  | D-17 |
| 4.3.3     | Acceptable Procedures                          | D-17 |
| 4.3.4     | Freeboard Allowances                           | D-18 |
| 4.4       | Stability Investigations                       | D-18 |
| 4.4.1     | Foundation and Material Investigations         | D-18 |
| 4.4.2     | Stability Assessment                           | D-18 |
| 4.4.2.1   | Seismic Stability                              | D-19 |
| 4.4.2.2   | Clay Shale Foundation                          | D-19 |
| 4.4.3     | Embankment Dams                                | D-20 |
| 4.4.3.1   | Liquefaction                                   | D-20 |
| 4.4.3.2   | Shear Failure                                  | D-20 |
| 4.4.3.3   | Loading Conditions                             | D-20 |
| 4.4.3.4   | Safety Factors                                 | D-21 |
| 4.4.3.5   | Seepage Failure                                | D-22 |
| 4.4.3.6   | Seepage Analyses                               | D-23 |
| 4.4.4     | Concrete Dams and Appurtenant Structures       | D-23 |
| 4.4.4.1   | Requirements for Stability                     | D-23 |
| 4.4.4.2   | Loads                                          | D-24 |
| 4.4.4.3   | Stresses                                       | D-24 |
| 4.4.4.4   | Overturning                                    | D-24 |
| 4.4.4.5   | Sliding                                        | D-24 |
| 4.4.4.5.1 | Sliding Resistance                             | D-25 |
| 4.4.4.5.2 | Downstream Resistance                          | D-26 |
| 4.4.4.5.3 | Safety Factor                                  | D-26 |

## CHAPTER 5 - REPORTS

|       |                       |      |
|-------|-----------------------|------|
| 5.1   | General               | D-28 |
| 5.2   | Preparation of Report | D-28 |
| 5.2.1 | Phase I Reports       | D-28 |
| 5.2.2 | Phase II Reports      | D-29 |

TABLES

|         |                                     |      |
|---------|-------------------------------------|------|
| TABLE 1 | Size Classification                 | D-8  |
| TABLE 2 | Hazard Potential Classification     | D-9  |
| TABLE 3 | Hydrologic Evaluation Guidelines    | D-12 |
| TABLE 4 | Factors of Safety (Embankment Dams) | D-21 |

FIGURES

|          |                                                    |      |
|----------|----------------------------------------------------|------|
| Figure 1 | Seismic Zone Map of Contiguous States              | D-30 |
| Figure 2 | Seismic Zone Map of California, Nevada and Arizona | D-31 |
| Figure 3 | Seismic Zone Map of Alaska                         | D-32 |
| Figure 4 | Seismic Zone Map of Hawaii                         | D-33 |
| Figure 5 | Design Envelope for Case I (Table 4)               | D-34 |
| Figure 6 | Design Envelope for Cases II and III (Table 4)     | D-34 |

APPENDIXES

|              |                  |      |
|--------------|------------------|------|
| Appendix I   | Engineering Data | D-35 |
| Appendix II  | Inspection Items | D-39 |
| Appendix III | P.L. 92-367      | D-45 |



# RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS

## CHAPTER 1 - INTRODUCTION

1.1. Purpose. This document provides recommended guidelines for the inspection and evaluation of dams to determine if they constitute hazards to human life or property.

1.2. Applicability. The procedures and guidelines outlined in this document apply to the inspection and evaluation of all dams as defined in the National Dam Inspection Act, Public Law 92-367. Included in this program are all artificial barriers together with appurtenant works which impound or divert water and which (1) are twenty-five feet or more in height or (2) have an impounding capacity of fifty acre-feet or more. Not included are barriers which are six feet or less in height, regardless of storage capacity, or barriers which have a storage capacity at maximum water storage elevation of fifteen acre-feet or less regardless of height.

1.3. Authority. The Dam Inspection Act, Public Law 92-367 (Appendix III), authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. The Chief of Engineers issues these guidelines pursuant to that authority.

## CHAPTER 2 - GENERAL REQUIREMENTS

2.1. Classification of Dams. Dams should be classified in accordance with size and hazard potential in order to formulate a priority basis for selecting dams to be included in the inspection program and also to provide compatibility between guideline requirements and involved risks. When possible the initial classifications should be based upon information listed in the National Inventory of Dams with respect to size, impoundment capacity and hazard potential. It may be necessary to reclassify dams when additional information becomes available.

2.1.1. Size. The classification for size based on the height of the dam and storage capacity should be in accordance with Table 1. The height of the dam is established with respect to the maximum storage potential measured from the natural bed of the stream or watercourse at the downstream toe of the barrier, or if it is not across a stream or watercourse, the height from the lowest elevation of the outside limit of the barrier, to the maximum water storage elevation. For the purpose of determining project size, the maximum storage elevation may be considered equal to the top of dam elevation. Size classification may be determined by either storage or height, whichever gives the larger size category.

TABLE 1

### SIZE CLASSIFICATION

| <u>Category</u> | <u>Impoundment</u>                |                              |
|-----------------|-----------------------------------|------------------------------|
|                 | <u>Storage (Ac-Ft)</u>            | <u>Height (Ft)</u>           |
| Small           | $< 1000 \text{ and } \geq 50$     | $< 40 \text{ and } \geq 25$  |
| Intermediate    | $\geq 1000 \text{ and } < 50,000$ | $\geq 40 \text{ and } < 100$ |
| Large           | $\geq 50,000$                     | $\geq 100$                   |

2.1.2. Hazard Potential. The classification for potential hazards should be in accordance with Table 2. The hazards pertain to potential loss of human life or property damage in the area downstream of the dam in event of failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Significant hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads

or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads.

TABLE 2

HAZARD POTENTIAL CLASSIFICATION

| <u>Category</u> | <u>Loss of Life</u><br>(Extent of Development)                                        | <u>Economic Loss</u><br>(Extent of Development)               |
|-----------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Low             | None expected (No permanent structures for human habitation)                          | Minimal (Undeveloped to occasional structures or agriculture) |
| Significant     | Few (No urban developments and no more than a small number of inhabitable structures) | Appreciable (Notable agriculture, industry or structures)     |
| High            | More than few                                                                         | Excessive (Extensive community, industry or agriculture)      |

2.2. Selection of Dams to be Investigated. The selection of dams to be investigated should be based upon an assessment of existing developments in flood hazard areas. Those dams possessing a hazard potential classified high or significant as indicated in Table 2 should be given first and second priorities, respectively, in the inspection program. Inspection priorities within each category may be developed from a consideration of factors such as size classification and age of the dam, the population size in the downstream flood area, and potential developments anticipated in flood hazard areas.

2.3. Technical Investigations. A detailed, systematic, technical inspection and evaluation should be made of each dam selected for investigation in which the hydraulic and hydrologic capabilities, structural stability and operational adequacy of project features are analyzed and evaluated to determine if the dam constitutes a danger to human life or property. The investigation should vary in scope and completeness depending upon the availability and suitability of engineering data, the validity of design assumptions and analyses and the condition of the dam. The minimum investigation will be designated Phase I, and an in-depth investigation designated Phase II should be

made where deemed necessary. Phase I investigations should consist of a visual inspection of the dam, abutments and critical appurtenant structures, and a review of readily available engineering data. It is not intended to perform costly explorations or analyses during Phase I. Phase II investigations should consist of all additional engineering investigations and analyses found necessary by results of the Phase I investigation.

2.4. Qualifications of Investigators. The technical investigations should be conducted under the direction of licensed professional engineers experienced in the investigation, design, construction and operation of dams, applying the disciplines of hydrologic, hydraulic, soils and structural engineering and engineering geology. All field inspections should be conducted by qualified engineers, engineering geologists and other specialists, including experts on mechanical and electrical operation of gates and controls, knowledgeable in the investigation, design, construction and operation of dams.



## CHAPTER 3 - PHASE I INVESTIGATION

3.1. Purpose. The primary purpose of the Phase I investigation program is to identify expeditiously those dams which may pose hazards to human life or property.

3.2. Scope. The Phase I investigation will develop an assessment of the general condition with respect to safety of the project based upon available data and a visual inspection, determine any need for emergency measures and conclude if additional studies, investigation and analyses are necessary and warranted. A review will be made of pertinent existing and available engineering data relative to the design, construction and operation of the dam and appurtenant structures, including electrical and mechanical operating equipment and measurements from inspection and performance instruments and devices; and a detailed systematic visual inspection will be performed of those features relating to the stability and operational adequacy of the project. Based upon findings of the review of engineering data and the visual inspection, an evaluation will be made of the general condition of the dam, including where possible the assessment of the hydraulic and hydrologic capabilities and the structural stability.

3.3. Engineering Data. To the extent feasible the engineering data listed in Appendix I relating to the design, construction and operation of the dam and appurtenant structures, should be collected from existing records and reviewed to aid in evaluating the adequacy of hydraulic and hydrologic capabilities and stability of the dam. Where the necessary engineering data are unavailable, inadequate or invalid, a listing should be made of those specific additional data deemed necessary by the engineer in charge of the investigation and included in the Phase I report.

3.4. Field Inspections. The field inspection of the dam, appurtenant structures, reservoir area, and downstream channel in the vicinity of the dam should be conducted in a systematic manner to minimize the possibility of any significant feature being overlooked. A detailed checklist should be developed and followed for each dam inspected to document the examination of each significant structural and hydraulic feature including electrical and mechanical equipment for operation of the control facilities that affect the safety of the dam.

3.4.1. Particular attention should be given to detecting evidence of leakage, erosion, seepage, slope instability, undue settlement, displacement, tilting, cracking, deterioration, and improper functioning of drains and relief wells. The adequacy and quality of maintenance and



operating procedures as they pertain to the safety of the dam and operation of the control facilities should also be assessed.

3.4.2. Photographs and drawings should be used freely to record conditions in order to minimize descriptions.

3.4.3. The field inspection should include appropriate features and items, including but not limited to those listed in Appendix II, which may influence the safety of the dam or indicate potential hazards to human life or property.

### 3.5. Evaluation of Hydraulic and Hydrologic Features.

3.5.1. Design Data. Original hydraulic and hydrologic design assumptions obtained from the project records should be assessed to determine their acceptability in evaluating the safety of the dam. All constraints on water control such as blocked entrances, restrictions on operation of spillway and outlet gates, inadequate energy dissipators or restrictive channel conditions, significant reduction in reservoir capacity by sediment deposits and other factors should be considered in evaluating the validity of discharge ratings, storage capacity, hydrographs, routings and regulation plan. The discharge capacity and/or storage capacity should be capable of safely handling the recommended spillway design flood for the size and hazard potential classification of the dam as indicated in Table 3. The hydraulic and hydrologic determinations for design as obtained from project records will be acceptable if conventional techniques similar to the procedures outlined in paragraph 4.3. were used in obtaining the data. When the project design flood actually used exceeds the recommended spillway design flood, from Table 3, the project design flood will be acceptable in evaluating the safety of the dam.

TABLE 3

#### HYDROLOGIC EVALUATION GUIDELINES

##### RECOMMENDED SPILLWAY DESIGN FLOODS

| <u>Hazard</u> | <u>Size</u>  | <u>*Spillway Design Flood (SDF)</u> |
|---------------|--------------|-------------------------------------|
| Low           | Small        | 50 to 100-yr freq                   |
|               | Intermediate | 100-yr to 1/2 PMF                   |
|               | Large        | 1/2 PMF to PMF                      |
| Significant   | Small        | 100-yr to 1/2 PMF                   |
|               | Intermediate | 1/2 PMF to PMF                      |
|               | Large        | PMF                                 |

(TABLE 3 Continued on next page)

(TABLE 3 Continued)

| <u>Hazard</u> | <u>Size</u>  | <u>*Spillway Design Flood (SDF)</u> |
|---------------|--------------|-------------------------------------|
| High          | Small        | 1/2 PMF to PMF                      |
|               | Intermediate | PMF                                 |
|               | Large        | PMF                                 |

\*The recommended design floods in this column represent the magnitude of the spillway design flood (SDF), which is intended to represent the largest flood that need be considered in the evaluation of a given project, regardless of whether a spillway is provided; i.e., a given project should be capable of safely passing the appropriate SDF. Where a range of SDF is indicated, the magnitude that most closely relates to the involved risk should be selected.

100-yr = 100-Year Exceedence Interval. The flood magnitude expected to be exceeded, on the average, of once in 100 years. It may also be expressed as an exceedence frequency with a one-percent chance of being exceeded in any given year.

PMF = Probable Maximum Flood. The flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The PMF is derived from probable maximum precipitation (PMP), which information is generally available from the National Weather Service, NOAA. Most Federal agencies apply reduction factors to the PMP when appropriate. Reductions may be applied because rainfall isohyets are unlikely to conform to the exact shape of the drainage basin and/or the storm is not likely to center exactly over the drainage basin. In some cases local topography will cause changes from the generalized PMP values, therefore, it may be advisable to contact Federal construction agencies to obtain the prevailing practice in specific areas.

3.5.2. Experience Data. In some cases where design data are lacking, an evaluation of overtopping potential may be based on watershed characteristics and rainfall and reservoir records. An estimate of the probable maximum flood may also be developed from a conservative, generalized comparison of the drainage area size and the magnitude of recently adopted probable maximum floods for damsites in comparable hydrologic regions. Where the review of such experience data indicates that the recommended spillway design flood would not cause overtopping additional hydraulic and hydrologic determinations will be unnecessary.

3.6. Evaluation of Structural Stability. The Phase I evaluations of structural adequacy of project features are expected to be based principally on existing conditions as revealed by the visual inspection, together with available design and construction information and records of performance. The objectives are to determine the existence of conditions which are hazardous, or which with time might develop into safety hazards, and to formulate recommendations pertaining to the need for any additional studies, investigations, or analyses. The results of this phase of the inspection must rely very substantially upon the experience and judgment of the inspecting engineer.

3.6.1. Design and Construction Data. The principal design assumptions and analyses obtained from the project records should be assessed. Original design and construction records should be used judiciously, recognizing the restricted applicability of such data as material strengths and permeabilities, geological factors and construction descriptions. Original stability studies and analyses should be acceptable if conventional techniques and procedures similar to those outlined in paragraph 4.4 were employed, provided that review of operational and performance data confirm that the original design assumptions were adequately conservative. The need for such analyses where either none exist or the originals are incomplete or unsatisfactory will be determined by the inspecting engineer based upon other factors such as condition of structures, prior maximum loadings and the hazard degree of the project. Design assumptions and analyses should include all applicable loads including earthquake and indicate the structure's capability to resist overturning, sliding and overstressing with adequate factors of safety. In general seepage and stability analyses comparable to the requirements of paragraph 4.4 should be on record for all dams in the high hazard category and large dams in the significant hazard category. This requirement for other dams will be subject to the opinion of the inspecting engineer.

3.6.2. Operating Records. The performance of structures under prior maximum loading conditions should in some instances provide partial basis for stability evaluation. Satisfactory experience under loading conditions not expected to be exceeded in the future should generally be indicative of satisfactory stability, provided adverse changes in physical conditions have not occurred. Instrumentation observations of forces, pressures, loads, stresses, strains, displacements, deflections or other related conditions should also be utilized in the safety evaluation. Where such data indicate abnormal behavior, unsafe movement or deflections, or loadings which adversely affect the stability or functioning of the structure, prompt reporting of such circumstances is required without the delay for preparation of the official inspection report.



3.6.3. Post Construction Changes. Data should be collected on changes which have occurred since project construction that might influence the safety of the dam such as road cuts, quarries, mining and groundwater changes.

3.6.4. Seismic Stability. An assessment should be made of the potential vulnerability of the dam to seismic events and a recommendation developed with regard to the need for additional seismic investigation. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist. Dams in Zones 3 and 4 should, as a minimum, have on record suitable analyses made by conventional equivalent static load methods. The seismic zones together with appropriate coefficients for use in such analyses are shown in Figures 1 through 4. Boundary lines are approximate and in the event of doubt about the proper zone, the higher zone should be used. All high hazard category dams in Zone 4 and high hazard dams of the hydraulic fill type in Zone 3 should have a stability assessment based upon knowledge of regional and local geology, engineering seismology, in situ properties of materials and appropriate dynamic analytical and testing procedures. The assessment should include the possibility of physical displacement of the structures due to movements along active faults. Departure from this general guidance should be made whenever in the judgment of the investigating engineer different seismic stability requirements are warranted because of local geological conditions or other reasons.

## CHAPTER 4 - PHASE II INVESTIGATION

4.1. Purpose. The Phase II investigation will be supplementary to Phase I and should be conducted when the results of the Phase I investigation indicate the need for additional in-depth studies, investigations or analyses.

4.2. Scope. The Phase II investigation should include all additional studies, investigations and analyses necessary to evaluate the safety of the dam. Included, as required, will be additional visual inspections, measurements, foundation exploration and testing, materials testing, hydraulic and hydrologic analysis and structural stability analyses.

4.3. Hydraulic and Hydrologic Analysis. Hydraulic and hydrologic capabilities should be determined using the following criteria and procedures. Depending on the project characteristics, either the spillway design flood peak inflow or the spillway design flood hydrograph should be the basis for determining the maximum water surface elevation and maximum outflow. If the operation or failure of upstream water control projects would have significant impact on peak flow or hydrograph analyses, the impact should be assessed.

4.3.1. Maximum Water Surface Based on SDF Peak Inflow. When the total project discharge capability at maximum pool exceeds the peak inflow of the recommended SDF, and operational constraints would not prevent such a release at controlled projects, a reservoir routing is not required. The maximum discharge should be assumed equal to the peak inflow of the spillway design flood. Flood volume is not controlling in this situation and surcharge storage is either absent or is significant only to the extent that it provides the head necessary to develop the release capability required.

4.3.1.1. Peak for 100-Year Flood. When the 100-year flood is applicable under the provisions of Table 3 and data are available, the spillway design flood peak inflow may be determined by use of "A Uniform Technique for Determining Flood Frequencies," Water Resources Council (WRC), Hydrology Committee, Bulletin 15, December 1967. Flow frequency information from regional analysis is generally preferred over single station results when available and appropriate. Rainfall-runoff techniques may be necessary when there are inadequate runoff data available to make a reasonable estimate of flow frequency.

4.3.1.2. Peak for PMF or Fraction Thereof. When either the Probable Maximum Flood peak or a fraction thereof is applicable under the provisions of Table 3, the unit hydrograph - infiltration loss technique is generally the most expeditious method of computing the spillway design flood peak for most projects. This technique is discussed in the following paragraph.



4.3.2. Maximum Water Surface Based on SDF Hydrograph. Both peak and volume are required in this analysis. Where surcharge storage is significant, or where there is insufficient discharge capability at maximum pool to pass the peak inflow of the SDF, considering all possible operational constraints, a flood hydrograph is required. When there are upstream hazard areas that would be imperiled by fast rising reservoirs levels, SDF hydrographs should be routed to ascertain available time for warning and escape. Determination of probable maximum precipitation or 100-year precipitation, whichever is applicable, and unit hydrographs or runoff models will be required, followed by the determination of the PMF or 100-year flood. Conservative loss rates (significantly reduced by antecedent rainfall conditions where appropriate) should be estimated for computing the rainfall excess to be utilized with unit hydrographs. Rainfall values are usually arranged with gradually ascending and descending rates with the maximum rate late in the storm. When applicable, conservatively high snowmelt runoff rates and appropriate releases from upstream projects should be assumed. The PMP may be obtained from National Weather Service (NWS) publications such as Hydrometeorological Report (HMR) 33. Special NWS publications for particular areas should be used when available. Rainfall for the 100-year frequency flood can be obtained from the NWS publication "Rainfall Frequency Atlas of the United States," Technical Paper No. 40; Atlas 2, "Precipitation Frequency Atlas of Western United States;" or other NWS publications. The maximum water surface elevation and spillway design flood outflow are then determined by routing the inflow hydrograph through the reservoir surcharge storage, assuming a starting water surface at the bottom of surcharge storage, or lower when appropriate. For projects where the bottom of surcharge space is not distinct, or the flood control storage space (exclusive of surcharge) is appreciable, it may be appropriate to select starting water surface elevations below the top of the flood control storage for routings. Conservatively high starting levels should be estimated on the basis of hydrometeorological conditions reasonably characteristic for the region and flood release capability of the project. Necessary adjustment of reservoir storage capacity due to existing or future sediment or other encroachment may be approximated when accurate determination of deposition is not practicable.

4.3.3. Acceptable Procedures. Techniques for performing hydraulic and hydrologic analyses are generally available from publications prepared by Federal agencies involved in water resources development or textbooks written by the academic community. Some of these procedures are rather sophisticated and require expensive computational equipment and large data banks. While results of such procedures are generally more reliable than simplified methods, their use is generally not warranted in studies connected with this program unless they can be performed quickly and inexpensively. There may be situations where the more complex techniques have to be employed to obtain reliable results; however, these cases will be exceptions rather than the rule. Whenever the acceptability of procedures is in question, the advice of competent experts should be sought. Such expertise is generally available in the Corps of Engineers, Bureau of

Reclamation and Soil Conservation Service. Many other agencies, educational facilities and private consultants can also provide expert advice. Regardless of where such expertise is based, the qualification of those individuals offering to provide it should be carefully examined and evaluated.

4.3.4. Freeboard Allowances. Guidelines on specific minimum freeboard allowances are not considered appropriate because of the many factors involved in such determinations. The investigator will have to assess the critical parameters for each project and develop its minimum requirement. Many projects are reasonably safe without freeboard allowance because they are designed for overtopping, or other factors minimize possible overtopping. Conversely, freeboard allowances of several feet may be necessary to provide a safe condition. Parameters that should be considered include the duration of high water levels in the reservoir during the design flood; the effective wind fetch and reservoir depth available to support wave generation; the probability of high wind speed occurring from a critical direction; the potential wave runup on the dam based on roughness and slope; and the ability of the dam to resist erosion from overtopping waves.

4.4. Stability Investigations. The Phase II stability investigations should be compatible with the guidelines of this paragraph.

4.4.1. Foundation and Material Investigations. The scope of the foundation and materials investigation should be limited to obtaining the information required to analyze the structural stability and to investigate any suspected condition which would adversely affect the safety of the dam. Such investigations may include borings to obtain concrete, embankment, soil foundation, and bedrock samples; testing specimens from these samples to determine the strength and elastic parameters of the materials, including the soft seams, joints, fault gouge and expansive clays or other critical materials in the foundation; determining the character of the bedrock including joints, bedding planes, fractures, faults, voids and caverns, and other geological irregularities; and installing instruments for determining movements, strains, suspected excessive internal seepage pressures, seepage gradients and uplift forces. Special investigations may be necessary where suspect rock types such as limestone, gypsum, salt, basalt, claystone, shales or others are involved in foundations or abutments in order to determine the extent of cavities, piping or other deficiencies in the rock foundation. A concrete core drilling program should be undertaken only when the existence of significant structural cracks is suspected or the general qualitative condition of the concrete is in doubt. The tests of materials will be necessary only where such data are lacking or are outdated.

4.4.2. Stability Assessment. Stability assessments should utilize in situ properties of the structure and its foundation and pertinent geologic



information. Geologic information that should be considered includes groundwater and seepage conditions; lithology, stratigraphy, and geologic details disclosed by borings, "as-built" records, and geologic interpretation; maximum past overburden at site as deduced from geologic evidence; bedding, folding and faulting; joints and joint systems; weathering; slickensides, and field evidence relating to slides, faults, movements and earthquake activity. Foundations may present problems where they contain adversely oriented joints, slickensides or fissured material, faults, seams of soft materials, or weak layers. Such defects and excess pore water pressures may contribute to instability. Special tests may be necessary to determine physical properties of particular materials. The results of stability analyses afford a means of evaluating the structure's existing resistance to failure and also the effects of any proposed modifications. Results of stability analyses should be reviewed for compatibility with performance experience when possible.

4.4.2.1. Seismic Stability. The inertial forces for use in the conventional equivalent static force method of analysis should be obtained by multiplying the weight by the seismic coefficient and should be applied as a horizontal force at the center of gravity of the section or element. The seismic coefficients suggested for use with such analyses are listed in Figures 1 through 4. Seismic stability investigations for all high hazard category dams located in Seismic Zone 4 and high hazard dams of the hydraulic fill type in Zone 3 should include suitable dynamic procedures and analyses. Dynamic analyses for other dams and higher seismic coefficients are appropriate if in the judgment of the investigating engineer they are warranted because of proximity to active faults or other reasons. Seismic stability investigations should utilize "state-of-the-art" procedures involving seismological and geological studies to establish earthquake parameters for use in dynamic stability analyses and, where appropriate, the dynamic testing of materials. Stability analyses may be based upon either time-history or response spectra techniques. The results of dynamic analyses should be assessed on the basis of whether or not the dam would have sufficient residual integrity to retain the reservoir during and after the greatest or most adverse earthquake which might occur near the project location.

4.4.2.2. Clay Shale Foundation. Clay shale is a highly overconsolidated sedimentary rock comprised predominantly of clay minerals, with little or no cementation. Foundations of clay shales require special measures in stability investigations. Clay shales, particularly those containing montmorillonite, may be highly susceptible to expansion and consequent loss of strength upon unloading. The shear strength and the resistance to deformation of clay shales may be quite low and high pore water pressures may develop under increase in load. The presence of slickensides in clay shales is usually an indication of low shear strength. Prediction

of field behavior of clay shales should not be based solely on results of conventional laboratory tests since they may be misleading. The use of peak shear strengths for clay shales in stability analyses may be unconservative because of nonuniform stress distribution and possible progressive failures. Thus the available shear resistance may be less than if the peak shear strength were mobilized simultaneously along the entire failure surface. In such cases, either greater safety factors or residual shear strength should be used.

#### 4.4.3. Embankment Dams.

4.4.3.1. Liquefaction. The phenomenon of liquefaction of loose, saturated sands and silts may occur when such materials are subjected to shear deformation or earthquake shocks. The possibility of liquefaction must presently be evaluated on the basis of empirical knowledge supplemented by special laboratory tests and engineering judgment. The possibility of liquefaction in sands diminishes as the relative density increases above approximately 70 percent. Hydraulic fill dams in Seismic Zones 3 and 4 should receive particular attention since such dams are susceptible to liquefaction under earthquake shocks.

4.4.3.2. Shear Failure. Shear failure is one in which a portion of an embankment or of an embankment and foundation moves by sliding or rotating relative to the remainder of the mass. It is conventionally represented as occurring along a surface and is so assumed in stability analyses, although shearing may occur in a zone of substantial thickness. The circular arc or the sliding wedge method of analyzing stability, as pertinent, should be used. The circular arc method is generally applicable to essentially homogeneous embankments and to soil foundations consisting of thick deposits of fine-grained soil containing no layers significantly weaker than other strata in the foundation. The wedge method is generally applicable to rockfill dams and to earth dams on foundations containing weak layers. Other methods of analysis such as those employing complex shear surfaces may be appropriate depending on the soil and rock in the dam and foundation. Such methods should be in reputable usage in the engineering profession.

4.4.3.3. Loading Conditions. The loading conditions for which the embankment structures should be investigated are (I) Sudden drawdown from spillway crest elevation or top of gates, (II) Partial pool, (III) Steady state seepage from spillway crest elevation or top of gate elevation, and (IV) Earthquake. Cases I and II apply to upstream slopes only; Case III applies to downstream slopes; and Case IV applies to both upstream and downstream slopes. A summary of suggested strengths and safety factors are shown in Table 4.

TABLE 4

FACTORS OF SAFETY †

| <u>Case</u> | <u>Loading Condition</u>                                                           | <u>Factor of Safety</u> | <u>Shear †† Strength</u>                                      | <u>Remarks</u>                                                                                                                                                                                 |
|-------------|------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I           | Sudden drawdown from spillway crest or top of gates to minimum drawdown elevation. | 1.2*                    | Minimum composite of R and S shear strengths<br>See Figure 5. | Within the drawdown zone submerged unit weights of materials are used for computing forces resisting sliding and saturated unit weights are used for computing forces contributing to sliding. |
| II          | Partial pool with assumed horizontal steady seepage saturation.                    | 1.5                     | $\frac{R+S}{2}$ for $R < S$<br><br>S for $R > S$              | Composite intermediate envelope of R and S shear strengths. See Figure 6.                                                                                                                      |
| III         | Steady seepage from spillway crest or top of gates with $K_h/K_v = 9$ assumed**    | 1.5                     | Same as Case II                                               |                                                                                                                                                                                                |
| IV          | Earthquake (Cases II and III with seismic loading)                                 | 1.0                     | ***                                                           | See Figures 1 through 4 for Seismic Coefficients.                                                                                                                                              |

† Not applicable to embankments on clay shale foundation. Experience has indicated special problems in determination of design shear strengths for clay shale foundations and acceptable safety factors should be compatible with the confidence level in shear strength assumptions.

†† Other strength assumptions may be used if in common usage in the engineering profession.

\* The safety factor should not be less than 1.5 when drawdown rate and pore water pressure developed from flow nets are used in stability analyses.

\*\*  $K_h/K_v$  is the ratio of horizontal to vertical permeability. A minimum of 9 is suggested for use in compacted embankments and alluvial sediments.



\*\*\* Use shear strength for case analyzed without earthquake. It is not necessary to analyze sudden drawdown for earthquake loading. Shear strength tests are classified according to the controlled drainage conditions maintained during the test. R tests are those in which specimen drainage is allowed during consolidation (or swelling) under initial stress conditions, but specimen drainage is not allowed during application of shearing stresses. S tests allow full drainage during initial stress application and shearing is at a slow rate so that complete specimen drainage is permitted during the complete test.

4.4.3.4. Safety Factors. Safety factors for embankment dam stability studies should be based on the ratio of available shear strength to developed shear strength,  $S_D$ :

$$S_D = \frac{C}{F.S.} + \sigma \frac{\tan \phi}{F.S.} \quad (1)$$

C = cohesion

$\phi$  = angle of internal friction

$\sigma$  = normal stress

The factors of safety listed in Table 4 are recommended as minimum acceptable. Final accepted factors of safety should depend upon the degree of confidence the investigating engineer has in the engineering data available to him. The consequences of a failure with respect to human life and property damage are important considerations in establishing factors of safety for specific investigations.

4.4.3.5. Seepage Failure. A critical uncontrolled underseepage or through seepage condition that develops during a rising pool can quickly reduce a structure which was stable under previous conditions, to a total structural failure. The visually confirmed seepage conditions to be avoided are (1) the exit of the phreatic surface on the downstream slope of the dam and (2) development of hydrostatic heads sufficient to create in the area downstream of the dam sand boils that erode materials by the phenomenon known as "piping" and (3) localized concentrations of seepage along conduits or through pervious zones. The dams most susceptible to seepage problems are those built of or on pervious materials of uniform fine particle size, with no provisions for an internal drainage zone and/or no underseepage controls.

4.4.3.6. Seepage Analyses. Review and modifications to original seepage design analyses should consider conditions observed in the field inspection and piezometer instrumentation. A seepage analysis should consider the permeability ratios resulting from natural deposition and from compaction placement of materials with appropriate variation between horizontal and vertical permeability. An underseepage analysis of the embankment should provide a critical gradient factor of safety for the maximum head condition of not less than 1.5 in the area downstream of the embankment.

$$F.S = i_c/i = \frac{H_c/D_b}{H/D_b} = D_b \frac{(\gamma_m - \gamma_w)}{H \gamma_w} \quad (2)$$

$i_c$  = Critical gradient

$i$  = Design gradient

$H$  = Uplift head at downstream toe of dam measured above tailwater

$H_c$  = The critical uplift

$D_b$  = The thickness of the top impervious blanket at the downstream toe of the dam

$\gamma_m$  = The estimated saturated unit weight of the material in the top impervious blanket

$\gamma_w$  = The unit weight of water

Where a factor of safety less than 1.5 is obtained the provision of an underseepage control system is indicated. The factor of safety of 1.5 is a recommended minimum and may be adjusted by the responsible engineer based on the competence of the engineering data.

#### 4.4.4. Concrete Dams and Appurtenant Structures.

4.4.4.1. Requirements for Stability. Concrete dams and structures appurtenant to embankment dams should be capable of resisting overturning, sliding and overstressing with adequate factors of safety for normal and maximum loading conditions.

4.4.4.2. Loads. Loadings to be considered in stability analyses include the water load on the upstream face of the dam; the weight of the structure, internal hydrostatic pressures (uplift) within the body of the dam, at the base of the dam and within the foundation; earth and silt loads; ice pressure, seismic and thermal loads, and other loads as applicable. Where tailwater or backwater exists on the downstream side of the structure it should be considered, and assumed uplift pressures should be compatible with drainage provisions and uplift measurements if available. Where applicable, ice pressure should be applied to the contact surface of the structure at normal pool elevation. A unit pressure of not more than 5,000 pounds per square foot should be used. Normally, ice thickness should not be assumed greater than two feet. Earthquake forces should consist of the inertial forces due to the horizontal acceleration of the dam itself and hydrodynamic forces resulting from the reaction of the reservoir water against the structure. Dynamic water pressures for use in conventional methods of analysis may be computed by means of the "Westergaard Formula" using the parabolic approximation (H.M. Westergaard, "Water Pressures on Dams During Earthquakes," Trans., ASCE, Vol 98, 1933, pages 418-433), or similar method.

4.4.4.3. Stresses. The analysis of concrete stresses should be based on in situ properties of the concrete and foundation. Computed maximum compressive stresses for normal operating conditions in the order of  $1/3$  or less of in situ strengths should be satisfactory. Tensile stresses in unreinforced concrete should be acceptable only in locations where cracks will not adversely affect the overall performance and stability of the structure. Foundation stresses should be such as to provide adequate safety against failure of the foundation material under all loading conditions.

4.4.4.4. Overturning. A gravity structure should be capable of resisting all overturning forces. It can be considered safe against overturning if the resultant of all combinations of horizontal and vertical forces, excluding earthquake forces, acting above any horizontal plane through the structure or at its base is located within the middle third of the section. When earthquake is included the resultant should fall within the limits of the plane or base, and foundation pressures must be acceptable. When these requirements for location of the resultant are not satisfied the investigating engineer should assess the importance to stability of the deviations.

4.4.4.5. Sliding. Sliding of concrete gravity structures and of abutment and foundation rock masses for all types of concrete dams should be evaluated by the shear-friction resistance concept. The available sliding resistance is compared with the driving force which tends to induce sliding to arrive at a sliding stability safety factor. The investigation should be made along all potential sliding paths. The critical path is that plane or combination of planes which offers the least resistance.

4.4.4.5.1. Sliding Resistance. Sliding resistance is a function of the unit shearing strength at no normal load (cohesion) and the angle of friction on a potential failure surface. It is determined by computing the maximum horizontal driving force which could be resisted along the sliding path under investigation. The following general formula is obtained from the principles of statics and may be derived by resolving forces parallel and perpendicular to the sliding plane:

$$R_R = V \tan (\phi + \alpha) + \frac{cA}{\cos \alpha (1 - \tan \phi \tan \alpha)} \quad (3)$$

where

$R_R$  = Sliding Resistance (maximum horizontal driving force which can be resisted by the critical path)

$\phi$  = Angle of internal friction of foundation material or, where applicable, angle of sliding friction

$V$  = Summation of vertical forces (including uplift)

$c$  = Unit shearing strength at zero normal loading along potential failure plane

$A$  = Area of potential failure plane developing unit shear strength "c"

$\alpha$  = Angle between inclined plane and horizontal (positive for uphill sliding)

For sliding downhill the angle  $\alpha$  is negative and Equation (1) becomes:

$$R_R = V \tan (\phi - \alpha) + \frac{cA}{\cos \alpha (1 + \tan \phi \tan \alpha)} \quad (4)$$

When the plane of investigation is horizontal, and the angle  $\alpha$  is zero and Equation (1) reduced to the following:

$$R_R = V \tan \phi + cA \quad (5)$$



4.4.4.5.2. Downstream Resistance. When the base of a concrete structure is embedded in rock or the potential failure plane lies below the base, the passive resistance of the downstream layer of rock may sometimes be utilized for sliding resistance. Rock that may be subjected to high velocity water scouring should not be used. The magnitude of the downstream resistance is the lesser of (a) the shearing resistance along the continuation of the potential sliding plane until it daylights or (b) the resistance available from the downstream rock wedge along an inclined plane. The theoretical resistance offered by the passive wedge can be computed by a formula equivalent to formula (3):

$$P_p = W \tan (\phi + \alpha) + \frac{cA}{\cos \alpha (1 - \tan \phi \tan \alpha)} \quad (6)$$

$P_p$  = passive resistance of rock wedge

$W$  = weight (buoyant weight if applicable) of downstream rock wedge above inclined plane of resistance, plus any superimposed loads

$\phi$  = angle of internal friction or, if applicable, angle of sliding friction

$\alpha$  = angle between inclined failure plane and horizontal

$c$  = unit shearing strength at zero normal load along failure plane

$A$  = area of inclined plane of resistance

When considering cross-bed shear through a relatively shallow, competent rock strut, without adverse jointing or faulting,  $W$  and  $\alpha$  may be taken at zero and  $45^\circ$ , respectively, and an estimate of passive wedge resistance per unit width obtained by the following equation:

$$P_p = 2 cD \quad (7)$$

where

$D$  = Thickness of the rock strut

4.4.4.5.3. Safety Factor. The shear-friction safety factor is obtained by dividing the resistance  $R_R$  by  $H$ , the summation of horizontal service



loads to be applied to the structure:

$$S_{s-f} = \frac{R_R}{H} \quad (8)$$

When the downstream passive wedge contributes to the sliding resistance, the shear friction safety factor formula becomes:

$$S_{s-f} = \frac{R_R + P_p}{H} \quad (9)$$

The above direct superimposition of passive wedge resistance is valid only if shearing rigidities of the foundation components are similar. Also, the compressive strength and buckling resistance of the downstream rock layer must be sufficient to develop the wedge resistance. For example, a foundation with closely spaced, near horizontal, relatively weak seams might not contain sufficient buckling strength to develop the magnitude of wedge resistance computed from the cross-bed shear strength. In this case wedge resistance should not be assumed without resorting to special treatment (such as installing foundation anchors). Computed sliding safety factors approximating 3 or more for all loading conditions without earthquake, and 1.5 including earthquake, should indicate satisfactory stability, depending upon the reliability of the strength parameters used in the analyses. In some cases when the results of comprehensive foundation studies are available, smaller safety factors may be acceptable. The selection of shear strength parameters should be fully substantiated. The bases for any assumptions; the results of applicable testing, studies and investigations; and all pre-existing, pertinent data should be reported and evaluated.

## CHAPTER 5 - REPORTS

5.1. General. This chapter outlines the procedures for reporting the results of the technical investigations. Hazardous conditions should be reported immediately upon detection to the owner of the dam, the Governor of the State in which the dam is located and the appropriate regulatory agency without delay for preparation of the formal report.

5.2. Preparation of Report. A formal report should be prepared for each dam investigated for submission to the regulatory agency and the owner of the dam. Each report should contain the information indicated in the following paragraphs. The signature and registration identification of the professional engineer who directed the investigation and who was responsible for evaluation of the dam should be included in the report.

5.2.1. Phase I Reports. Phase I reports should contain the following information:

5.2.1.1. Description of dam including regional vicinity map showing location and plans, elevations and sections showing the essential project features and the size and hazard potential classifications.

5.2.1.2. Summary of existing engineering data, including geologic maps and information.

5.2.1.3. Results of the visual inspection of each project feature including photographs and drawings to minimize descriptions.

5.2.1.4. Evaluation of operational adequacy of the reservoir regulation plan and maintenance of the dam and operating facilities and features that pertain to the safety of the dam.

5.2.1.5. Description of any warning system in effect.

5.2.1.6. Evaluation of the hydraulic and hydrologic assumptions and structural stability.

5.2.1.7. An assessment of the general condition of the dam with respect to safety based upon the findings of the visual inspection and review of engineering data. Where data on the original design indicate significant departure from or non-conformance with guidelines contained herein, the engineer-in-charge of the investigation will give his opinion of the significance, with regard to safety, of such factors. Any additional studies, investigations and analyses considered essential to assessment of the safety of the dam should be listed, together with an opinion about the urgency of such additional work.

5.2.1.8. Indicate alternative possible remedial measures or revisions in operating and maintenance procedures which may (subject to further evaluation) correct deficiencies and hazardous conditions found during the investigation.

5.2.2. Phase II Reports. Phase II reports should describe the detailed investigations and should supplement Phase I reports. They should contain the following information:

5.2.2.1. Summary of additional engineering data obtained to determine the hydraulic and hydrologic capabilities and/or structural stability.

5.2.2.2. Results of all additional studies, investigations, and analyses performed.

5.2.2.3. Technical assessment of dam safety including deficiencies and hazardous conditions found to exist.

5.2.2.4. Indicate alternative possible remedial measures or revision in maintenance and operating procedures which may (subject to further evaluation) correct deficiencies and hazardous conditions found during the investigation.

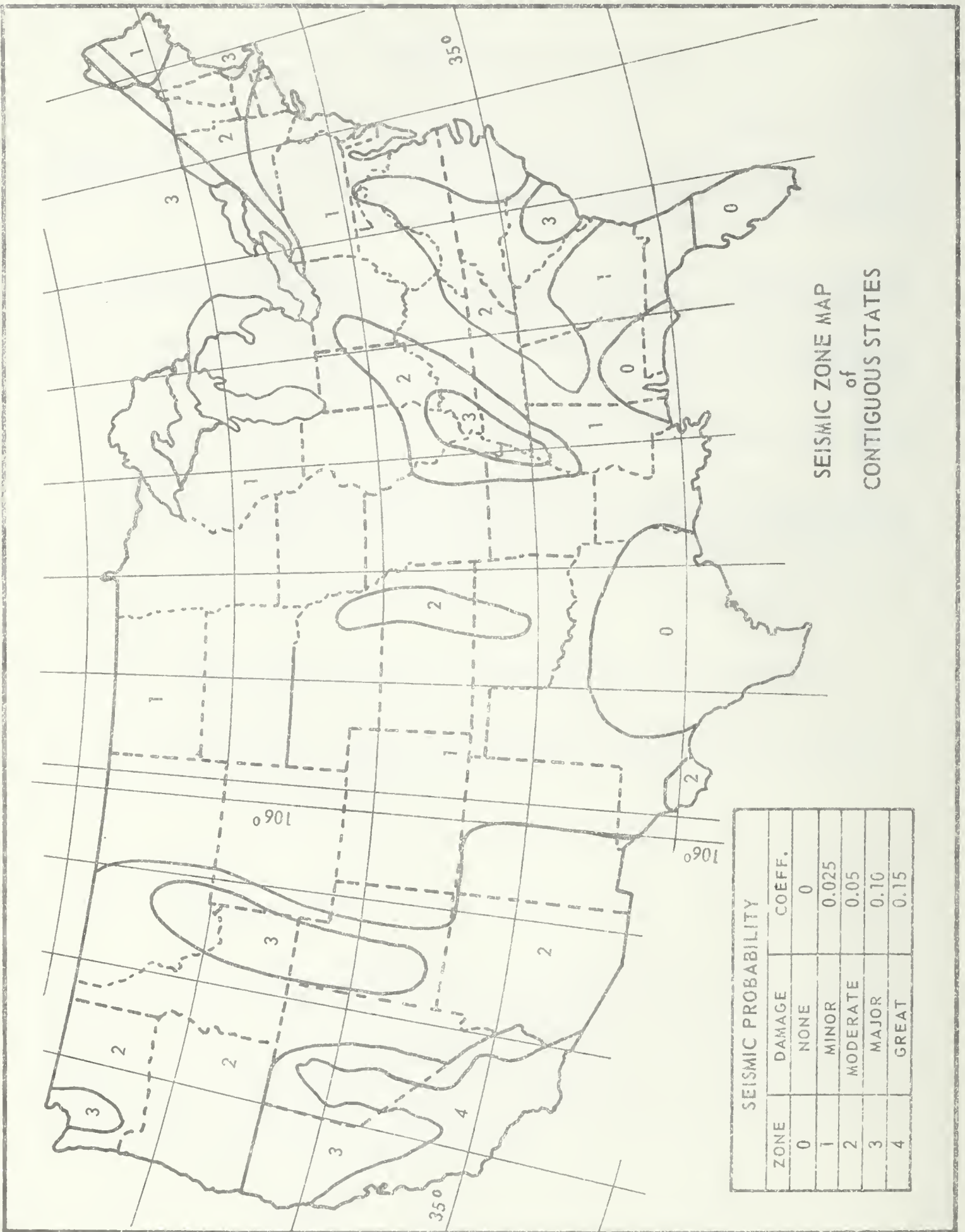


Figure 1



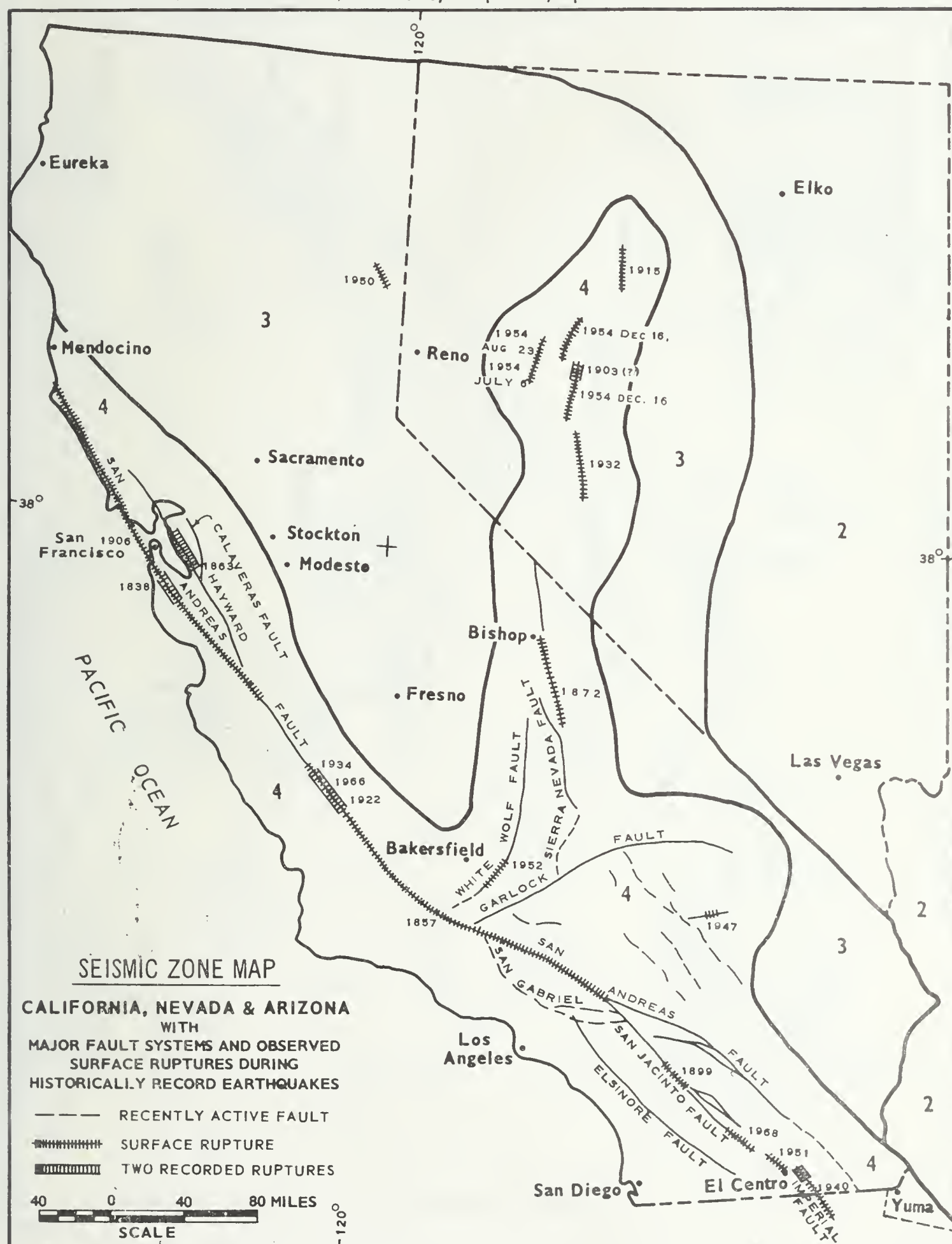


Figure 2



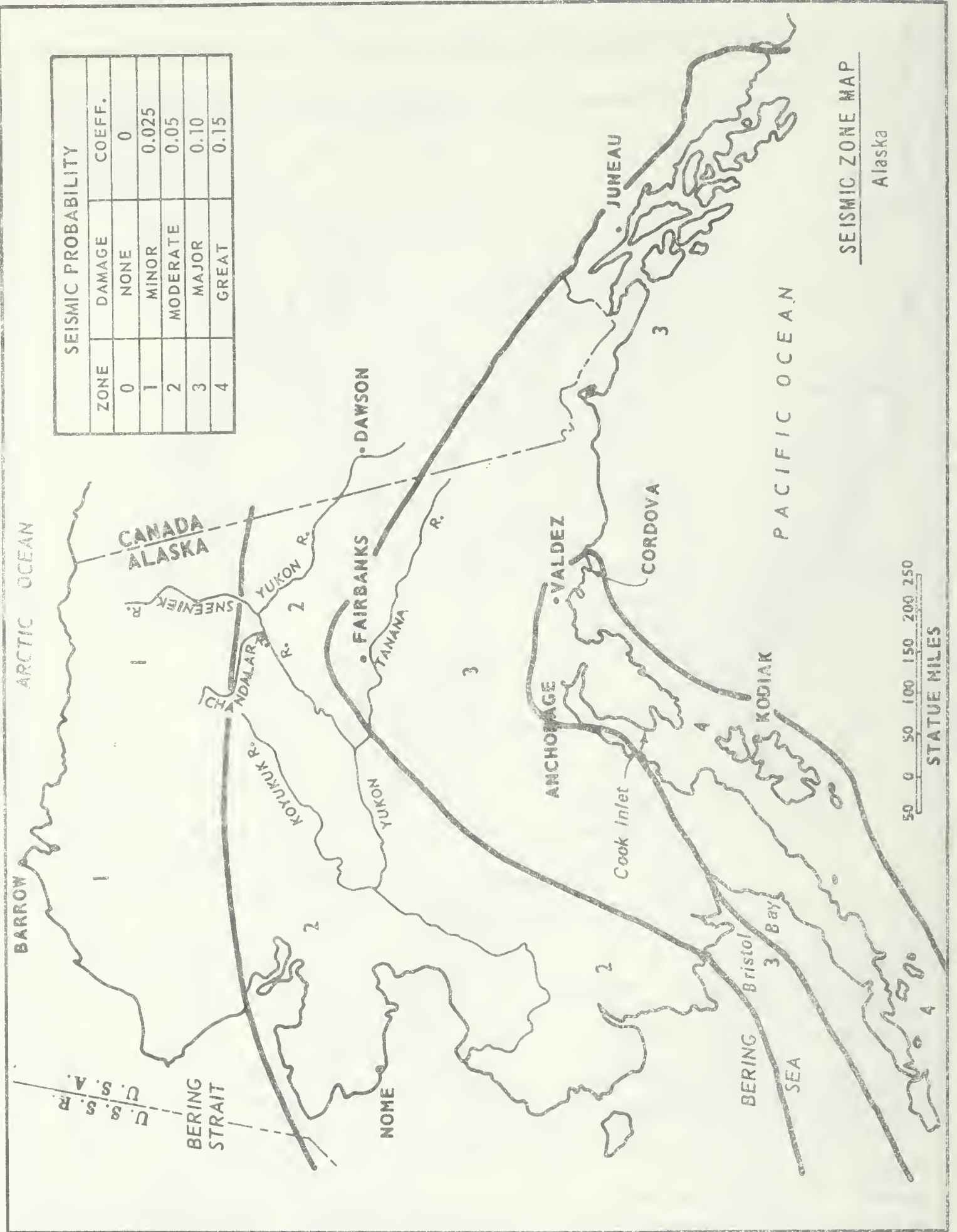
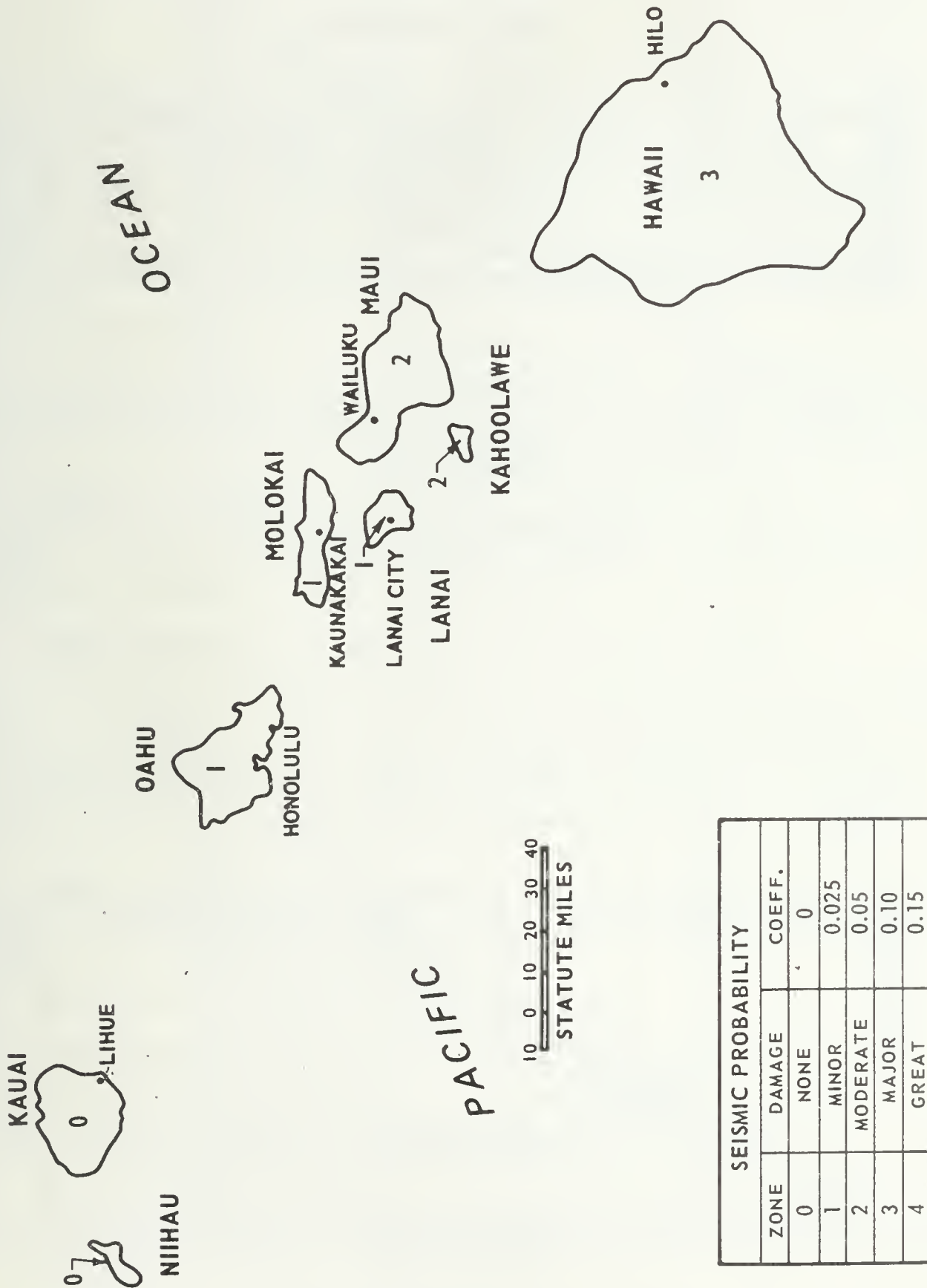


Figure 3



SEISMIC ZONE MAP

Hawaii

Figure 4

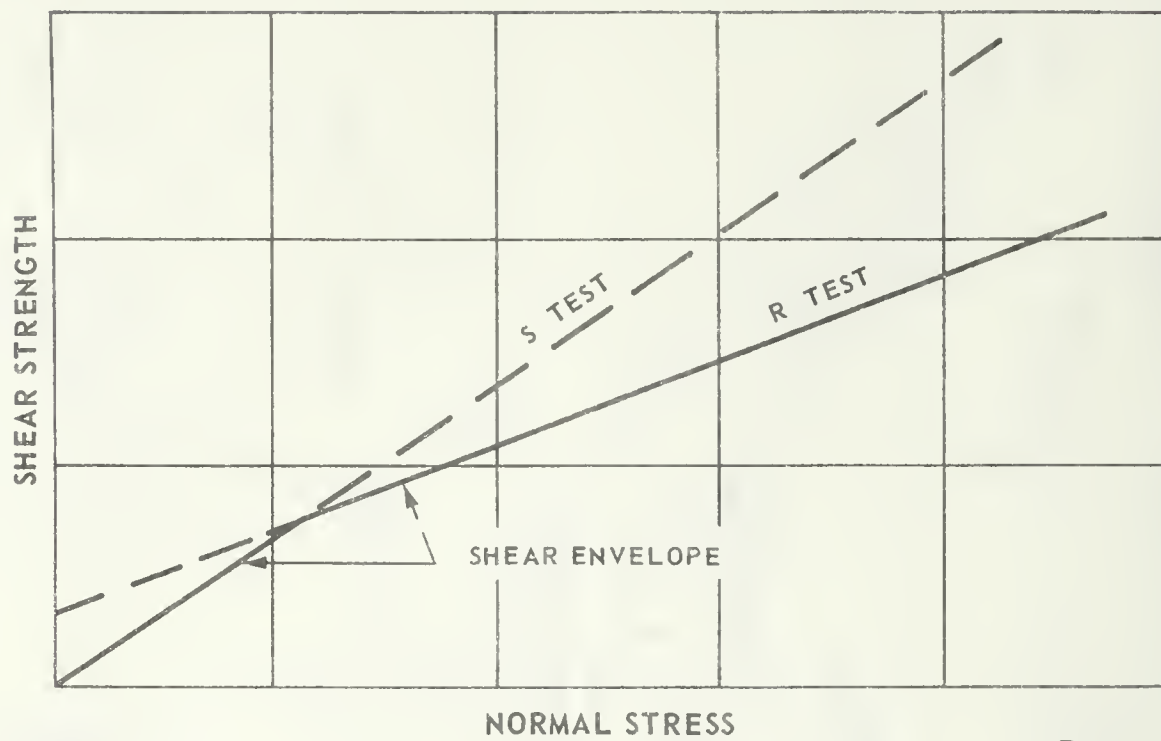


Figure 5

SHEAR ENVELOPE FOR CASE I

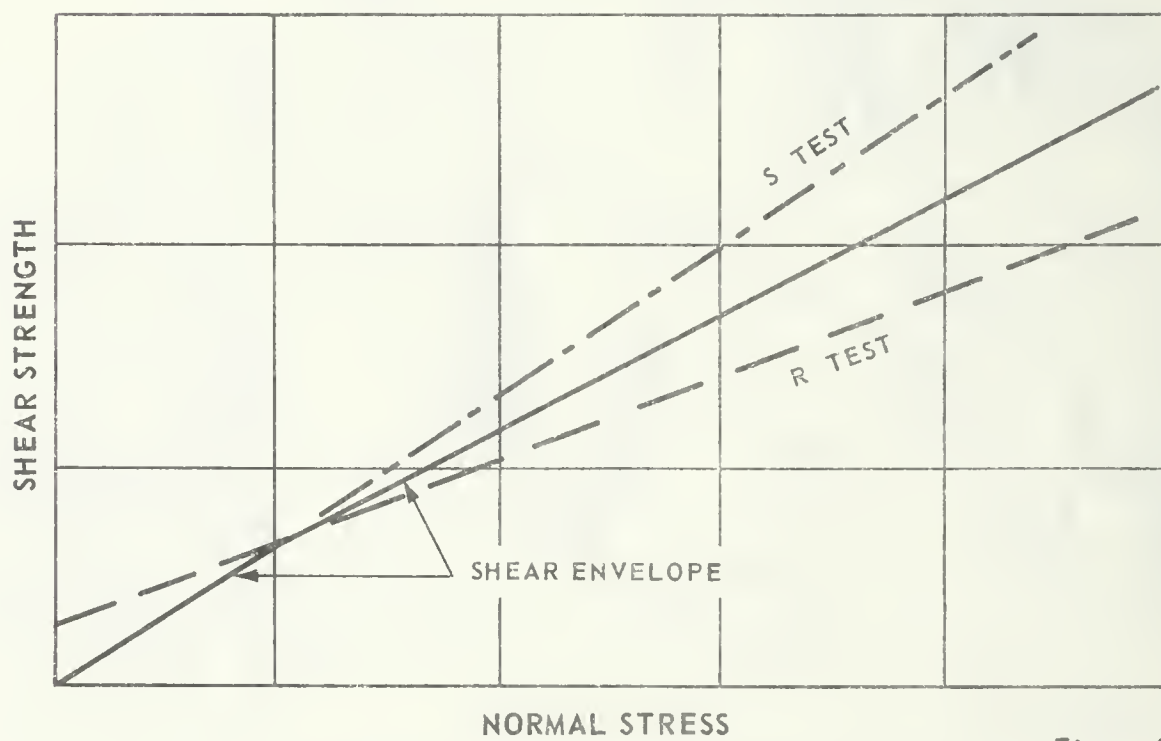


Figure 6

SHEAR ENVELOPE FOR CASES II AND III

APPENDIX I  
ENGINEERING DATA

This appendix lists engineering data which should be collected from project records and, to the extent available, included in the Phase I investigation report. The list is intended to serve as a checklist and not to establish rigid data requirements. Such a compilation should also facilitate future inspections and investigations. Only data readily available will be included in Phase I reports, but data lacking and deemed necessary for an adequate safety evaluation should be identified.

1. General Project Data

a. Regional Vicinity Map showing the location of the dam, the upstream drainage area and the downstream area subject to potential damage due to failure of the dam and misoperation or failure of the operating equipment.

b. As-Built Drawings indicating plans, elevations and sections of the dam and appurtenant structures including the details of the discharge facilities such as outlet works, limited service and emergency spillways, flashboards, fuse plugs and operating equipment.

2. Hydrologic and Hydraulic Data including the following:

a. Drainage area and basin runoff characteristics (indicating pending changes).

b. Elevation of top of conservation pool or normal upper retention water surface elevation, as applicable (base level of any flood impoundment).

c. Storage capacity including dead or inactive storage, corresponding to top of conservation or normal upper retention level (cumulative, excluding flood control and surcharge storage).

d. Elevation of the top of flood control pool.

e. Storage capacity of flood control zone (incremental).

f. Elevation of maximum design pool (corresponding to top of surcharge storage or spillway design flood).

g. Storage capacity of surcharge zone (incremental, above top of flood control pool or, above normal upper retention level if flood control space not provided).



h. Height of freeboard (distance between maximum design flood water surface and top of dam).

i. Elevation of top of dam (lowest point of embankment or non-overflow structure).

j. Elevation of crest, type, width, crest length and location of spillways (number, size and type of gates if controlled).

k. Type, location, entrance and exit inverts of outlet works and emergency drawdown facilities (number, size and shape of conduits and gates, including penstocks and sluices).

l. Location, crest elevation, description of invert and abutments (concrete, rock, grass, earth) and length of limited service and emergency spillways.

m. Location and description of flashboards and fuse plugs, including hydraulic head (pool elevation) and other conditions required for breaching, along with the assumed results of breaching.

n. Location and top elevation of dikes and floodwalls (overflow and non-overflow) affected by reservoir. Include information on low reaches of reservoir rim.

o. Type, location, observations and records of hydrometeorological gages appurtenant to the project.

p. Maximum non-damaging discharge, or negligible damage rate, at potential damage locations downstream.

3. Foundation Data and Geological Features including logs of borings, geological maps, profiles and cross sections, and reports of foundation treatment.

4. Properties of Embankments and Foundation Materials including results of laboratory tests, field permeability tests, construction control tests, and assumed design properties for materials.

5. Concrete Properties including the source and type of aggregate, cement used, mix design data and the results of testing during construction.

6. Electrical and Mechanical Equipment type and rating of normal and emergency power supplies, hoists, cranes, valves and valve operator, control and alarm systems and other electrical and mechanical equipment and systems that could affect the safe operation of the dam.



7. Construction History including diversion scheme, construction sequence, pertinent construction problems, alterations, modifications and maintenance repairs.

8. Water Control Plan including regulation plan under normal conditions and during flood events or other emergency conditions. The availability of dam tenders, means of communication between dam tenders and authority supervising water control, and method of gate operation (manual, automatic, or remote control) should be included. Flood warning systems should be described in sufficient detail to enable assessment of their reduction in the flood hazard potential.

9. Operation Record.

a. Summary of past major flood events including any experiences that presented a serious threat to the safety of the project or to human life or property. The critical project feature, date and duration of event, causative factor, peak inflow and outflow, maximum elevation of water surface, wind and wave factors if significant, issuance of alert or evacuation warnings and adequacy of project feature involved should be included in the summary of past experience of serious threat to the safety of the project.

b. Records of performance observations including instrumentation records.

c. List of any known deficiencies that pose a threat to the safety of the dam or to human life or property.

d. History of previous failures or deficiencies and pending remedial measures for correcting known deficiencies and the schedule for accomplishing remedial measures should be indicated.

10. Earthquake History including a summary of the seismic data of significant recorded earthquakes in the vicinity of the dam and information on major damage in the vicinity of the dam from both recorded and unrecorded earthquakes. Regional geologic maps and other documents showing fault locations should be collected.

11. Inspection History including the results of the last safety inspection, the organization that performed the inspection, the date inspection performed and the authority for conducting the inspection.

12. Principal Design Assumptions and Analyses.

a. Hydrologic and Hydraulic Determinations.

(1) Quantity, time and area distribution, and reference source of depth-area-duration data of spillway design storm precipitation (point precipitation if applicable).

(2) Maximum design flood inflow hydrograph including loss rates (initial and average for design flood conditions) and time of runoff concentration of reservoir watershed (peak inflow only when applicable).

(3) Maximum design flood outflow hydrograph (maximum outflow only when applicable).

(4) Discharge-frequency relationship, preferably at damsite, including estimated frequency of spillway design flood for small dams, when appropriate.

(5) Reservoir area and storage capacity versus water surface elevation (table or curves).

(6) Rating curves (free flow and partial gate openings) for all discharge facilities contributing to the maximum design flood outflow hydrograph. Also a composite-rating of all contributing facilities, if appropriate.

(7) Tailwater rating curve immediately below damsite including elevation corresponding to maximum design flood discharge and approximate nondamaging channel capacity.

(8) Hydrologic map of watershed above damsite including reservoir area, watercourse, elevation contours, and principal stream-flow and precipitation gaging stations.

b. Stability and Stress Analysis of the dam, spillway and appurtenant structures and features including the assumed properties of materials and all pertinent applied loads.

c. Seepage and Settlement Analyses. The determination of distribution, direction and magnitude of seepage forces and the design and construction measures for their control. Settlement estimates and steps adopted to compensate for total settlement and to minimize differential settlements.

## APPENDIX II

### INSPECTION ITEMS

This appendix provides guidance for performing field inspections and may serve as the basis for developing a detailed checklist for each dam.

#### 1. Concrete Structures in General.

a. Concrete Surfaces. The condition of the concrete surfaces should be examined to evaluate the deterioration and continuing serviceability of the concrete. Descriptions of concrete conditions should conform with the appendix to "Guide for Making a Condition Survey of Concrete in Service," American Concrete Institute (ACI) Journal, Proceedings Vol. 65, No. 11, November 1968, page 905-918.

b. Structural Cracking. Concrete structures should be examined for structural cracking resulting from overstress due to applied loads, shrinkage and temperature effects or differential movements.

c. Movement - Horizontal and Vertical Alignment. Concrete structures should be examined for evidence of any abnormal settlements, heaving, deflections, or lateral movements.

d. Junctions. The conditions at the junctions of the structure with abutments or embankments should be determined.

e. Drains - Foundation, Joint, Face. All drains should be examined to determine that they are capable of performing their design function.

f. Water Passages. All water passages and other concrete surfaces subject to running water should be examined for erosion, cavitation, obstructions, leakage or significant structural cracks.

g. Seepage or Leakage. The faces, abutments and toes of the concrete structures should be examined for evidence of seepage or abnormal leakage, and records of flow of downstream springs reviewed for variation with reservoir pool level. The sources of seepage should be determined if possible.

h. Monolith Joints - Construction Joints. All monolith and construction joints should be examined to determine the condition of the joint and filler material, any movement of joints, or any indication of distress or leakage.

i. Foundation. Foundation should be examined for damage or possible undermining of the downstream toe.



j. Abutments. The abutments should be examined for sign of instability or excessive weathering.

## 2. Embankment Structures.

a. Settlement. The embankments and downstream toe areas should be examined for any evidence of localized or overall settlement, depressions or sink holes.

b. Slope Stability. Embankment slopes should be examined for irregularities in alignment and variances from smooth uniform slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond the toe, and surface cracks which indicate movement.

c. Seepage. The downstream face of abutments, embankment slopes and toes, embankment - structure contacts, and the downstream valley areas should be examined for evidence of existing or past seepage. The sources of seepage should be investigated to determine cause and potential severity to dam safety under all operating conditions. The presence of animal burrows and tree growth on slopes which might cause detrimental seepage should be examined.

d. Drainage Systems. All drainage systems should be examined to determine whether the systems can freely pass discharge and that the discharge water is not carrying embankment or foundation material. Systems used to monitor drainage should be examined to assure they are operational and functioning properly.

e. Slope Protection. The slope protection should be examined for erosion-formed gullies and wave-formed notches and benches that have reduced the embankment cross-section or exposed less wave resistant materials. The adequacy of slope protection against waves, currents, and surface runoff that may occur at the site should be evaluated. The condition of vegetative cover should be evaluated where pertinent.

3. Spillway Structures. Examination should be made of the structures and features including bulkheads, flashboards, and fuse plugs of all service and auxiliary spillways which serve as principal or emergency spillways for any condition which may impose operational constraints on the functioning of the spillway.

a. Control Gates and Operating Machinery. The structural members, connections, hoists, cables and operating machinery and the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the equipment. Where cranes are intended to be used for handling gates and bulkheads, the availability, capacity and condition of the cranes and lifting beams should be investigated. Operation of control

systems and protective and alarm devices such as limit switches, sump high water alarms and drainage pumps should be investigated.

b. Unlined Saddle Spillways. Unlined saddle spillways should be examined for evidence of erosion and any conditions which may impose constraints on the functioning of the spillway. The ability of the spillway to resist erosion due to operation and the potential hazard to the safety of the dam from such operation should be determined.

c. Approach and Outlet Channels. The approach and outlet channels should be examined for any conditions which may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.

d. Stilling Basin (Energy Dissipators). Stilling basins including baffles, flip buckets or other energy dissipators should be examined for any conditions which may pose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined.

4. Outlet Works. The outlet works examination should include all structures and features designed to release reservoir water below the spillway crest through or around the dam.

a. Intake Structure. The structure and all features should be examined for any conditions which may impose operational constraints on the outlet works. Entrances to intake structure should be examined for conditions such as silt or debris accumulation which may reduce the discharge capabilities of the outlet works.

b. Operating and Emergency Control Gates. The structural members, connections, guides, hoists, cables and operating machinery including the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the operating and emergency gates, valves, bulkheads, and other equipment.

c. Conduits, Sluices, Water Passages, Etc. The interior surfaces of conduits should be examined for erosion, corrosion, cavitation, cracks, joint separation and leakage at cracks or joints.

d. Stilling Basin (Energy Dissipator). The stilling basin or other energy dissipator should be examined for conditions which may impose any constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined by soundings.



e. Approach and Outlet Channels. The approach and outlet channels should be examined for any conditions which may impose constraints on the functioning of the discharge facilities of the outlet works, or present a hazard to the safety of the dam.

f. Drawdown Facilities. Facilities provided for drawdown of the reservoir to avert impending failure of the dam or to facilitate repairs in the event of stability or foundation problems should be examined for any conditions which may impose constraints on their functioning as planned.

5. Safety and Performance Instrumentation. Instruments which have been installed to measure behavior of the structures should be examined for proper functioning. The available records and readings of installed instruments should be reviewed to detect any unusual performance of the instruments or evidence of unusual performance or distress of the structure. The adequacy of the installed instrumentation to measure the performance and safety of the dam should be determined.

a. Headwater and Tailwater Gages. The existing records of the headwater and tailwater gages should be examined to determine the relationship between other instrumentation measurements such as stream flow, uplift pressures, alignment, and drainage system discharge with the upper and lower water surface elevations.

b. Horizontal and Vertical Alignment Instrumentation (Concrete Structures). The existing records of alignment and elevation surveys and measurements from inclinometers, inverted plumb bobs, gage points across cracks and joints, or other devices should be examined to determine any change from the original position of the structures.

c. Horizontal and Vertical Movement, Consolidation, and Pore-Water Pressure Instrumentation (Embankment Structures). The existing records of measurements from settlement plates or gages, surface reference marks, slope indicators and other devices should be examined to determine the movement history of the embankment. Existing piezometer measurements should be examined to determine if the pore-water pressures in the embankment and foundation would under given conditions impair the safety of the dam.

d. Uplift Instrumentation. The existing records of uplift measurements should be examined to determine if the uplift pressures for the maximum pool would impair the safety of the dam.

e. Drainage System Instrumentation. The existing records of measurements of the drainage system flow should be examined to establish the

normal relationship between pool elevations and discharge quantities and any changes that have occurred in this relationship during the history of the project.

f. Seismic Instrumentation. The existing records of seismic instrumentation should be examined to determine the seismic activity in the area and the response of the structures to past earthquakes.

6. Reservoir. The following features of the reservoir should be examined to determine to what extent the water impounded by the dam would constitute a danger to the safety of the dam or a hazard to human life or property.

a. Shore line. The land forms around the reservoir should be examined for indications of major active or inactive landslide areas and to determine susceptibility of bedrock stratigraphy to massive landslides of sufficient magnitude to significantly reduce reservoir capacity or create waves that might overtop the dam.

b. Sedimentation. The reservoir and drainage area should be examined for excessive sedimentation or recent developments in the drainage basin which could cause a sudden increase in sediment load thereby reducing the reservoir capacity with attendant increase in maximum outflow and maximum pool elevation.

c. Potential Upstream Hazard Areas. The reservoir area should be examined for features subject to potential backwater flooding resulting in loss of human life or property at reservoir levels up to the maximum water storage capacity including any surcharge storage.

d. Watershed Runoff Potential. The drainage basin should be examined for any extensive alterations to the surface of the drainage basin such as changed agriculture practices, timber clearing, railroad or highway construction or real estate developments that might extensively affect the runoff characteristics. Upstream projects that could have impact on the safety of the dam should be identified.

7. Downstream Channel. The channel immediately downstream of the dam should be examined for conditions which might impose any constraints on the operation of the dam or present any hazards to the safety of the dam. Development of the potential flooded area downstream of the dam should be assessed for compatibility with the hazard classification.

8. Operation and Maintenance Features.

a. Reservoir Regulation Plan. The actual practices in regulating the reservoir and discharges under normal and emergency conditions should be

examined to determine if they comply with the designed reservoir regulation plan and to assure that they do not constitute a danger to the safety of the dam or to human life or property.

b. Maintenance. The maintenance of the operating facilities and features that pertain to the safety of the dam should be examined to determine the adequacy and quality of the maintenance procedures followed in maintaining the dam and facilities in safe operating condition.



## APPENDIX III



Public Law 92-367  
92nd Congress, H. R. 15951  
August 8, 1972

### An Act

To authorize the Secretary of the Army to undertake a national program of inspection of dams.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the term "dam" as used in this Act means any artificial barrier, including appurtenant works, which impounds or diverts water, and which (1) is twenty-five feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier, if it is not across a stream channel or watercourse, to the maximum water storage elevation or (2) has an impounding capacity at maximum water storage elevation of fifty acre-feet or more. This Act does not apply to any such barrier which is not in excess of six feet in height, regardless of storage capacity or which has a storage capacity at maximum water storage elevation not in excess of fifteen acre-feet, regardless of height.

National dam inspection program.  
"Dam."

SEC. 2. As soon as practicable, the Secretary of the Army, acting through the Chief of Engineers, shall carry out a national program of inspection of dams for the purpose of protecting human life and property. All dams in the United States shall be inspected by the Secretary except (1) dams under the jurisdiction of the Bureau of Reclamation, the Tennessee Valley Authority, or the International Boundary and Water Commission, (2) dams which have been constructed pursuant to licenses issued under the authority of the Federal Power Act, (3) dams which have been inspected within the twelve-month period immediately prior to the enactment of this Act by a State agency and which the Governor of such State requests be excluded from inspection, and (4) dams which the Secretary of the Army determines do not pose any threat to human life or property. The Secretary may inspect dams which have been licensed under the Federal Power Act upon request of the Federal Power Commission and dams under the jurisdiction of the International Boundary and Water Commission upon request of such Commission.

Army, authorization.

Exceptions.

41 Stat. 1063;  
49 Stat. 863.  
16 USC 791a.

86 STAT. 506  
86 STAT. 507

SEC. 3. As soon as practicable after inspection of a dam, the Secretary shall notify the Governor of the State in which such dam is located the results of such investigation. The Secretary shall immediately notify the Governor of any hazardous conditions found during an inspection. The Secretary shall provide advice to the Governor, upon request, relating to timely remedial measures necessary to mitigate or obviate any hazardous conditions found during an inspection.

Notice to Governors.

SEC. 4. For the purpose of determining whether a dam (including the waters impounded by such dam) constitutes a danger to human life or property, the Secretary shall take into consideration the possibility that the dam might be endangered by overtopping, seepage, settlement, erosion, sediment, cracking, earth movement, earthquakes, failure of bulkheads, flashboard, gates on conduits, or other conditions which exist or which might occur in any area in the vicinity of the dam.

SEC. 5. The Secretary shall report to the Congress on or before July 1, 1974, on his activities under the Act, which report shall include, but not be limited to—

Report to Congress.

- (1) an inventory of all dams located in the United States;
- (2) a review of each inspection made, the recommendations furnished to the Governor of the State in which such dam is located and information as to the implementation of such recommendation;

**Liability.**

(3) recommendations for a comprehensive national program for the inspection, and regulation for safety purpose of dams of the Nation, and the respective responsibilities which should be assumed by Federal, State, and local governments and by public and private interests.

SEC. 6. Nothing contained in this Act and no action or failure to act under this Act shall be construed (1) to create any liability in the United States or its officers or employees for the recovery of damages caused by such action or failure to act; or (2) to relieve an owner or operator of a dam of the legal duties, obligations, or liabilities incident to the ownership or operation of the dam.

Approved August 8, 1972.

---

**LEGISLATIVE HISTORY:**

HOUSE REPORT No. 92-1232 (Comm. on Public Works).  
CONGRESSIONAL RECORD, Vol. 118 (1972):

July 24, considered and passed House.

July 25, considered and passed Senate.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 8, No. 33:  
Aug. 9, Presidential statement.







## APPENDIX E

### RESOLUTIONS OF STATE ORGANIZATIONS AND NATIONAL CONFERENCES

| Contents                                                                                                                             | Page |
|--------------------------------------------------------------------------------------------------------------------------------------|------|
| 1. Resolutions of the Engineering Foundation Conference on Inspection, Maintenance and Rehabilitation of Old Dams, 28 September 1973 | E-2  |
| 2. Resolutions of the Engineering Foundation Conference on Safety of Small Dams, 9 August 1974                                       | E-4  |
| 3. Resoltion No. 2, 47th Annual Meeting of the Association of Western State Engineers, 30 August 1974                                | E-6  |
| 4. Resoultion by the Western States Water Council Regarding Dam Safety Program, 13 October 1974                                      | E-8  |
| 5. Resolution VI, Dam Safety Act by the Southern Environmental Resources Conference 20th Annual Meeting 4-6 June 1974                | E-9  |

(COPY)

ENGINEERING FOUNDATION CONFERENCES

Engineering Foundation, 345 East 47 Street, New York, New York 10017.  
(212) 752-6800, Ext 294

CONFERENCE ON INSPECTION, MAINTENANCE, AND REHABILITATION OF OLD DAMS  
SEPTEMBER 23-28, 1973

September 28, 1973

RESOLUTIONS

Whereas there are thousands of dams in America that have been in service for decades; and

Whereas national dam safety legislation has been passed to initiate a program of safety inspection of existing dams in the public interest; and

Whereas nearly 200 Engineers and Administrators having interest and responsibilities in the dam program from all across the nation have been assembled in an Engineering Foundation Conference the week of September 23-28 at the Asilomar Conference Grounds in Pacific Grove, California, discussing programs and problems; and

Whereas the following resolutions were formulated, discussed, and approved at the Conference:

Now therefore be it resolved that:

1. That Dr. Ellis L. Armstrong, his committee and participants in the Conference be complimented for the excellent technical program that was presented and that Dr. Sandford S. Cole and his staff be complimented for supporting the Conference and arranging for the physical facilities and social events. The foreign participants should be especially thanked for traveling the long distance to share their experiences with us.
2. That the determination of the adequacy of new and old dams be based on the application of current standards and methods and that all states should establish a procedure for review of plans and specifications and the issuance of licenses for the construction of new dams and major alterations of old dams.

3. That states should have prime responsibility for inspection and regulation of non-federal dams for safety and that adequate laws should be enacted by states. These laws should include provisions for the establishment of a state program with adequate funds for implementation. For uniformity, use of the concepts of the USCOLD model for the inspection and safety of dams is suggested as a basis for these new laws and for revision of existing laws.
4. That the Corps of Engineers and the Bureau of Reclamation be requested to furnish guidelines for the inspection of dams to interested engineers and that ASCE and USCOLD be requested to establish a joint committee for continuing the development of guidelines for the inspection of dams.
5. That the National Congress and State Legislative Bodies be urged to recognize the significance of well planned and executed inspection, maintenance and repair programs for old dams and that they provide effective financial assistance for such programs to the owners and to regulatory agencies entrusted with enforcement of the programs when the need for financial assistance has been demonstrated.
6. That the proceedings of this Conference be published.
7. That an Engineering Foundation Conference be organized within the next year for the express purpose of considering the unique problems of small dams, with special emphasis on licensing, inspection, maintenance and repair of these dams.
8. That an Engineering Foundation Conference be held two years hence for evaluating the progress made on these resolutions. Also that the chairman for the organizing committee of the next conference be selected within the next 60 days by the organizing committee of this Conference.

Submitted by the

Resolution Committee:

Walter H. Price, Chairman

Dr. William Baron      Charles Boothby

E. R. Lewandowski      W. D. Oradat

Roy Winkle

Approved by unanimous vote of

the Conference participants

September 28, 1973



(COPY)

ENGINEERING FOUNDATION CONFERENCES

Engineering Foundation, 345 East 47 Street, New York, New York 10017.  
(212) 752-6800, Ext 294

CONFERENCE ON SAFETY OF SMALL DAMS, AUGUST 4-9, 1974

August 9, 1974

RESOLUTIONS

WHEREAS, the 1974 Engineering Foundation Conference on "Safety of Small Dams" has convened at New England College in Henniker, N.H. during the week of August 4-9, 1974 for the express purpose of considering the unique problems of small dams; and

WHEREAS, The Corps of Engineers report that their national inventory of dams being conducted under direction of Public Law 92-367 indicates the existence of approximately 55,000 non-federal dams in the United States; and

WHEREAS, the proceedings of the conference revealed numerous failures of small dams across the nation, resulting in loss of life and serious damage to public and private property and environmental degradation; and

WHEREAS, the proceedings of the conference confirm that the nation is experiencing rapid escalation of dam construction; and

WHEREAS, those in attendance at the conference have unanimously expressed their belief that failures of dams in the United States will continue to occur at an increasing rate unless a coordinated nationwide program is implemented for effective regulation, inspection, evaluation, rehabilitation and maintenance of non-Federal dams; and

NOW THEREFORE BE IT RESOLVED THAT:

1. That states, in carrying out the prime responsibility for inspection and regulation of non-federal dams for safety, proceed to enact the necessary legislation and to implement promptly an orderly plan, including appropriate levels of funding, for a systematic approach to the inspection, evaluation, maintenance, and rehabilitation of dams across the Nation;
2. That the Secretary of the Army, in making his recommendation to Congress for a national program of inspection of dams in compliance with PL 92-367, include a provision for federal cost sharing.

3. To further the cause for the exchange of information and experience, State agency officials charged with dam safety be encouraged to form a national association. Be it further resolved that the Chairman of this Conference form an ad hoc committee to pursue this goal.

4. That the dissemination of information addressing the issues of dam safety and its relationship to protecting the public be accelerated. Therefore, the proceedings of the conference should be published. The Engineering Joint Council be requested to use its offices to involve its member societies in the issues of dam safety. The public should be made aware by an information program developed by the professional societies to the problems of dam safety.

5. The Engineering Foundation be requested to organize a conference in 1975 as resolved by the 1973 Engineering Foundation Conference on the Inspection, Maintenance and Rehabilitation of Old Dams. This conference should serve to evaluate the progress made on the 1973 and 1974 resolutions. Additional suggested conference topics are adequate funding, legislative support, legal liabilities and evaluation criteria.

6. That Conference Chairman, Commissioner Malcolm E. Graf, his committee, and participants in the Conference be commended for the excellent technical program that was presented and that the sincere appreciation of the conferees be expressed to Dr. Sandford S. Cole and his staff for supporting the conference and arranging for the physical facilities and social events. Our appreciation is also expressed to officials of New England College and their staff for the courtesies and hospitality extended.

Submitted by the Resolution Committee:

Bob Hunt, Chairman

Leo Andronic  
Neil F. Bogner  
Foster D. Coleman

Duane G. Jelik  
Ulrich Kappus  
Stanley E. Walker

Approved by vote of the Conference  
participants:

August 9, 1974

(COPY)

47TH ANNUAL MEETING OF THE ASSOCIATION OF WESTERN  
STATE ENGINEERS

RESOLUTION NO. 2

Resolution Relating to P.L. 92-367  
Federal Dam Safety Program

WHEREAS, the enactment of P.L. 92-367 requires the Secretary of the Army, acting through the Corps of Engineers, to carry out a program of inventory and safety inspections for dams throughout the United States; and

WHEREAS, the Secretary of the Army reportedly will submit to Congress in January 1975 a report as to the results of the inventory and recommendations on a continuing program for the inspection and regulation of dams of the nation and on the respective responsibilities therein which should be assumed by federal, state and local governments and by other public and private interests; and

WHEREAS, the President has declared that "the safety of non-Federal dams should rest primarily with the states" and has directed the Secretary of the Army to utilize "the experience of those states which have effective dam safety programs" by seeking "the greatest possible degree of state participation under this legislation"; and

WHEREAS, a tentative recommendation of the Corps of Engineers is reported to be that responsibility for inspection and assurance as to safety of non-federal dams rest with the states; and

WHEREAS, the members of the Association desire to maintain and strengthen the role of the states in any dam safety program; and

WHEREAS, many states may require federal funds in order to initiate and implement the recommendations of the Secretary of the Army.

NOW, THEREFORE, BE IT RESOLVED, that the Secretary of the Army and the Corps of Engineers be strongly encouraged to emphasize in the report to Congress the primary responsibility of the states in any recommended program of inspection and regulation of non-federal dams; and

BE IT FURTHER RESOLVED, that the Secretary of the Army recommend to Congress that it is a matter of public interest and necessity that federal funds be made available to those states desiring and requiring funds for initiation and implementation of a dam safety program; and

BE IT FURTHER RESOLVED, that a copy of this Resolution be forwarded to the Secretary of the Army, the Chief of the Corps of Engineers, to each member of the Congressional Delegations and the Governors of the member states of this Association.

ADOPTED, this 30th day of August, 1974

ASSOCIATION OF WESTERN STATE ENGINEERS

Orrin Ferris, President



(COPY)

WESTERN STATES WATER COUNCIL  
COUNCIL MINUTES

Monterey, California  
October 13, 1972

RESOLUTION  
BY THE WESTERN STATES WATER COUNCIL  
REGARDING  
DAM SAFETY PROGRAM

WHEREAS, the enactment of H.R. 15951 (P.L. 92-367) requires the Secretary of the Army, acting through the Chief of Engineers, to carry out a program of safety inspections for dams throughout the United States; and

WHEREAS, The Secretary of the Army shall, by July 1, 1974, make recommendations to Congress for the inspection and regulation of dams of the nation, and the respective responsibilities which should be assumed by Federal, State, and local governments and by public and private interests; and

WHEREAS, The President of the United States had stated that, "The safety of non-Federal dams should rest primarily with the States," and that "Some states are already conducting effective safety programs," and

WHEREAS, The President has directed the Secretary of the Army to utilize "The experience of those States which have effective dam safety programs" by seeking "the greatest possible degree of State participation under this legislation," and

WHEREAS, it is the desire of the Western States Water Council that the dam safety inspection programs remain a prime responsibility of the states,

NOW THEREFORE BE IT RESOLVED that the Corps of Engineers maximize the use of existing State programs and initiative by:

- (1) Developing criteria of inspection and programming in harmony with existing State programs and criteria;
- (2) Allowing States, where practicable, to perform Safety inspections under contracts with the Secretary of the Army;
- (3) Assisting in the enhancement, strengthening, and (where lacking) the formulation and initiation of State dam safety programs

So that the Secretary of Army may provide Congress and the Governors a meaningful report by July 1, 1974.



(COPY)

SOUTHERN ENVIRONMENTAL RESOURCES CONFERENCE 20TH ANNUAL MEETING  
JUNE 4-6, 1974

VI. DAM SAFETY ACT

WHEREAS, the Dam Safety Act, Public Law 92-367, directs the Corps of Engineers to prepare an inventory and make an inspection of certain non-Federal dams; and

WHEREAS, it is the policy for the States to be allowed to contract with the Corps of Engineers to carry out these inventory and inspection responsibilities:

NOW, THEREFORE, BE IT RESOLVED by the Southern Environmental Resources Conference that Congress be urged to provide the necessary funds to the Corps of Engineers to complete the inventory and inspection responsibilities assigned by the Dam Safety Act; and

BE IT FURTHER RESOLVED that those States without adequate provisions in their existing laws be encouraged to enact the laws necessary to obtain remedial action by an administrative agency for any dams found to be unsafe.





UNIVERSITY OF ILLINOIS-URBANA  
627.8UN32N C001 V001  
NATIONAL PROGRAM OF INSPECTION OF DAMS\$W



3 0112 008449503