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SAFETY OF DAMS

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HEARING

BEFORE THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

NINETY-SECOND CONGRESS

SECOND SESSION

ON

S. 3449

TO AUTHORIZE AND DIRECT THE WATER RESOURCES COUNCIL TO COORDINATE A NATIONAL PROGRAM TO INSURE THE SAFETY OF DAMS AND OTHER WATER STORAGE AND CONTROL STRUCTURES, TO PROVIDE TECHNICAL SUPPORT TO STATE PROGRAMS FOR THE LICENSING AND INSPECTION OF SUCH STRUCTURES, TO ENCOURAGE ADEQUATE STATE SAFETY LAWS AND METHODS OF IMPLEMENTATION THEREOF, AND FOR OTHER PURPOSES

JULY 20, 1972



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THE HISTORY OF THE

REPUBLIC OF THE UNITED STATES

OF AMERICA

The history of the Republic of the United States of America is a story of growth and progress. It begins with the first settlers who came to the shores of the continent in search of a new life. They found a land of vast potential, but also one of hardship and struggle. The early years were marked by the fight for independence from British rule, a fight that culminated in the signing of the Declaration of Independence in 1776. This was followed by the drafting of the Constitution, which established the framework of the new nation. The years that followed were a period of rapid expansion and development. The United States grew from a small collection of colonies to a vast, powerful nation. It was a time of great achievement, but also of great challenge. The nation faced numerous wars, both internal and external, and it was through these struggles that it emerged as a more unified and resilient people. The history of the United States is a testament to the power of the human spirit and the ability of a nation to overcome adversity and build a better future for itself. It is a story that continues to inspire and guide us today.

SAFETY OF DAMS

THURSDAY, JULY 20, 1972

U.S. SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The committee met, pursuant to notice, at 10 a.m., in room 3110, New Senate Office Building, Hon. Frank E. Moss presiding.

Present: Senator Moss.

Also present: Daniel Dreyfus, professional staff member.
Senator Moss. The hearing will come to order.

OPENING STATEMENT OF THE CHAIRMAN

This is a hearing on S. 3449. The purpose of this hearing before the Committee on Interior and Insular Affairs this morning is to take testimony on S. 3449, a bill to authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures, to provide technical support to State programs for the licensing and inspection of such structures, to encourage adequate State safety laws and methods of implementation thereof, and for other purposes.

In recent months, this Nation has experienced a series of tragic floods. On February 26, the most disastrous flood in West Virginia's history swept through the Buffalo Creek Valley. At least 118 lives were lost—the exact total may never be known—damage exceeded \$50 million, and 4,000 people were left homeless.

The intensity of the Buffalo Creek flood had been increased from that of an average 10-year-frequency flood to about 40 times the intensity of a 50-year-frequency flood because of the failure of dams constructed of coal waste in connection with a mining operation.

In June, over 200 people were killed by a flood in the vicinity of Rapid City, S. Dak. Again, the severity of the damage was greatly increased by the failure of the Canyon Lake Dam. Meanwhile, the city of Sturgis, S. Dak., narrowly escaped destruction when the imminent failure of the abandoned Fort Mead Dam above the town was discovered and forestalled by emergency action.

The recent record hurricane rains along the eastern seaboard presented dozens of occasions of failures, partial failures, or threats of failures of water impoundments.

These occurrences point up the grim fact that there are innumerable dams in existence throughout the United States which are under no effective public control to insure that they were competently designed and constructed initially, that they are being adequately inspected and maintained, or that the design remains adequate under current hydrologic conditions in the watershed.

The safety of these impoundments should be a matter of great concern to public officials. The security of life and property below the reservoirs depends upon professionally competent design and construction supervision, and programs for regular inspection and maintenance of completed structures. Unfortunately, there is no uniformity among State laws regulating dams.

In July of 1966 the U.S. Committee on Large Dams surveyed existing State law and reported that the majority of the States either had not enacted laws adequate to safeguard the public or did not fully support the laws already enacted. In 1969 the same body prepared and circulated a model State law for State supervision of safety of dams and reservoirs.

As is often the case, however, most States have small water resources staffs which are already overburdened with a variety of duties regarding water supply, water quality control, and other water resource responsibilities. If an expedited program of inspection of all non-Federal impoundments nationwide is to be carried out by the States, as it should be, the expertise and manpower of the Federal agencies which have engineering competence and which are leaders in the field of hydraulic structures must be mobilized to assist in the effort.

The purpose of S. 3449 is to make the technical expertise of the Federal water resource development agencies available to assist the States in establishing and implementing State programs of licensing and inspection to insure the safety of dams and other water storage and control structures. The bill was introduced by Senator Jackson. He has thus far been joined by 18 cosponsors including myself.

The reports of the executive agencies, which were received by the committee yesterday, are in general opposition to providing Federal support to assist the States with this problem.

Although the dimensions of the problem can only be guessed at, the existence of a serious threat to life and property seems undeniable. We are hoping today to receive constructive suggestions of effective measures to deal with an unacceptable situation.

The text of S. 3449 and the executive communications from the Water Resources Council and the Office of Management and Budget will be inserted in the record at this point.

(The documents referred to follow:)

92^D CONGRESS
2^D SESSION

S. 3449

IN THE SENATE OF THE UNITED STATES

APRIL 4, 1972

Mr. ROBERT C. BYRD (for Mr. JACKSON) introduced the following bill; which was read twice and referred to the Committee on Interior and Insular Affairs

A BILL

To authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures, to provide technical support to State programs for the licensing and inspection of such structures, to encourage adequate State safety laws and methods of implementation thereof, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 That this Act may be cited as the "National Safety of Dams
4 Act".

5 SECTION 1. Congress, recognizing the responsibility
6 of the Federal Government and the governments of the
7 several States to provide for the public welfare, finds—

1 (a) that provisions for the licensing and inspection
2 by the States of the construction and operation of struc-
3 tures for the storage and regulation of water vary widely
4 among the several States and in a number of States are
5 inadequate to insure the safety and welfare of the public;

6 (b) that even in States which do provide for State
7 licensing and inspection of such structures, there fre-
8 quently are not adequate funds, personnel, and technical
9 ability to maintain an adequate schedule of inspection of
10 dams and other water control structures with the fre-
11 quency and detail necessary to insure their safety;

12 (c) that the Federal Government has accepted re-
13 sponsibilities for broad public protection from floods in
14 programs for the direct Federal construction of flood
15 control and waterway improvement works, Federal
16 financial assistance for the construction of flood control
17 works by others, regulation of the construction of im-
18 poundments on navigable streams, and programs of dis-
19 aster relief for areas affected by floods;

20 (d) that the Federal water resource development
21 agencies possess technical competence in every aspect of
22 design, construction, operation, and safety of water stor-
23 age and control structures which need not and probably
24 cannot be duplicated at the level of State government;
25 and

1 (e) that the necessity for an expedited national pro-
2 gram to insure the safety of water storage and control
3 structures has been recently and tragically demonstrated
4 in the cost of lives lost and property damaged and in
5 reports which document the lack of safety in many such
6 structures throughout the Nation.

7 SEC. 2. To implement an expedited national program to
8 insure the safety of water storage and control structures, the
9 Secretaries of the Interior, Army, and Agriculture, acting
10 through the Water Resources Council, are authorized and
11 directed to develop a program of technical assistance for the
12 support of State programs for the licensing and inspection of
13 non-Federal dams and other water storage and control struc-
14 tures. The existing technical personnel and facilities of the
15 Bureau of Reclamation and Geological Survey, the Army
16 Corps of Engineers, and the Soil Conservation Service shall
17 be made available as otherwise provided in this Act to imple-
18 ment this program.

19 SEC. 3. Upon the establishment of the program author-
20 ized by section 2, and upon written application by the Gov-
21 ernor of a State to the Water Resources Council (herein-
22 after referred to as the "Council"), the Council shall, in
23 consultation with State officials designated by the Governor,
24 prepare a technical assistance plan to insure the safety of
25 water storage and control structures in the State. Federal

1 assistance provided under the plan may include any or all
2 of the following functions:

3 (a) technical review and recommendations to the
4 appropriate State official concerning the adequacy of the
5 designs of water storage and control structures which are
6 proposed for State licensing or are currently under
7 construction;

8 (b) field inspection of existing water storage and
9 control structures and recommendations to appropriate
10 State officials concerning the safety of such structures
11 and remedial measures required to protect life and prop-
12 erty from any inadequacies found therein;

13 (c) technical assistance to State officials on specific
14 problems arising from State licensing and inspection of
15 water storage and control structures; and

16 (d) technical assistance to State officials on the
17 development of general criteria for the design, construc-
18 tion, operation, and maintenance of water storage and
19 control structures.

20 SEC. 4. No State shall be eligible for assistance

21 SEC. 4. No State shall be eligible for assistance under this
22 Act until it has shown to the satisfaction of the Council that—

23 (a) the State requires by law that the construction
24 of new water storage and control structures, as defined in
25 this Act, and the modification, enlargement, and removal

1 of such existing structures must be approved in writing
2 by an appropriate State agency having engineering com-
3 petence;

4 (b) The State provides by law for the inspection by
5 a State official having engineering competence of water
6 storage and control structures during construction and of
7 existing structures periodically during operation;

8 (c) the State by law provides authority to an ap-
9 propriate State official having engineering competence to
10 suspend construction work, to restrict operation, and to
11 require repairs or modifications of water storage and con-
12 trol structures for the protection of life and property;

13 (d) the State provides by law or regulation a pro-
14 cedure acceptable to the Water Resources Council for
15 prompt and adequate consideration of complaints to the
16 State by citizens who are or claim to be endangered or
17 damaged by water storage and control structures; and

18 (e) the Governor of the State has designated a
19 State official with engineering competence to administer
20 the State laws and to represent the State in cooperation
21 with the Council pursuant to this Act.

22 SEC. 5. Nothing in the Act shall add to or detract from
23 the legal responsibility of the United States for damages
24 caused by the partial or total failure of any water storage or
25 control structure.

1 SEC. 6. For the purposes of this Act:

2 (a) A "water storage or control structure" means any
3 artificial barrier including appurtenant works which does
4 or will impound or divert water and which (1) is or will be
5 twenty-five feet or more in height above the natural stream-
6 bed or from the lowest elevation of the base of the barrier to
7 the maximum elevation of impounded water, or (2) has or
8 will have a maximum impounding capacity of fifty acre-feet
9 or more, or (3) is a conveyance work designed to pass
10 flood flows for the purpose of protecting life or property:
11 *Provided*, That barriers which either are less than six feet in
12 height or have a maximum impounding capacity of less than
13 fifteen acre-feet shall be excluded: *Provided further*, That
14 "water storage or control structure" shall not include any
15 structure constructed, operated, or owned by the United
16 States.

17 (b) A "State" includes the District of Columbia, Puerto
18 Rico, and the territories of Guam, American Samoa, and the
19 Virgin Islands.

20 SEC. 7. The Water Resources Council is authorized to
21 make such rules and regulations as it may deem necessary or
22 appropriate for carrying out the provisions of this Act.

23 SEC. 8. There are authorized to be appropriated to the
24 Water Resources Council not more than \$5,000,000 annually

- 1 for the five fiscal years beginning with the fiscal year of
- 2 the date of enactment of this Act for the administration and
- 3 for transfer to the agencies enumerated in section 2 of this
- 4 Act to carry out the purposes of this Act.

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., July 19, 1972.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate,
Washington, D.C.

DEAR MR. CHAIRMAN: This responds to your request for the views of this Department on S. 3449, a bill "To authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures, to provide technical support to State programs for the licensing and inspection of such structures, to encourage adequate State safety laws and methods of implementation thereof, and for other purposes."

We recommend that the bill not be enacted.

S. 3449 provides for a Federal program of technical assistance concerning dam safety which would be administered through the Water Resources Council to the States. Technical personnel of the Bureau of Reclamation and Geological Survey of this Department, together with the Army Corps of Engineers and the Agriculture Department's Soil Conservation Service would be available to carry out the program and \$5 million would be authorized to be appropriated over five fiscal years. Assistance provided under the bill would be conditioned upon a State showing that (a) construction or change in water storage and control structures must be approved by an appropriate State agency, (b) State law provides for regular adequate dam inspection, (c) State law contains adequate authority to suspend work on or require repair or modification of such structures, (d) citizen complaints about such structures will be adequately considered, and (e) a State official with engineering competence has been designated to administer the State laws and represent the State in cooperation with the Water Resources Council. The United States would continue its existing responsibility for Federal water storage or control structures.

This Department concurs in the view underlying the bill that increased attention should be given to assuring the safety of dams. We have directed continuing efforts toward assuring the safety of Federal dams under purview of this Department, and we are working with the Departments of the Army and of Agriculture and other agencies concerned with safety for all Federal dams. However, our joint efforts have not reached the point where this Department is prepared to make recommendations to this Committee.

Non-Federal dams also should receive increased attention. At present some States do not have effective programs for licensing and inspection of water shortage and control structures. Modern meteorological and hydrological techniques plus additional years of precipitation and runoff experience may reveal that the maximum probable floods at some dams are substantially greater than estimated when the structures were designed and constructed. Many non-Federal dams have been inadequately engineered and have not been periodically maintained or inspected.

We feel, however, that safety of non-Federal dams is primarily a State responsibility. S. 3449 recognizes this but would encourage States to assume that responsibility by offering Federal technical assistance on a non-reimbursable basis.

We do not know at this time enough about the dimensions of the non-Federal dam problem to determine the extent of Federal involvement, if any, which may be justified. Technical assistance of the type contemplated is generally available from Federal agencies or from private consultants. Rather than establish another narrow Federal assistance program, we urge Congress to enact the President's revenue sharing bills which would make funds available to States and allow the States to establish priorities within broad categories.

The Office of Management and Budget has advised that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely yours,

JAMES R. SMITH,
Assistant Secretary of the Interior.

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF MANAGEMENT AND BUDGET,
Washington, D.C., July 18, 1972.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This is in reply to your letter of April 28, 1972, requesting the views of the Office of Management and Budget on S. 3448, a bill "To authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures, to provide technical support to State programs for the licensing and inspection of such structures, to encourage adequate State safety laws and methods of implementation thereof, and for other purposes."

Assuring the safety of dams is a commendable objective. Dam safety is a problem in some instances, as evidenced by recent failures. However, it is not clear to us that legislation extending Federal responsibility to a new program area as contemplated by S. 3449 is necessary or desirable. Further information is needed on the scope of this problem, the relative effectiveness of programs conducted by the individual states, and the costs and benefits of alternative approaches to the problem.

At present, non-Federal owners are subject to State regulation in most cases, and are responsible for the construction, operation, and maintenance of their water control and retention structures; they are ultimately responsible for the safety of such structures. In maintaining safety, they have access to the engineering advice and consultation of both Federal and non-Federal entities.

This Administration is deeply concerned about the matter of dam safety. We believe, however, that this existing mechanism, under the leadership of the States, should meet the problem.

For the reason stated above, the Office of Management and Budget does not favor enactment of S. 3449.

Sincerely,

WILFRED H. ROMMEL,
Assistant Director for Legislative Reference.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D.C., July 20, 1972.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate.

DEAR MR. CHAIRMAN: This is in response to your letter of April 28, 1972, requesting a report on S. 3449, a bill cited as the "National Safety of Dams Act."

The bill authorizes and directs the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures, to provide technical support to state programs for the licensing and inspection of such structures, and to encourage adequate state safety laws and methods of implementation.

The Department of Agriculture does not favor enactment of the proposed legislation at this time. The scope of the problem and the area of applicability are unknown. Moreover, the safety of non-federal dams should remain a responsibility of the state. Enactment of this bill would shift certain of these responsibilities to the federal government without substantive analysis, for instance, of the adequacy of existing programs conducted by the states.

The Office of Management and Budget advises there is no objection to submission of this report from the standpoint of the Administration's program.

Sincerely,

T. K. COWDEN, *Assistant Secretary.*

U.S. WATER RESOURCES COUNCIL,
Washington, D.C., July 9, 1972.

HON. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This is in reply to your letter of April 28, 1972, requesting that the Council study and report on S. 3449, "National Safety of Dams Act."

While recognizing that a safety of dams problem exists in some areas, the Council does not favor enactment of the bill at this time. Safety of non-Federal dams is currently a State responsibility and the Council does not see enough evidence for the Federal Government to undertake an expanded program as authorized by the bill.

The Council feels that there are too many unknowns and uncertainties as to the magnitude and scope of the programs proposed in the bill. More information is needed concerning the number of water storage and control structures and the safety problems involved before we assess the nature of the amount and type of assistance they need. More information is also needed as to the adequacy of existing State programs and alternatives to strengthening these programs.

The Office of Management and Budget has advised that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely yours,

ROGERS C. B. MORTON, *Chairman.*

Senator Moss. We have several very important witnesses to hear from today. We have a difficult floor situation with votes that will be coming on and it is going to be necessary to expedite the hearing and also there will be times when we have to take a recess as the members of the committee are required to go to the floor and vote on matters that are now on the floor.

Incidentally, this is one of the very few hearings that will be held in the remainder of this session. The Senate decided that beginning next week, without some special occasion for which permission must be obtained from the two leaders, hearings would not be permitted to be held during the time the Senate is in session.

Since we go in at 9 o'clock every morning, that pretty well precludes public hearings for the remainder of this session of the Congress.

We have three or four witnesses from the Federal agencies and I think we will have all of those gentlemen come to the table together.

Mr. W. Don Maughan, Director of Water Resources Council; Gen. John W. Morris, Director of Civil Works of the Corps of Engineers; Mr. Keating, Acting Commissioner of Reclamation, and Mr. William B. Davey, Deputy Administrator for Field Services, Soil Conservation Service, and he will be accompanied by Neil F. Bogner.

Will you gentlemen come to the table and perhaps proceed with your statements and any questions can be directed to the specific witness that has the background to answer that specific question.

STATEMENTS OF W. DON MAUGHAN, DIRECTOR, WATER RESOURCES COUNCIL; MAJ. GEN. JOHN MORRIS, DIRECTOR OF CIVIL WORKS, CORPS OF ENGINEERS; WILLIAM H. KEATING, ACTING COMMISSIONER OF RECLAMATION; ACCOMPANIED BY M. N. LANGLEY AND ROY H. BOYD; WILLIAM B. DAVEY, DEPUTY ADMINISTRATOR FOR FIELD SERVICES, SOIL CONSERVATION SERVICE, ACCOMPANIED BY NEIL F. BOGNER, ASSISTANT DIRECTOR, ENGINEERING DIVISION, SOIL CONSERVATION SERVICE

Senator Moss. We will start off with Mr. Don Maughan from my home State, who is Director of the Water Resources Council.

Will you proceed, Don?

STATEMENT OF W. DON MAUGHAN

Mr. MAUGHAN. Thank you very much, Chairman Moss.

I do have a short statement which I will read. I appear on behalf of the Water Resources Council at Chairman Rogers C. B. Morton's request.

S. 3449 would authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures. The Council's statutory responsibilities at present include coordinating Federal water and related land resources efforts and assisting the States to improve their own capability in water and related land programs.

The Secretaries of Interior, Army, and Agriculture, who are members of the Council, are designated in S. 3449 to implement an expedited national program to insure the safety of water storage and control structures.

Specifically, the bill would provide technical support to State programs by drawing upon the expert capability of the Departments of Interior, Army, and Agriculture, through a program coordinated by the Council. The Council mechanism would also be used to encourage adequate State safety laws and methods of implementation.

Since the Council was set up in 1965, it has established working relationships with all 50 States, the District of Columbia, and Puerto Rico. The Council has found that the States have grown substantially in their water program capability in a relatively short period of time—particularly in planning and policymaking. They have also shown a growing willingness to do a better job in all areas under their jurisdiction.

Since safety of non-Federal dams and water storage and control structures is currently under the States jurisdiction and responsibility, we are reluctant to see any program started to assist the States until the State views are carefully considered.

The Council is aware of problem areas in dam safety, but we do not believe there is sufficient showing of such a lack of State capacity that the Federal Government must undertake the expanded programs on a national basis that would be authorized by the bill at this time.

The Council would like to have more information than is presently compiled before decisions are made as to the nature of the amount and type of assistance the States might need. We feel, further, that the States themselves should examine what alternatives are available to strengthening their programs on dam safety, with or without Federal assistance, before the Federal and State Governments are committed to a specific course of action and a specific means of assistance. At present, we are simply unable to make a reliable estimate of how much Federal assistance might be needed to satisfy the objectives of the bill.

Accordingly, the Council does not favor enactment of S. 3449 at this time.

Thank you for extending the invitation to the Council to appear at this hearing.

Senator Moss. Thank you, Mr. Maughan, for bringing that report to us and as I indicated we will hear from the other Federal witnesses and perhaps there will be some questions that we want to ask.

General Morris, we will hear from you now, sir.

STATEMENT OF GEN. JOHN W. MORRIS

General MORRIS. Mr. Chairman, and members of the committee. I am Maj. Gen. John W. Morris, Director of Civil Works, Office of the Chief of Engineers.

I appreciate the opportunity to testify before you today on S. 3449 which would provide for a national program to insure the safety of dams and other water storage and control structures.

This bill would authorize the Secretaries of Interior, Army, and Agriculture, acting through the Water Resources Council, to develop a program of technical assistance for the support of State programs for the licensing and inspection of non-Federal dams and other water storage and control structures. The Water Resources Council would, upon written request of the Governor of a State and in consultation with State officials designated by the Governor, prepare a technical assistance plan to insure the safety of water storage and control structures in the State. A State would not be eligible for assistance unless it had enacted laws and established procedures governing the safety of such structures as specified in the bill.

The Corps of Engineers is fully aware of the problems associated with dam safety, and shares the concern of the committee. We feel, however, that the safety of non-Federal dams is first a State responsibility and before any new Federal program is established, further information as to the scope of the problem and the capabilities of the States is needed. Without such information, we cannot define the extent of the Federal interest in this matter and the type of assistance which might be needed. For these reasons, we do not favor enactment of the bill at this time.

Mr. Chairman, that concludes my statement. I will be pleased to answer any questions the committee may have.

Senator Moss. Thank you, General. I think we will have a question or two to ask you to answer.

I want, though, to get the other statements in.

Mr. Keating, we will hear from you next.

STATEMENT OF W. H. KEATING

Mr. KEATING. Thank you, Mr. Chairman.

I am Bill Keating, Assistant Commissioner of the Bureau of Reclamation.

I want to express the regrets of Commissioner Ellis Armstrong, as he would have liked to have attended this session, but was prevented by a previous commitment to be at a House hearing. I want to thank you for this opportunity to appear before you today to discuss the Department's views on S. 3449, a bill to authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures.

The Department's concern regarding safety of dams was expressed to this committee by Reclamation Commissioner Armstrong during the hearings on the Brantley project on January 25, 1972. At that time we advised you that we were consulting with other Federal agencies responsible for construction of dams or operation of reservoirs

to see if a general agreement could be reached among them on approaches to use for improving dam safety including uniform dam safety standards for all dams.

S. 3449 recognizes the need for uniform dam safety standards for all States. It provides for technical assistance from Federal water resource development agencies through direct coordination of the Water Resources Council. Such technical advice could be provided by the Bureau of Reclamation, the Geological Survey, the Army Corps of Engineers, and the Soil Conservation Service only if a State has established by law an appropriate agency staffed with personnel of competent engineering capabilities to administer a safety of dams program that would be authorized under this bill.

The Department concurs in the view underlying the bill that increased attention should be given to assuring the safety of dams. We have directed continuing efforts toward assuring the safety of Federal dams under the purview of this Department and we are working with the Departments of the Army and of Agriculture and other agencies concerned with safety for all Federal dams. However, our joint efforts have not reached the point where this Department is prepared to make recommendations to this committee.

Non-Federal dams also should receive increased attention. At present some States do not have effective programs for licensing and inspection of water storage and control structures. Modern meteorological and hydrological techniques plus additional years of precipitation and runoff experience may reveal that the maximum probable floods at some dams are substantially greater than estimated when the structures were designed and constructed. Many non-Federal dams have been inadequately engineered and have not been periodically maintained or inspected.

We feel, however, that safety of non-Federal dams is primarily a State responsibility. S. 3449 recognizes this but would encourage States to assume that responsibility by offering Federal technical assistance on a nonreimbursable basis.

We do not know at this time enough about the dimensions of the non-Federal dam problem to determine the extent of Federal involvement, if any, which may be justified. Technical assistance of the type contemplated is generally available from Federal agencies or from private consultants. Rather than establish another narrow Federal assistance program, we urge Congress to enact the President's revenue sharing bills which would make funds available to States and allow the States to establish their spending priorities within broad categories.

Another point of concern to us is the requirement under the bill that the Federal agencies provide the needed technical assistance with existing personnel and facilities. If several States should request help, it could be provided only by dropping or deferring some of the ongoing or planned water resource development programs already authorized.

The inventory process alone of determining what dams should be considered is a major undertaking. The Bureau of Reclamation is already limited on personnel to carry out its own safety of dams program initiated in 1966.

Under this program, we have determined that 81 of the more than 240 Reclamation dams require special safety studies. A very cursory survey of storage structures in areas upstream from Reclamation reservoirs indicates that conditions at more than 300 non-Federal dams must be analyzed as to their possible failure in order to consider such factors in insuring the safety of Reclamation's dams. We do not know the total number that would be included by this measure, but it undoubtedly would number in the thousands.

In those instances where unsafe conditions exist in dams within our jurisdiction, reservoir operations are modified to provide more safety. Additionally, flood-warning networks have been established whereby appropriate Federal, State and local agencies can be provided advance notice of major flooding or possible dam failures.

In addition to the potential loss of life from failure of a dam, the breaching and abandonment of an unsafe dam would result in other damages and loss of benefits (flood control, recreation, fish and wildlife, and esthetic conditions surrounding a lake) to the general public, as well as to the dam owners and water user contractors.

Thank you.

Senator Moss. Thank you very much, Mr. Keating, for your statement. I will have some questions to put to you, but I would like to hear from Mr. Davey first in the Soil Conservation Service.

STATEMENT OF WILLIAM B. DAVEY

Mr. DAVEY. Thank you, Mr. Chairman; I am William Davey, Deputy Administrator for Field Services, U.S. Department of Agriculture, Soil Conservation Service.

I appreciate the opportunity to appear before you, and present the views of the Department of Agriculture on S. 3449, a bill cited as the National Safety of Dams Act.

The bill would authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures, to provide technical support to State programs for the licensing and inspection of such structures, and to encourage adequate State safety laws and methods of implementation.

Increasingly, the matter of dam safety has been subjected to public scrutiny and the adequacy of programs to assure the safety of non-Federal dams has been questioned.

The Department of Agriculture has long been concerned with the safety of dams and other water storage and control structures. For those programs for which the Department has responsibility, designs, standards, and specifications fully reflect this concern. Upon request and on a case-by-case basis, the engineering expertise of the Department is made available to non-Federal interests, providing advice and consultation on small watershed hydrology, design, correction of deficiencies and the like. Assistance has also been given to some State agencies in formulating licensing and inspection of one sort or another.

While acknowledging that dam safety is an important objective, the Department of Agriculture does not favor enactment of S. 3449 at this time.

The scope of the problem and the area of applicability are unknown. Moreover, the safety of non-Federal dams is, and should remain, a responsibility of the States. Enactment of this bill would shift certain of these responsibilities from the States to the Federal Government and would be done without substantive analysis of the adequacy of existing programs conducted by the States.

Mr. Chairman, accompanying me is Mr. Neil Bogner, Assistant Director of the Engineering Division, Soil Conservation Service. If you have questions of a technical nature, we would be pleased to respond to them.

Senator Moss. Thank you and we are glad Mr. Bogner is here.

I notice in the testimony of all the Federal witnesses, it is generally the same and there is a recurring pattern that it is a State responsibility and therefore ought to be left with the States. But that is exactly the point, I think. When Buffalo Creek Dam goes out and there is a loss of life and a lot of damage, immediately the Federal Government comes in to try to repair as much of that damage as possible.

We can't restore life, of course, but we are called upon for a billion dollars or some amount like that and nobody turns around and just says, "Well, that is the responsibility of West Virginia." It is the responsibility of the Federal Government. And we all have a responsibility where life is threatened.

Now, I want to ask some questions to see if maybe we aren't just sidestepping this. I heard one of the witnesses say if we had revenue-sharing and hand the money out to the States, they would do it. But I don't know if that is an adequate answer here.

Mr. Maughan, are you aware of the report published by the Committee on Large Dams in 1966, on the supervision of dams by State authorities?

Mr. MAUGHAN. I am aware of it, Mr. Chairman.

Senator Moss. That report shows with few exceptions, there is gross inadequacy in the attention of the States to the construction and maintenance of dams. Has this situation changed appreciably since that report was published?

Mr. MAUGHAN. From personal knowledge and a little bit of review, the State of Tennessee in 1971, December to be exact, made another survey of the statutes. They did not survey the effective necessity of the programs in the State and they found I think, a number of States who did not have adequate programs in 1966 and do have them now. In other words, I think the swing is toward improvement, but just how much, I can't tell you.

Senator Moss. Has your agency recently reviewed the State laws and capabilities in this area?

Mr. MAUGHAN. No, Mr. Chairman, we haven't directly. I have made some informal contacts with a number of States and I have some personal knowledge.

This University of Tennessee study which is the most recent one that comes to our attention, does indicate there are about 41 States with some sort of statutes already available.

Senator Moss. You say in your statement, you would like to have more information than is presently compiled. What efforts are being made to get that additional information?

Mr. MAUGHAN. Nothing specifically on a formal matter, until this hearing came up.

The administration's position had to be worked out before the council would undertake any specific efforts in any direction. We have under our title III grant program, noticed that some of the States have used to a limited extent, some of the funds for that purpose to do some safety work. The State of Connecticut, for instance. But we have not taken any broad-scale effort to do this, Mr. Chairman.

Senator Moss. Well, can any of you gentlemen tell me what the executive branch is doing to develop viable alternatives to S. 3449? Is this simply a problem to pass off to the States, or are you willing and able to do something?

Mr. MAUGHAN. It is my understanding in a number of cases, and West Virginia is one of them, there have been some efforts by the Corps of Engineers, for instance, to help the State of West Virginia out in its inspection program to some degree, and there are other efforts to do this in certain areas.

General MORRIS. Following the Buffalo Creek tragedy, there was a specific instruction to the corps to join with the State in reviewing all of the types of structures similar to the one at Buffalo Creek that had been processed and reaching a conclusion.

Senator Moss. What capability did you find in the State of West Virginia to take care of this matter on its own, without the intervention of the corps?

General MORRIS. Mr. Chairman, I would like to supply more definitive information, but my general understanding is that the State of West Virginia needed our help very much to do this.

Senator Moss. In general, without being too specific, did you find they had very limited personnel and rather limited expertise in this field?

General MORRIS. In view of the largeness of the problem, to deal with it in a short period of time, they definitely needed help. If it had not been for the emergency on a more deliberate basis, I feel the State of West Virginia might have done this.

Senator Moss. Well, we have had a situation in Utah recently. There is an old CCC dam that was built on Cold Creek above Cedar City. When we had a very heavy flash flood situation down there, we began to have concern about this earthen structure on Cold Creek and the dam seemed to be definitely deteriorated, and a flood hazard, but when the officials of Cedar City tried to get help, they couldn't find anybody who would assume the responsibility.

It had been built by the Federal Government, but long since had been removed from the jurisdiction of Federal maintenance of dams and there it was in the State.

Our State has limited capacity in this area, too, although I imagine we have more expertise than a great many States, and we do have an effective water and power board that oversees the building of dams. But here we were just left with a threat above one of our sizable cities out there.

General MORRIS. It is my understanding, Mr. Chairman, that the debris detention structure is being corrected with assistance from our office, as well as local. On West Virginia, that is one of the States that

does have good legislation dealing with the design construction and inspection and maintenance of structures. The question of capability is the one I was addressing, not law.

Senator Moss. Well, I am glad to have that report and certainly one of the things we ought to have help on is encouraging the States to have adequate legislation for licensing, inspection and maintenance of dams and enough expertise and personnel to do the job effectively.

A bursting of a dam is a good example of the old saw of closing the barn door after the horse is gone. The thing to do is to do the work ahead of time, because the results are so disastrous.

Mr. Davey, in your testimony you said the scope of the problem and the area of applicability are unknown. Well, how are we going to find out the area of the problem and the area of applicability?

Mr. DAVEY. We have some statements of the total number of dams across the country of the size that normally the Department of Agriculture deals with.

In the area of floodwater retarding, and multipurpose dams, a small watershed-type of situation, we have statement there are some 16,860 of these types of structures out there, of which some 5,800 had been installed under Public Law 566.

In the area of the farm-bond-type situation, some of which are responsibly sizable, there are better than 1,800,000. What we don't know is how many of these represent any sort of hazard. This is the difficult part of the situation. We have, as I say, some reasonable statements of the number, but it is only a judgment statement as to whether 10 percent, 40 percent, 60 percent would represent a hazard.

This is the area of applicability aspect and the total scope which gives us problems in statementing what actually would be required to even make an inventory.

Senator Moss. You also say enactment of this bill would shift certain responsibilities from the States to the Federal Government. How would it shift the responsibility if you were simply a consultant giving technical advice and assistance to the States?

Mr. DAVEY. Well, it would also, if I recall, indicate something in the nature of an inventory, onsite loss at this type of structure, judgment statements as to the concern of safety and the like, all of which would be done here by Federal people and not necessarily by State people. This is the area of shift which we indicated.

Senator Moss. Well, do you concur in the rather basic premise of this bill that a large body of expertise in this field of hydraulic structures and impoundment rests in the Federal Government, in the Federal departments and relatively less exists among the States?

Mr. DAVEY. Yes; I think the Federal departments have a greater overall capability, both in the point of view of numbers and perhaps experience in some areas.

Senator Moss. The thrust then of this legislation, what we are attempting to do, of course, is to bring into play this expertise in a safety measure without transferring the responsibility. Of course, the State has the responsibility and always will for the safety of its own citizens, and or matters within the State.

They even assume some responsibility if it is a Federal structure. The State has some police power responsibility that attaches all the time.

Mr. DAVEY. Yes. As a matter of fact, our Public Law 566 structures really are non-Federal. They are transferred for operation and maintenance to local sponsors and do not represent any Federal impoundment as such.

Senator MOSS. Well, the thing that bothers me, it seems to me in general, is that we are simply saying, it is kind of tough, and when there is a specific assignment as was given to the corps in West Virginia, we are still going to let the States rock along; some of them doing a good job and some of them not so good. Probably some of them doing very little, although Maughan says it is improving. It is better now than it was in 1965 when that report of the Large Dams Committee was compiled.

The series of events that we have had this year have been unusual for its amount of precipitation, but that is what you have to be ready for, the unusual. We have been having troubles to the point where we are alarmed and think we have to do something.

Mr. Keating, on page 2, you note that the executive branch, after some years of consultation, is not yet prepared to recommend a policy for the safety of federally owned and operated dams. The Senate recently had to pass legislation on the Brantley project in New Mexico, to correct a series of hazards involving Federal dams without the administration's recommendation. How long do you think we will be waiting for a recommendation on the safety of dams?

Mr. KEATING. Hopefully, not too long. We have had several meetings among the Federal agencies trying to determine uniform safety standards for dams. Hopefully, we can determine an acceptable formula for sharing of costs; i.e., how much of the costs would be nonreimbursable and charged to the safety of dams and how much would be charged to the owner of the dam or the entity which must finally pay for it and the irrigation benefit. This is our real prime concern, how the costs are to be divided.

Senator MOSS. Are you close to the point where you are going to make some recommendation to the Congress on that?

Mr. KEATING. Not in terms of days or weeks, but I don't think it is something that is going to drag on for years. I think we have to come to a position soon. We are sympathetic to a safety of dams program. We are quite concerned. This involves people and you cannot ignore the people.

Senator MOSS. Could we be hopeful that we might be able to get at it next year, perhaps, when we come back to the new session?

Mr. KEATING. We have been working on this program for a number of years, as you well know, and are hopeful that we can bring the matter to a conclusion soon.

Mr. LANGLEY. Mr. Chairman, at the last meeting, which involved the Corps, Interior, TVA, Federal Power Commission, the President's Office of Science and Technology, we found that one of the real hard things to do, even on Federal dams, is to bring into complete focus our individual problems, and how to approach them. So far, our efforts have been concentrated on Federal dams, although we have recognized that upstream from our dams are non-Federal dams that jeopardize the safety of the Federal dams. So these upstream dams must be considered.

In that meeting, I believe you could say it was informally agreed that there must be some national form of licensing, inspection, and

followup review of maintenance of all dams that have a potential for downstream disaster.

It also was recognized that there is a lot of competence in this field in the private professional consulting firms employing licensed professional engineers—more in some States than others. Certainly, the expertise is not all confined in the Federal agencies, although the Federal agencies have some of the very top recognized expertise in this field.

Senator MOSS. Do you have any idea how much the Bureau of Reclamation has spent on a study of safety for existing dams thus far?

Mr. LANGLEY. We have spent over \$1 million since 1965, reviewing and updating the operating criteria relating directly to safety of dams, including meetings with representatives of Governors of all of the 17 contiguous western States in regard to upstream dams; and for preparing reports on our own dams in an order of priority to reflect those we consider the most critical.

Senator MOSS. Well, that is a large amount of money, but if just one dam goes out, that soon becomes a small amount of money.

Mr. LANGLEY. We think we have spent too little on this program, that it deserves a higher priority than it has had.

Senator MOSS. The Bureau's statement outlines many complexities in the dam safety problem. Aside from efforts being taken on Federal dams, do you believe adequate attention is being given to stopping the repetition of disaster?

Mr. KEATING. No, it is not being done. We have participated with a lot of States, and by the way, I consider the West Virginia problem somewhat different from the safety of dams problem we are discussing.

The structure on Buffalo Creek was a slag pile and not a dam. It was a water impoundment that was not designed to impound water. We sent a team, including eight of our engineers, to West Virginia to review similar structures as part of the Bureau of Mines effort toward a mine safety program to determine the ability of the structures to retain water for which they were not designed. The team inspected 38 coal waste banks and identified some 30 that showed signs of instability. We have helped a lot of States from time to time through our cooperation with the States, at their request and usually with State money. This past 3 weeks we have had seven members of Reclamation in the State of Pennsylvania assisting the State, through the Office of OEP, review dams that may have been damaged by the recent hurricane floods in the State of Pennsylvania. Reclamation has some ability to help the States. We have done quite a bit of this, making major reviews and studies of dams in difficulty. But more must be done in the way of individual State effort, we agree.

Senator MOSS. Do you have any familiarity with the size of the State budgets, generally, in this water resources field? Is it large or small, do you have any idea of that?

Mr. KEATING. I don't know, maybe Mr. Maughan might know more about this because there is some money made available to the States through the Water Resources Council.

Mr. MAUGHAN. I can't give you too good of a sampling. I know the State of California spends the most of any State and they have a staff of 20 or 25 people on it, so their budget must be a half million dollars a year. I did talk to a State who recently established a dam

safety program in the State of Arizona, they are spending on the order of \$35,000 a year with a three-man staff.

In that State they have about 250 structures to inspect. I did hear from the State and they felt this would carry on an adequate inspection program in that State.

Senator Moss. Do you concur in that? Do you think they could conduct an adequate sophisticated inspection program on their non-Federal dams with that sized staff?

Mr. MAUGHAN. On the basis of what I know in Arizona and the number of structures, yes, I do. They are in a different situation than the eastern and midwestern States where there are many more structures. That is where I lose my knowledge as to how much has to be done.

Senator Moss. Of course, any kind of generalization has to be inaccurate, but my belief is that the States are not staffed adequately to do this job.

Mr. MAUGHAN. I agree.

Senator Moss. In some way, we have to find the expertise and manpower to do it and the States have to be involved and have to have responsibility. If they don't have the expertise and they are short on their financial ability to acquire more, then we have a problem that requires some Federal attention.

How much is being spent by Interior in review of the mine waste dams?

Mr. KEATING. We don't have that information at this time. The review of mine waste dams comes under the Bureau of Mines. I think we can get that information and provide it for you. They do have a budgeted amount in 1972 and a larger amount in fiscal year 1973, but let us provide that for the record, sir.

Senator Moss. Thank you. Provide it for the record.

(The information requested follows:)

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C.

HON. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate,
Washington, D.C.

DEAR MR. CHAIRMAN: During the hearing before your Committee on July 20, 1972, concerning S. 3449, the Department of the Interior witness, Assistant Commissioner William H. Keating of the Bureau of Reclamation, promised to supply information requested by Senator Moss on the amount being spent by the Department on review of mine waste dams.

The Bureau of Mines spent \$757,000 in FY 1972 for the investigation of coal waste embankments, including engineering studies of the dam failure which caused the Buffalo Creek disaster on February 26, 1972. This amount also covered work done by the Geological Survey and the Bureau of Reclamation.

For FY 1973, the Bureau of Mines appropriations bill is pending before Congress which includes \$1,000,000 for a coal mine waste materials and storage program.

Please let us know if you need additional information.

Sincerely yours,

ROGERS C. B. MORTON,
Secretary of the Interior.

Senator Moss. This again is a specialized thing, we sort of attack this piecemeal and some disasters occur, rather than a general overall program. Does any one of the witnesses have any idea how much we

are spending for disaster relief because of the recent floods in Pennsylvania and West Virginia?

General MORRIS. The floods in Pennsylvania, sir, as of yesterday, the Corps of Engineers have awarded something in excess of 1100 contracts valued at \$24 million on the initial disaster relief in Susquehanna, Schuylkill, Rappahannock, James River and the Potomac Basin. Most of that, over half of it was debris removal by category and about half of it was generally in the Wilkes-Barre area by location.

We have now embarked on another phase of this program and this is under the instruction of the OEP to provide emergency housing. This problem is too gross and so big, as you are probably aware, we established a temporary district office in Harrisburg. We are presently statementing our investment and the cost of disaster relief, but our agency alone would approach \$50 million and could go to \$100 million.

Senator Moss. I appreciate that. Of course, I recognize this all doesn't come from dam failure, but this was the general flood condition.

General MORRIS. I would like to say, sir, in considering the bill, one of the things that disturbs me slightly, is one of the definitions of a structure is 25 feet. We have levees that are that high. So you begin to wonder of the perimeters in the legislation. This is somewhat uncertain. But here I say there were no dam failures in this particular disaster. There levees which were overcome.

Senator Moss. Well, I appreciate your response and there is much for us yet to consider in this matter. It may be—I don't know if we have to have further hearings after this, but I do appreciate your responses and I feel we have to move into this area if we are going to avoid some of the disasters that have come upon us.

Thank you very much, gentlemen.

My colleague, Senator Bennett, has prepared a statement for the record and I will direct it be placed in the record at this point.

(The statement referred to follows:)

STATEMENT OF HON. WALLACE F. BENNETT, A U.S. SENATOR FROM THE STATE OF UTAH

Mr. Chairman, I appreciate this opportunity to testify in full support of S. 3449, which I have had the honor to co-sponsor. This bill will provide Federal technical assistance to the States to insure the safety of non-Federal dams throughout the nation.

The need for such legislation was clearly demonstrated in my own State of Utah recently when the citizens of Cedar City became concerned about the condition of an earthen dam on Coal Creek about six miles above the city which was built by the CCC during depression days. The dam had deteriorated and was definitely a flood hazard. When Cedar City officials tried to get help in restoring the dam, they encountered a serious problem because no one would assume responsibility.

The city contacted the Corps of Engineers to see if they could rebuild the dam. However, when the Corps discovered that the dam was on Bureau of Land Management land they said they could not do anything because it was in the jurisdiction of another government agency. The city then applied to the BLM for permission to buy the dam, but were advised by their lawyers that if they got title they would also assume responsibility.

Fortunately, we were able to get this particular problem resolved and the Bureau of Land Management initiated an agreement with the Corps of Engineers for immediate repair of the Coal Creek Dam. Repair work started on July 3 and will be completed as rapidly as possible to minimize the threat from flash thunderstorms in the area.

I welcomed the opportunity to co-sponsor this measure with the distinguished Chairman, Mr. Jackson, because there is a real need for an expedited national program to insure the safety of dams and other water storage and control structures.

State water resource staffs are already overburdened with a variety of duties regarding water supply, quality control and other responsibilities. This bill would provide the support the states need to attack the problem of dam safety.

At the request of the Governor of a State, the Water Resources Council, together with State officials, would prepare a technical assistance plan to assure the safety of water storage and control structures in the state. Technical assistance would be provided by the Bureau of Reclamation, the Geological Survey, the Army Corps of Engineers and the Soil Conservation Service to support the State program of licensing and inspection. Each State would have to provide that it has adequate safety laws and methods for implementation of those laws as a precondition for Federal assistance. An annual sum of \$5,000,000 would be authorized for the administration of the program.

Mr. Chairman, the recent tragic floods in Rapid City and Buffalo Creek have clearly demonstrated the need for this legislation. Nearly 30,000 dams and reservoirs in the United States are not under Federal control, and many of these are incapable of sustaining the impact of flood flows. Adequate licensing and regular inspection programs are necessary to assure those living below these dams that their lives and property are safe. I urge your Committee's favorable action on this measure so that the Congress may have an opportunity to consider it at the earliest possible moment.

Thank you, Mr. Chairman.

Senator Moss. Mr. Keith Higginson, director, Department of Water Administration, Boise, Idaho. Glad to have you, Mr. Higginson.

STATEMENT OF KEITH HIGGINSON, DIRECTOR, DEPARTMENT OF WATER ADMINISTRATION, BOISE, IDAHO

Mr. HIGGINSON. Thank you, Senator. My name is Keith Higginson, I am director of the Idaho Department of Water Administration. I am also currently serving as president of the Association of Western State Engineers. Our organization is composed of the official of each of the 19 Western States, who is charged with the responsibility for administration of the development and use of the State's water resources.

Since the announcement of this hearing, I have polled the membership of the association asking for their views concerning S. 3449, and I believe that this statement presents the position of the Western States concerning it.

We are aware of the recent tragedies in West Virginia and South Dakota which apparently gave rise to this legislation, and we sympathize with the victims of those events. We would hope, however, that no one would be mistakenly led to believe that the disasters were entirely caused by the failure of a water storage dam or that implementation of this legislation would prevent similar occurrences in the future.

The dangers attendant with storage of water behind any type of structure are a matter for great public concern. We have all seen the results of, and are aware of the destructive force of water. We agree that State programs for supervision of the design, construction and maintenance of dams and reservoirs should be reviewed in light of the recent events.

Public safety is now, and should remain, the responsibility of the States. Where assistance is needed, it is proper that the Federal agencies provide consultation. Such assistance has been available in the past on an informal basis. S. 3449 would make such assistance available on a more formal basis by request of the Governors. We, therefore, favor passage of S. 3449 with some reservations. These can best be expressed by referring to various sections of the bill.

Section 1(d). The reference to the expertise of the Federal agencies and the comparison to the assumed competence of the staffs of the various States is not only inaccurate, but insulting. It is true the Federal Government spends more money building dams than any other entity, but such dams are greatly in the minority as far as total structures are concerned. In Idaho, for example, we have records of 479 existing dams which are at least 20 feet in height or store at least 50 acre feet of water. Of these, only 39, or 8 percent are owned or controlled by Federal agencies, while 440 or 92 percent are private structures. These were all built with non-Federal engineering, design and inspection.

We have had a safety of dams program since the first law was passed in 1895. This was updated in 1969 when the Idaho Legislature adopted a slight revision of the U.S. Committee on Large Dams, USCOLD, model law. We have a small, but competent staff of professional engineers and engineering technicians who make necessary reviews of plans and inspections during and following construction. What most States need is consultation on particular problems and financial assistance to augment on-going State programs.

Section 1(e). It is our impression that the recent tragedies in West Virginia and South Dakota were not, in fact, the result of failures of water storage or control structures.

Section 2. The word "non-Federal" on page 3, line 13, should be stricken. We see no reason why a national program of dam safety should not include all dams, public and private. We have seen examples where the Federal agencies have hidden behind the so-called sovereign immunity of the United States and refused to accept inspections by State authority, even though when such inspections are made, they sometimes reveal weaknesses which need correction. There appears to be a fear that someone will discover and let the public know that the Federal agencies ain't all that expert at building dams without problems.

As an example, a letter written to a Federal agency forwarding our certificate of approval for storage of water in two Idaho dams following a routine inspection was answered with the curt reply, "You are no doubt aware that—the dams are owned and operated by the United States pursuant to congressional authority. The State of Idaho has no authority to regulate and control these works." That same letter pointed out that the reason repairs had not been made as found by our engineers to be needed was that " * * * the present policy is to defer major maintenance on these structures as long as it is safe to do so."

The law, as proposed, should be amended to provide a program to assure the proper design, construction, and maintenance of all dams, including those of the Federal Government. What assurances do the States have that the Federal dams are properly constructed, except the claim that the agencies are staffed with experts.

Section 3. We have used the four functions of Federal assistance provided in this section on an informal basis. This has been of great help to us. Formalization of these Federal-State working arrangements would be of some benefit, although, I, for one, would not agree to adoption of all design and construction criteria currently used by Federal public works agencies. In many cases, Federal structures are overdesigned at increased cost without any significant increase in

safety. As one of my colleagues puts it, the agencies "construct on the basis of a flood resulting from 16 inches of boiling hot water falling on 13 feet of snow." I could not, in good engineering conscience, agree that every small dam in my State should have to meet similar criteria.

The Western States feel that an additional function should be added to this section similar to title III of the Water Resources Planning Act. The assistance most needed from Congress is financial assistance for the underfunded State dam safety programs, provided they meet the eligibility requirements of section 4. I recommended consideration of the USCOLD model law as a guide in determining whether the State laws are adequate,

Section 4(d). The term adequate consideration needs to be defined. Also, the section is ambiguous as to claims of damage or danger from structures, whereas the actual damage or danger is more likely to result from the water stored behind those structures.

Section 6(a). Since the program will be implemented through the States, the definition of a water storage or control structure subject to regulation should be defined by the laws of the respective States. Also, part 3 of the definition is too indefinite to be meaningful.

The last two and a half lines of section 6(a) following the colon should be deleted for the same reasons as stated above.

Section 8. The authorized funds should be available for assistance to the States as discussed earlier.

The Western States welcome and need the assistance of the Federal Government. We recognize a continuing need to safeguard the public welfare by assuring that water storage and conveyance structures are properly designed, constructed, and maintained. We hope that passage of an amended S. 3449 will provide us with:

One, formalized consulting services of Federal experts on particular problems at the initiation of the States. This is particularly important to States just starting new safety programs and those, like Idaho, with small staffs.

Two, assurances that all dams in each State are properly designed, constructed, and maintained, regardless of ownership or control.

Three, financial assistance to augment State dam safety programs which meet Federal guidelines.

Four, incentives to those States which presently have no dam safety laws to adopt laws within the guidelines of section 4.

Mr. Chairman, that is the end of my statement. I do have copies of two documents which I would like to leave with the committee, one is entitled "An Inventory of Dams in the State of Idaho" which lists the present status, ownership, and condition of the 479 dams we have identified in Idaho and the other one is a copy of our rules and regulations and State law regarding safety of dams.

Senator Moss. Thank you very much, we are happy to have those documents and they will be in the committee file to examine when we discuss this matter.

I do appreciate your very fine statement and since you say you consulted at least with your water engineering counterparts in the Western States, I am sure this represents a general view held by the States there. Of course, the States where we have the greatest concern about water are the arid and western States where we had to have impoundment and regulations of water in order to survive in the

climate in which we live. I am glad to have you defend the State staff and their expertise. If this implies that the States do not have that, I think the implication is wrong. It is rather that the States are so limited in resources, financially, they haven't been able to establish and employ the number of experts that we feel are needed or at least that was the general thinking of the sponsors of the bill in putting it forward.

You indicate that there ought to be a general criteria for safety on Federal dams as well as State dams. How can we insure that? You gave the instance where the Federal Government replied back that they weren't going to do any additional maintenance as long as it was safe enough.

Mr. HIGGINSON. I think the problem we have with some of Federal structures can be resolved as it is in Idaho, with regard to our State act which provides that the plans for construction of Federal dams shall be filed with our Department for information only. Not for our approval, but for information. We then review those structures and have information that helps us answer inquires and provides us with the kind of information needed in an emergency situation.

The problem that we see is not with the Federal Works Agency such as the Corps of Engineers and the Bureau of Reclamation, but with other Federal entities who do have dams and there is no Federal program that I know of to see that they are properly maintained. The dams I was speaking of are owned by a different Federal agency, not the two that I mentioned.

Senator Moss. Would an example be the dam that I was talking about, built by the CCC, years ago and nobody could find out who had jurisdiction over it as the concern arose about its safety.

Mr. HIGGINSON. That would certainly be an example. Your reference to Cold Creek Dam is one I am familiar with. The ones I am referring to are Bureau of Indian Affairs structures.

Senator Moss. Well, that is a very good point to make. By the same token, on the establishment of the criterion States, should there be a minimum criteria that is federally promulgated, or must it be left to the States themselves to determine that?

Mr. HIGGINSON. I think I would prefer that the States promulgate the standard and design under certain guidelines set out by the Federal Government if there is to be a national program of the safety of dams. We simply cannot agree with some of the criteria that Federal agencies are currently using as being necessary in every instance for the safety of the structure.

Senator Moss. I know my State has had some divergence with the Federal Government similar to what you are describing, talking about overdesign of dams that made them so expensive that they become economically impossible or burdensome to build. I wonder how there would be a way to bring that into an acceptable criteria without the overdesigning?

Mr. HIGGINSON. I think this could be handled through section 3 of this bill which provides for a program to be implemented at the request of the Governor of each State, in which he would reach agreement as to the criteria, as to the technical assistance level necessary in that particular State.

For example, it was mentioned in California that they have a very adequate and competent staff at the State level. So there is probably no need other than for particular problems for consultation with the Federal Government in California, because the State staff is adequate. Certainly, the level of technical assistance in that State would be different from what it would be in my State of Idaho where we do need a bit more assistance.

The program designed and set up for that State at the initiation of the Governors could take care of the criteria to be used for implementing the program.

Senator Moss. Well, I thank you for coming and testifying. Mr. Higginson, and I appreciate your statement. You were very specific about the matters that you felt in this bill needed to be changed and that is exactly what we like to have our witnesses come and do, be specific. That enables us then, as we sit down and look at the bill, to focus on what you think and what your counterparts generally in the west think should be done in this bill, in order to make it acceptable.

I understand that you approve of the general idea that we are trying to get at here, but you just think things must be changed in order to make it workable and desirable and acceptable.

Mr. HIGGINSON. Thank you very much.

Senator Moss. Thank you, Mr. Higginson.

Mr. Kuiper, of the State of Colorado was to be a witness, but he is testifying on the House side and has asked his statement be placed in the record. I am advised that we also have a statement from New Mexico and California. They will be placed in the record at this point.

(The documents referred to follow:)

STATEMENT OF C. J. KUIPER, STATE ENGINEER, EXECUTIVE DIRECTOR, DIVISION OF WATER RESOURCES, STATE OF COLORADO

Mr. Chairman and distinguished senators, My name is C. J. Kuiper and as State Engineer, I am Executive Director of the Division of Water Resources with responsibilities under Colorado Water Law for safety of dams and reservoirs. I am here today as the official representative of Governor John A. Love, who could not appear today because of previous commitments and in my capacity as Executive Director of the Division of Water Resources. The position of the State of Colorado is in support of the intent and concept of S. 3449 with certain modifications.

The State of Colorado is fully aware of the disastrous happenings as a result of dam failures in South Dakota and West Virginia and agrees that some responsibility for the safety of dams rests with the federal government.

The major item of our concern is that responsibility for safety of dams remain with the states and not be preempted by federal agencies. There are certain dangers of such preemption in the working of the authorizing section as well as Section 1 and Section 2. We are sure this is not the intent of the legislation and we respectfully request consideration for amending such working. In the authorizing paragraph in the second line, it is suggested that the words "assist the states to" be inserted between the words "to" and "insure", and on page 3 of the Bill in Section 2, line 7, insert the words "assist the states to" at the end of line 7. We feel that this additional wording more fully comprehends the intent of this proposed legislation.

I would urge that subsection (d) of Section I be deleted as being derogatory and very misleading in the case of most states. This subsection could very well be interpreted to imply that federal agencies have a monopoly on technical competence and I can assure you that this is not the case in the State of Colorado. The requirements for assistance under Section 4 present no problems to the State of Colorado since all of these provisions are included in the Colorado Statutes and competent technical experts are presently employed on the staff of the State Engineer.

We have some reservations on Section 7 regarding rules and regulations to be enacted by the Water Resources Council and would prefer that a statement be included to provide that such rules and regulations not be more restrictive than the act itself. We feel very strongly that the states can and should act responsibly in the area of dam safety and certain provisions to insure responsible action should be included, however, a super federal agency, in our opinion, is not the solution to this problem. Since most states are equipped with adequate provisions in the law and staff to control most situations concerning dam safety, the federal agencies should act more in a consulting and advisory position with provisions for some federal funding to assist the states. We would suggest that funding of this effort be in a manner similar to Title III of the Water Resources Planning Act of 1965 to assist the states in establishing or improving their dam safety programs.

We would recommend that Section 6(a) be amended to comprehend the size of structures according to the statutes of each individual state.

As State Engineer, I have the general responsibility and duty to approve plans and specifications for the construction of new dams and rehabilitation of existing dams. To be more specific, the Colorado Revised Statutes, Chapter 148, Article 5, Section 5, provides that:

"No reservoir of capacity of more than one thousand acre-feet or having a dam or embankment in excess of ten feet in vertical height, or having a surface area at high water line in excess of twenty acres shall hereafter be constructed in this state except that the plans and specifications for the same shall have first been approved by the state engineer and filed in this office".

I usually require employment of a consulting engineer but may act as consulting engineer during the construction of dams and have the authority to require what material is to be used and how the dam is to be constructed. No dam is considered to be complete unless the owner receives a written statement from the State Engineer that the construction of the dam has been inspected and properly completed according to plans and specifications.

The State Engineer has the specific duty to annually inspect all dams located within the state and to determine the amount of water which the reservoir is capable of safely impounding during that year. In the event any owner of a reservoir impounds water to a depth greater than has been determined to be safe the State Engineer has the authority and responsibility to proceed to withdraw from said reservoir as much of the water as is in excess of the amount determined to be safe. Our law also provides that upon complaint being made by one or more persons that a dam is unsafe, the State Engineer has the duty to inspect said dam and make a determination on safety. If the dam and reservoir are found to be unsafe an order for withdrawal of water to a level which is safe is mandatory.

When I became State Engineer in 1969, the Dam Section in my office consisted of a staff of two. It was, therefore, impossible to adequately perform the duties as have been generally outlined. Since that time I have requested and obtained additional funds from our legislature so that the staff now consists of seven engineers. There is a qualified engineer in charge of this section, two engineers occupy their entire time reviewing plans and specifications for new dams and rehabilitation of old dams, and four engineers devote full time to the annual inspection of dams and reservoirs.

The seven engineers working in the Dam Section have the expertise to approve the construction of dams, to properly inspect dams in operation and specify other engineering work necessary to rehabilitate unsafe structures.

In the State of Colorado there are approximately 2000 dams that require annual inspections. As you are all aware, the State of Colorado is a very large state and, consequently with the limited staff available, we have been able to inspect only 900 dams each year.

While there is a great improvement over conditions prevailing three years ago, it is still inadequate since, in my opinion, each and every dam should be inspected annually. Limitations on funds and personnel permit that we only inspect those distressed dams which are reported to my office or which are called to my attention. Federal funding to meet the expansion of the existing program along the lines mentioned above would solve this problem.

There is an existing provision within the Bureau of Reclamation's program to assist any state in a consulting capacity provided the state enters into a contract approved by the Commissioner of Reclamation and is funded through state appropriations. We took advantage of this particular provision in one case of a distressed

dam in the vicinity of Denver which my engineers declared unsafe in spite of the fact that the consulting engineer representing the owners disagreed. Under contract with the Bureau of Reclamation and for about \$3,000 a panel of experts from the Chief Engineer's office reviewed both sides of the disagreement inspected the dam site, and reported in their findings which were generally in agreement with the State Engineer's staff. In my opinion, this prevented a costly law suit and assured the safety of the dam. An interesting development subsequent to this report occurred during the drawdown of the water level of the reservoir. Before the drawdown was completed, a foundation failure was evidenced by movement of the entire structure down stream resulting in an upheaval of two acres of grassed-over area below the downstream toe of the dam. In this particular case the expertise of Bureau of Reclamation specialists confirmed the opinion of my own staff and avoided not only costly litigation, which would have delayed corrective measures but, more importantly, prevented dam failure with loss of life and considerable property damage downstream. This demonstrated to me the effectiveness of the concept envisioned in S. 3449.

With these proposed changes we strongly support this legislation in the belief that it would help to avert repetition of recent disasters with which we are all familiar.

STATEMENT OF S. E. REYNOLDS, STATE ENGINEER OF NEW MEXICO

Mr. Chairman, my name is S. E. Reynolds, I am State Engineer for the State of New Mexico. It is the responsibility of the State Engineer to approve the design of new, non-federal water storage and control structures and to inspect such existing structures and specify any changes necessary to insure their safety. I appreciate very much the opportunity to appear before this distinguished committee in support of S. 3449.

The laws of the State of New Mexico nearly, if not fully, meet the criteria for eligibility for assistance set out in Section 4 of the bill. Some minor amendment of our statutes may be needed to require approval in writing prior to the modification or removal of existing structures, but I do not contemplate any difficulty in having any amendments needed enacted by our legislature.

There are about 135 dams and reservoirs in New Mexico that are "water storage or control structures" as that term is defined in section 6(a) of the bill. Such structures are inspected occasionally by representatives of my office to determine their safety and in a few instances we have solicited and gratefully received the assistance of federal agencies in the inspection of such works. To assure that the lives and property of those living below these dams are safe the works should be inspected more frequently and more completely.

To give the states assurance that the legislation would not undermine the integrity of the states authority over dam safety, I recommend that the bill be amended by inserting the words "for approval by the Governor or his designee" after the word "prepare" in line 24 on page 3 of the bill. With this amendment the pertinent clause of Section 3 would read "* * * the Council shall, in consultation with state officials designated by the Governor, prepare for approval by the Governor or his designee a technical assistance plan to insure the safety of water storage and control structures in the State."

I am advised that the ownership, operation, maintenance and control of a number of water storage or control structures constructed by the United States have been turned over to local interests so that the United States has no direct responsibility for the safety of these structures. Under the second proviso of Section 6(a) of the bill these structures would not be included in the program to be established by the bill. I recommend that this proviso beginning at line 13 on page 6 of the bill be amended to read "Provided further, That 'water storage or control structure' shall not include any structure owned by the United States or operated by or under the supervision of the United States."

The enactment of S. 3449 would provide valuable assistance to the State of New Mexico in its efforts to guard against threats to life and property from unsafe water control structures in the State. I urge this Committee's early and favorable action on S. 3449 with amendments such as those outlined above.

In conclusion, Mr. Chairman, I wish to express on behalf of the State of New Mexico appreciation of the opportunity to appear before this distinguished committee to express the views of the State on S. 3449.

STATEMENT OF THE CALIFORNIA DEPARTMENT OF WATER RESOURCES*

My statement covers California's program for supervising the safety of dams for the protection of life and property. California's extensive experience regarding this important subject should be helpful in your considerations of S. 3449.

Following the St. Francis Dam failure in 1928, the Legislature in 1929 enacted a comprehensive law providing for the safety regulation of dams in this state over a certain size and capacity. Several amendments during the past 41 years have strengthened the law, which is now codified in Division 3 of the California Water Code.

The objective of the law is public safety—the protection of people and property from the consequences of dam or reservoir failures.

The law is administered by the State Department of Water Resources through the professional engineering staff of the Department's Division of Safety of Dams augmented by special consultants as the need arises.

Safety of structures is secured by the Department's independent evaluation of design and supervision of construction of new dams and by surveillance and repair of operating dams.

Written approval must be secured from the Department before commencing construction of a new dam or important work on an existing dam. Before giving such approval, the Department independently reviews and analyzes all site and design factors related to safety and requires revisions in any portions of the plans or specifications necessary to assure a safe structure.

Inspections are made by the Department during construction to verify compliance with the approved plans and specifications and to assure that necessary design changes or unforeseen foundation conditions are recognized and that the design is modified as necessary because of such conditions.

Once completed, the dams remain under periodic surveillance by the Department, and owners are required to safely operate and maintain their dams. Any work found necessary to protect life and property must be made by the owner at his expense before he is allowed to continue impounding water. The level of impoundment of water permitted in the reservoirs is controlled by the Department's issuance of conditional and revocable certificates authorizing use of the dam and reservoir.

With the passage of time selected dams are identified and then reevaluated for structural integrity and spillway capacity as the performance history of the structure unfolds, as the hydrologic record period increases, and as structural analysis techniques advance. The owner is required to make any improvements found necessary.

Of greatest importance is the professional and technical competence of the staff. The Department employs professional engineers and engineering-geologists qualified and experienced in the design, construction, operation, and maintenance of dams of all types. They keep abreast of and apply new techniques of design and construction. The continuity of technical and program management experience resulting from a 43-year period of dam safety surveillance adds significantly to staff capability in achieving California's dam safety program objectives.

The Department has the power to proceed through the courts, if necessary, to obtain compliance with its requirements. The Department is empowered during emergencies affecting any dam to employ any remedial means necessary for the protection of life and property.

The law provides for prompt consideration of complaints by citizens alleging that their person or property is endangered by dams.

The Department's annual budget for the dam safety program is approximately \$1,250,000. Program costs are partially offset through fees paid by dam owners. Forty-three registered engineers and engineering-geologists are employed. Nearly 1,100 existing dams and reservoirs are under State jurisdiction. As many as 25 new dams are constructed annually. These dams and reservoirs are owned by municipalities, special districts, the State, private corporations and individuals. An index of these dams is contained in Bulletin 17-71, "Dams Within Jurisdiction of the State of California", which is also attached to this statement (retained in Committee file.) Dams owned by the Federal Government are not under State supervision.

*Filed by William R. Gianelli, Director of Water Resources, at the hearing of the Senate Committee in Washington, D.C., July 20, 1972.

Some of the 1,100 jurisdictional dams were built prior to enactment of the State's dam safety law in 1929. Consequently, the original designs and construction were not regulated by State authority. However, one element of California's total program was an original evaluation of these preexisting dams. This evaluation comprehensively explored the designs of these dams by independent structural analyses and by study of their construction histories. Repairs or alterations were made wherever necessary.

In 1964, a special program of inspection and safety evaluation of *all* existing dams was undertaken with priority given dams in urban locations. Particular attention was given to factors such as susceptibility of dam foundations to subsidence, seismicity, and adverse geologic structure. Dams were repaired or altered wherever an unsafe condition was disclosed.

California's dam safety law has served well since 1929, with relatively little change required. It was last strengthened in 1965. The recent adoption of California's law in 1970 by the United States Committee on Large Dams as a model for use by other states is indicative of the suitability and strength of California's law.

In recent years California has advised many other governments exploring and establishing their own dam safety programs. These governments included the states of Tennessee, Massachusetts, Missouri, Idaho, Montana, Texas, and Kentucky; the Australian provinces of Victoria, Tasmania, and Queensland; and the nations of Venezuela and Argentina.

California regards the protection of life and property from dam failures as a state responsibility. Federal agencies making technical reviews as proposed in S. 3449 do not assume ultimate responsibility. Responsibility continues to lie with the State. Accordingly, we recommend that federal legislation be directed toward encouraging states to adopt effective dam safety laws such as California's and that the legislation provide financial support during the early years to eligible states for use in staffing and conducting their own state dam safety programs under their direct control and authority.

California offers its experience in regulatory dam safety supervision to this committee and would be pleased to furnish further details for your consideration in enacting federal legislation beneficial to the dam safety programs of individual states. We support the concept of S. 3449 and may wish to comment further as the bill moves through the legislative process.

STATE OF CALIFORNIA

The Resources Agency

Department of Water Resources
Division of Safety of Dams

STATUTES AND REGULATIONS
PERTAINING TO
SUPERVISION OF
DAMS AND RESERVOIRS
1970

NORMAN B. LIVERMORE, JR.
Secretary for Resources
The Resources Agency

RONALD REAGAN
Governor
State of California

WILLIAM R. GIANELLI
Director
Department of Water Resources

FOREWORD

Prior to August 14, 1929, such State supervision over dams as was in effect was exercised either through the State Engineer or the Railroad Commission. However, this supervision was limited in scope and extended to less than half of the dams in the State. In addition various Federal offices exercised supervision in various degrees over debris dams, dams owned by the Government, and those occupying Government rights of way. There were a great many dams, however, which had no form of supervision, either Federal or State.

For the purpose of safeguarding life and property, the Legislature of 1929 invested the duty of supervision of dams, with the exception of those owned by the United States, in the Department of Public Works to be administered and exercised by the State Engineer. In 1956 this function was transferred to the Department of Water Resources.

STATE AND FEDERAL SUPERVISION

In some cases the construction of a dam will be under the supervision of both the Department of Water Resources and a Federal agency such as the Federal Power Commission, California Debris Commission, or United States Forest Service. In such cases State and Federal supervision will be carried out in such a manner as to minimize delays and to eliminate duplication of work by the owner and the supervising agencies. In all such cases application for approval of plans, etc., must be made to the Department of Water Resources.

WATER RIGHTS-APPROPRIATION

Approval of an application to construct a dam does not grant the right to appropriate water. For information concerning water rights, applicants are referred to the Water Code and to the publication of the State Water Resources Control Board, "Regulations and Information Pertaining to Appropriation of Water in California".

DEPARTMENT OF FISH AND GAME

Under the provisions of Section 6500 of the Water Code, whenever an application for approval of plans and specifications for a new dam, or for the enlargement of any dam, in any stream of this State, is filed with the Department of Water Resources pursuant to Part 1 of Division 3 of the Water Code, a copy of the application shall be filed by the applicant with the Department of Fish and Game as required by the Fish and Game Code.

EXPLANATORY STATEMENT

This pamphlet sets forth the provisions of Parts 1 and 2 of Division 3 of the Water Code and the regulations of the Department of Water Resources contained in Subchapter 1 of Chapter 2, Title 23, California Administrative Code.

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CALIFORNIA WATER CODE

DIVISION 3. DAMS AND RESERVOIRS

PART 1. SUPERVISION OF DAMS AND RESERVOIRS

Chapter 1. Definitions

6000. Unless the context otherwise requires, the definitions in this chapter govern the construction of this part.

6002. "Dam" means 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 the barrier, as determined by the department, or from the lowest elevation of the outside limit of the barrier, as determined by the department, 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.

6003. Any such barrier which is or will be not in excess of 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.

6004. No obstruction in a canal used to raise or lower water therein or divert water therefrom, no levee, including but not limited to a levee on the bed of a natural lake the primary purpose of which levee is to control floodwaters, no railroad fill or structure, and no road or highway fill or structure, no circular tank constructed of steel or concrete or of a combination thereof, no tank elevated above the ground, and no barrier which is not across a stream channel, watercourse, or natural drainage area and which has the principal purpose of impounding water for agricultural use shall be considered a dam. In addition, no obstruction in the channel of a stream or watercourse which is 15 feet or less in height from the lowest elevation of the obstruction and which has the single purpose of spreading water within the bed of the stream or watercourse upstream from the obstruction for percolation underground shall be considered a dam.

6004.5. "Reservoir" means any reservoir which contains or will contain the water impounded by a dam.

6005. "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 the United States.

6006. "Alterations", "repairs", or either of them, mean only such alterations or repairs as may affect the safety of the dam or reservoir.

6007. "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 or reservoir.

6008. Water storage elevation means that elevation of water surface which could be obtained by the existing dam or reservoir, as previously operated, were there no outflow and were the reservoir full of water.

Chapter 2. General Provisions

6025. It is the intent of the Legislature by this part to provide for the regulation and supervision of dams and reservoirs exclusively by the State.

6026. 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, or operation thereof, nor to limit the size of any dam or reservoir or the amount of water which may be stored therein. This part 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, or (b) are not subject to regulation by another public agency or body.

6027. Whenever supervision of safety of design or construction of a proposed or existing dam or reservoir is exercised by the United States or any of its agencies pursuant to a jurisdiction superior to that of the state, and the requirements made under authority of such jurisdiction are so contradictory with requirements made by the department under this part that a compliance cannot be made which will meet both federal and state requirements, then the state requirements shall be modified by the department sufficiently to make possible compliance with both federal and state requirements.

6028. No action shall be brought against the state or the department 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.
- (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.

6029. Nothing in this part 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.

6030. The findings and orders of the department and the certificate of approval of any dam or reservoir issued by the department are final and conclusive and binding upon all state agencies, regulatory or otherwise, as to the safety of design, construction, maintenance, and operation of any dam or reservoir.

6031. Nothing in this part 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.

Chapter 3. Administrative Provisions

6052. The department 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 part.

6053. The department may employ consultants.

6054. When the safety and technical 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 department shall appoint a consulting board of two or more consultants to report to the department on the safety features involved.

6055. The cost and expense of a consulting board if appointed on the request of an owner shall be paid by the owner.

6056. The department shall retain a board of three consultants who shall make an independent report to the director upon the issuance, modification, or renewal of any certificate of approval for any dam owned by the department.

Chapter 4. Powers of the Department

Article 1. Powers in General

6075. The department, under the police power of the state, shall supervise the construction, enlargement, alteration, repair, maintenance, operation, and removal of dams and reservoirs for the protection of life and property as provided in this part.

6076. All dams and reservoirs in the state are under the jurisdiction of the department.

6077. It is unlawful to construct, enlarge, repair, alter, remove, maintain, or operate any dam or reservoir except upon approval of the department as provided in this part.

6078. The department 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 part.

6079. In carrying out the provisions of this part the department may cooperate with the United States or any of its agencies.

6080. In making any investigations or inspections required or authorized by this part the department or its representatives may enter upon private property as may be necessary.

6081. In determining whether or not a dam or reservoir or proposed dam or reservoir constitutes or would constitute a danger to life or property, the department shall take into consideration the possibility that the dam or reservoir might be endangered by seepage, earth movement, or other conditions which exist or which might occur in any area in the vicinity of the dam or reservoir. Whenever the department deems that any such condition endangers a dam or reservoir, it shall order the owner to take such action as the department determines to be necessary to remove the resultant danger to life and property.

Article 2. Maintenance and Operation

6100. Supervision over the maintenance and operation of dams and reservoirs insofar as necessary to safeguard life and property from injury by reason of the failure thereof is vested in the department.

6101. The department may require owners to keep records of, and to report on, maintenance, operation, staffing, and engineering and geologic investigations and shall issue such rules and regulations and orders as necessary to secure maintenance and operation and to require staffing and engineering and geologic investigations which will safeguard life and property. In addition, the owner of a dam or reservoir or his agent shall fully and promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrence affecting the dam or reservoir.

6102. The department, from time to time, 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 necessary to disclose information sufficient to enable the department to determine conditions of dams and reservoirs in regard to their safety and to perform at their expense other work necessary to secure maintenance and operation which will safeguard life and property.

Article 3. Emergency Work

6110. The department shall immediately employ any remedial means necessary to protect life and property if 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 threaten the safety of any dam or reservoir.

6111. In applying the remedial means provided for in this article, the department may in emergency do any of the following:

(a) Lower the water level by releasing water from the reservoir.

(b) Completely empty the reservoir.

(c) Take such other steps as may be essential to safeguard life and property.

6112. The department 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.

6113. The cost and expenses 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 recoverable by the state from the owner by action brought by the department in the superior court of the county wherein the dam or reservoir or any part thereof is situated.

Article 4. Investigations and Studies

6120. For the purpose of enabling it to make decisions as compatible with economy and public safety as possible the department shall make or cause to be made such investigations and shall gather or cause to be gathered such data as may be needed for a proper review and study of the various features of the design and construction of dams, reservoirs, and appurtenances.

6121. The department shall also make or cause to be made such watershed investigations and studies as may facilitate its decisions.

Article 5. Action and Procedure to
Restrain Violations

6150. The department may commence an action or proceeding under this article, either by mandamus or injunction, for the purpose of stopping or preventing violations or threatened violations.

6151. 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 part or by any approval, order, rule, regulation, or requirement of the department under the authority of this part; or

(b) Doing or permitting anything or about to do or permit anything to be done in violation of or contrary to this part or any approval, order, rule, regulation, or requirement of the department under this part.

6152. Any action or proceeding under this article shall be commenced in the superior court in and for the county 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.

6153. Any action or proceeding under this article shall be brought by petition in the superior court, alleging the violation or threatened violation complained of, and praying for appropriate relief by way of mandamus or injunction.

6154. The court shall specify a time, not exceeding twenty days after the service of the copy of the petition, within which the owner or person complained of shall answer the petition, and in the meantime the owner or person may be restrained.

6155. In case of default in answer or after answer the court shall immediately inquire into the facts and circumstances of the case.

6156. The court may join such parties as it deems necessary or proper in order to make its judgment, order, or writ effective.

6157. The final judgment in such action or proceeding shall either dismiss the action or proceeding or direct that the writ of mandamus or injunction issue or be made permanent as prayed for in the petition, or in such modified or other form as will afford appropriate relief.

Chapter 5. Applications

Article 1. New Dams and Reservoirs or Enlargements of Dams and Reservoirs

6200. 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 department written approval of plans and specifications.

6201. A separate application for each dam or reservoir shall be filed with the department upon forms to be provided by it, except that only one application need be filed for a dam and the reservoir which will contain the water impounded by the dam.

6202. 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 or reservoir and appurtenant works.
- (c) The storage capacity of the reservoir.
- (d) Such other pertinent information as the department requires.
- (e) As accurately as may be readily obtained, the area of the drainage basin, rainfall and streamflow records and floodflow records and estimates.

6203. The department may also require the following:

- (a) Data concerning subsoil and 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 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, availability and quality of construction materials, and other pertinent features.

(d) Such other appropriate information as may be necessary in a given instance.

6204. 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 department may waive the requirements.

6205. The application shall set forth the purpose for which the impounded or diverted water is to be used.

6206. The application shall be accompanied by maps and plans and specifications of such character and size and setting forth such pertinent details and dimensions as the department requires.

The maps and plans and specifications shall be a part of the application.

Article 2. Repairs, Alterations, or Removals

6225. 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 part, the owner shall secure the written approval of the department, except as provided in this article.

6226. The application shall give such pertinent information or data concerning the dam or reservoir, or both, as may be required by the department 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 department.

6227. The application shall state the proposed time of commencement and of completion of construction.

6228. 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 department may require. The department may waive any of the requirements of this section if found by it unnecessary.

6229. In case of an emergency where repairs are necessary to safeguard life and property repairs may be started immediately, but the department shall be notified at once of proposed repairs and of work under way.

6230. The proposed repairs and work shall be made to conform to such orders as the department issues.

Article 3. Dams Constructed Prior to August 14, 1929

6250. Unless application for approval of the dam has heretofore been made, every owner of a dam completed prior to August 14, 1929, shall, immediately after the effective date of this part, file an application for the approval of such dam.

6251. A separate application shall be made for each dam and shall be filed with the department upon forms to be supplied by it and shall supply such appropriate information concerning the dam as the department requires.

6252. The department shall give notice to file to owners 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 part.

6253. The notice provided for in this article may be given by registered mail and a return receipt signed by the owner shall constitute prima facie evidence of service.

Article 4. Approval of Applications

6260. Upon receipt of any application other than an application provided for in Article 3 of this chapter the department shall give its consideration thereto and shall approve or disapprove the same within the time provided in this article.

6261. A defective application made in a bona fide attempt to conform to the law and rules and regulations of the department shall not be rejected but notice of defect shall be sent to the applicant by ordinary and registered mail.

6262. If within thirty days of the date of mailing the notice the applicant does not file an amended and perfected application, the application shall be rejected and canceled unless for good cause shown the department allows the applicant further time.

6263. No application shall be approved in less than ten days from its receipt but all applications shall be approved or disapproved as soon as practicable after the receipt of all data and information found necessary by the department.

6264. Approvals may be granted under terms, conditions, and limitations necessary to safeguard life and property.

6265. Actual construction shall be commenced within one year after date of approval, otherwise the approval becomes void.

6266. The department may, upon written application and for good cause shown, extend the time for commencing construction.

6267. Notice shall be given to the department at least ten days before construction is to be commenced and such other notices shall be given to the department as it may require.

Chapter 6. Fees

6300. The application for a new dam or reservoir or enlargement shall set forth the estimated cost, as defined in this article, of the dam or reservoir or enlargement and shall be accompanied by a filing fee based upon the estimated cost and according to the following schedule:

(a) For the first one hundred thousand dollars (\$100,000) a fee of 3 percent of the estimated cost.

(b) For the next four hundred thousand dollars (\$400,000) a fee of 1-1/2 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 two-fifths of 1 percent.

In no case, however, shall the minimum fee be less than one hundred dollars (\$100).

6301. One filing 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.

6302. For the purposes of this part, the estimated cost of the dam or 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.

(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.

6303. The costs of right-of-way, detached powerhouses, electrical generating machinery, and roads and railroads affording access to the dam or reservoir shall not be included among the items used in the determination of cost.

6304. An application shall not be considered by the department until the filing fee is received.

6305. In the event the actual cost exceeds the estimated cost by more than 15 percent, a further fee shall be required by the department before final approval and shall be 115 percent of the amount by which the original fee is less than it would have been had the cost it was based upon been the same as the actual cost. No further fee shall be required, however, if such fee is to be computed at less than twenty dollars (\$20).

6306. Applications for dams found by the department to have been less than 90 percent constructed on August 14, 1929, shall be accompanied by fees as much less than provided for dams commenced after that date as the percentage of construction found by the department to have been completed on that date.

6307. (a) An annual fee shall be paid on or before December 31, 1970, and on or before December 31 of each succeeding year, based upon the height of the dam, including all enlargements thereto, substantially completed by or in operation on June 30, 1970, and on June 30 each succeeding year. The annual fee shall be thirty dollars (\$30) plus one dollar (\$1) per foot of height of the dam.

(b) For purposes of this section, height of the dam means the vertical distance, to the nearest foot, from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the department, or from the lowest elevation of the outside limit of the barrier, as determined by the department, if it is not across a stream channel or watercourse, to the maximum possible water storage elevation.

6308. All fees and other charges collected under the provisions of this part shall be paid into the State Treasury immediately after the department has certified as to the correctness of the amounts received and made any adjustments necessary.

6309. The fees provided for in this article shall be required of all enumerated in the definition of owner in Chapter 1 of this part.

Chapter 7. Inspection and Approval

Article 1. New or Enlarged Dams and Reservoirs

6350. Immediately upon completion of a new dam or reservoir or enlargement of a dam or reservoir the owner shall give a notice of completion to the department and as soon thereafter as possible shall file with the department supplementary drawings or descriptive matter showing or describing the dam or reservoir as actually constructed, including the following:

- (a) A record of all grout holes and gouting.
- (b) A record of permanent location points and bench marks.
- (c) A record of tests of concrete or other material used in the construction of the dam or reservoir.

(d) Any other items which may be of permanent value and have a bearing on the safety and permanency of the dam or reservoir.

6351. In connection with the enlargement of a dam or reservoir, the supplementary drawings and descriptive matter need apply only to the new work.

6352. As soon as possible after giving notice of completion, the owner shall file an affidavit with the department stating the actual cost of the dam or reservoir in such detail as the department 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 department. The department shall then make its own appraisal of the cost of construction or enlargement and determine what further fee, if any, is required. Upon making a determination that a further fee is required, the department shall notify the owner by certified mail of the amount of such fee within fifteen days and shall notify the owner that he may appear within sixty days thereafter before an authorized representative of the department to protest the amount of the fee, in whole or in part, determined by the department to be required, and the sufficiency of the appraisal upon which such determination was based.

6354. As soon as practicable the completed dam or reservoir shall be inspected by the department.

6355. A certificate of approval shall be issued upon a finding that the dam or reservoir is safe to impound water within the limitations prescribed in the certificate. Upon written request by an owner for a certificate of approval, the department shall issue the certificate if it finds that the dam or reservoir is safe to impound water within the limitations prescribed in the certificate. Pending issuance of a certificate of approval by the department, the owner of the dam or reservoir shall not, through action or inaction, cause the dam or reservoir to impound water.

Article 1.5. Certificates of Approval

6357. Each certificate of approval issued by the department under this part may contain such terms and conditions as the department may prescribe.

6357.1. The department may revoke 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 department may also amend the terms and conditions of any such certificate by issuing a new certificate containing the revised terms and conditions.

6357.2. The owner of a dam or reservoir for which a certificate of approval has been issued shall not, through action or inaction, cause the dam or reservoir to impound water after the certificate terminates unless a new certificate is issued for the dam or reservoir. A new certificate shall be issued upon a finding by the department that the dam or reservoir is safe to impound water within the limits prescribed in the certificate.

6357.3. With respect to each certificate of approval or written consent for use of a dam which has been issued by the department or a predecessor of the department and which is in effect prior to the effective date of this article, the department shall, within one year from such effective date, issue a new certificate of approval, which shall supersede the previous certificate or written consent for use, or shall revoke the existing certificate or written consent for use if it finds that the dam or reservoir is not safe to impound water.

6357.4. Before any certificate of approval is revoked by the department, the department 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 for a writ of mandate to inquire into the validity of action of the department 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 2. Repaired or Altered
Dams and Reservoirs

6360. Immediately upon completion of the repair or alteration of any dam or reservoir, the owner shall give notice of completion to the department and as soon thereafter as possible shall file with it 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 department requires.

6362. As soon as practicable the dam or reservoir as repaired or altered shall be inspected by the department.

6363. A certificate of approval shall be issued upon a finding that the dam or reservoir is 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.

6364. The certificate of approval shall supersede any previous certificate of approval issued for the dam or reservoir so repaired or altered.

Article 3. Removal of Dams and
Reservoirs

6370. Upon completion of the removal of a dam or reservoir such evidence as to the manner in which the work was performed and as to the conditions obtaining after the removal as the department requires shall be filed with the department.

6371. 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.

6372. Before final approval of the removal of a dam or reservoir is issued, the department shall inspect the work and determine that all danger to life and property has been eliminated.

Article 4. Dams Completed Prior
to August 14, 1929

6380. The department shall make inspections at State expense of all dams in the State completed prior to August 14, 1929.

6381. The department shall require owners to perform at their expense such work or tests as necessary to disclose information sufficient to enable the department to determine whether to issue certificates of approval or to issue orders directing further work at the owners' expense necessary to safeguard life and property.

6382. If, upon inspection or upon completion to the satisfaction of the department of all work that may be ordered, the department finds that the dam is safe to the full extent for which use is or will be made, a certificate of approval shall be issued.

Article 5. Complaints as to
Unsafe Conditions

6390. Upon receipt of a written complaint alleging that the person or property of the complainant is endangered by the construction, maintenance, or operation of any dam or reservoir the department shall cause an inspection to be made unless the data, records, and inspection reports on file with it are found adequate to enable a determination whether or not the complaint is meritorious.

6391. If the complainant insists upon an inspection and deposits with the department a sum estimated by it to be sufficient to cover costs of an inspection, the department shall cause an inspection to be made despite its finding as to the sufficiency of its records to determine the alleged danger.

6392. If it is found that an unsafe condition exists, the department shall take such action as is necessary to render or cause the condition to be rendered safe and any money deposited to secure an inspection shall be returned.

6393. If, after an inspection is made on account of a complaint, the complaint is found by the department to have been without merit, any money deposited therefor shall be payable into the State Treasury.

Article 6. Inspection During
Progress of Work

6400. During the construction, enlargement, repair, alteration, or removal of any dam or reservoir the department shall make continuous or periodical inspections at state expense for the purpose of securing conformity with the approved plans and specifications but shall require the owner to perform at his expense such work or tests as necessary to disclose information sufficient to enable the department to determine that conformity with the approved plans and specifications is being secured.

6401. 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 department that amendments, modifications, or changes are necessary to insure safety, the department may order the owner to revise the plans and specifications.

6402. If conditions are revealed which will not permit the construction of a safe dam or reservoir the approval may be revoked.

6403. In the event that conditions imposed may be waived or made less burdensome without sacrificing a proper margin of safety, the department may authorize an owner to revise the plans and specifications accordingly.

6404. If at any time during construction, enlargement, repair, or alterations of any dam or reservoir the department finds that the work is not being done in accordance with the provisions of the approval and the approved plans and specifications or in accordance with the approval and revised plans and specifications, it shall give a written notice and order by registered mail or by personal service to the owner.

6405. The notice and order shall state the particulars in which the approval and approved plans and specifications or the approval and approved plans and specifications as revised are not being or have not been complied with and shall order the immediate compliance with the approval and approved plans and specifications or with the approval and approved revised plans and specifications as the case may be.

6406. The department may order that no further work be done until such compliance has been effected and approved by the department.

6407. A failure to comply with the approval and approved plans and specifications as originally approved or as revised shall render the approval subject to revocation by the department, if compliance is not made in accordance therewith after notice and order from the department as provided in this article.

Chapter 8. Offenses and Punishment

6425. Every person who violates any of the provisions of this part or of any approval, order, rule, regulation, or requirement of the department is guilty of a misdemeanor and punishable by a fine of not more than two thousand dollars (\$2,000) or by imprisonment in the county jail not exceeding six months, or both. In the event of a continuing violation each day that the violation continues constitutes a separate and distinct offense.

6426. Any person who willfully obstructs, hinders, or prevents the department or its agents or employees from performing the duties imposed by this part or who willfully resists the exercise of the control and supervision conferred by this part upon the department or its agents or employees is guilty of a misdemeanor and punishable as provided in this article.

6427. 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 part, or any inspector, agent, or employee of the department who has knowledge of such work being done and who fails to immediately notify the department thereof is guilty of a misdemeanor and punishable as provided in this article.

6428. Any owner who fails to pay any annual fee or any part of any annual fee required to be paid pursuant to Section 6307 within the time required shall pay a penalty of 10 percent of the annual fee or part of the annual fee, in addition to the annual fee or part of the annual fee, plus interest at the rate of one-half of 1 percent per month, or fraction thereof, from the date on which the annual fee or the part of the annual fee became due and payable to the state until the date of payment.

Chapter 9. Dams Under Construction
Prior to August 14, 1929

6450. Any dam which the department finds was not 90 percent constructed on August 14, 1929, shall be subject to the same provisions as a dam commenced after that date.

6451. Construction work on such a dam may proceed, if an application for approval thereof is filed, until an order from the department is received approving the dam or specifying how its construction must be made or altered to render it safe. After receipt of an order directing the construction of such a dam, work thereafter must be in accordance with the order.

6452. Dams found to be 90 percent or more constructed on August 14, 1929, shall be subject to the same supervision as dams which were completed prior to that date.

Chapter 10. Dams and Reservoirs Under
State Supervision Through
1965 Revisions of Part 1

Article 1. Dams and Reservoirs Completed
Before 1965 Revisions

6455. Every owner of a dam or reservoir that falls within the definition of a dam or reservoir in this part by virtue of the amendment of Section 6002 or the addition of Section 6004.5 at the 1965 Regular Session of the Legislature and that was completed prior to September 17, 1965, shall immediately file an application with the department for the approval of such dam or reservoir, provided that this Chapter 10 shall not apply to any reservoir which contains the water impounded by a dam for which a certificate of approval is in effect on September 17, 1965.

6456. A separate application shall be made for each dam or reservoir and shall be filed with the department upon forms to be supplied by it and shall include or be accompanied by such appropriate information concerning the dam or reservoir as the department requires.

6457. The department 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 part.

6458. The notice provided for in this article may be given by registered or certified mail and a return receipt signed by the owner shall constitute prima facie evidence of service.

6459. The department shall make inspections of such dams or reservoirs at state expense.

6460. The department shall require owners of such dams or reservoirs to perform at their expense such work or tests as necessary to disclose information sufficient to enable the department to determine whether to issue certificates of approval or to issue orders directing further work at the owners' expense necessary to safeguard life and property. For this purpose, the department may require an owner to lower the water level of, or to empty, the reservoir.

6461. If upon inspection or upon completion to the satisfaction of the department of all work that may be ordered, the department finds that the dam or reservoir is 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 department that a certificate will not be issued because the dam or reservoir will not safely impound water. Before such notice is given by the department, the department 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. Any petition for a writ of

mandate to inquire into the validity of the action of the department shall be commenced within thirty days after receipt by the owner of a written notice from the department that a certificate of approval will not be issued.

Article 2. Dams and Reservoirs Under
Construction Before 1965 Revisions

6465. Any dam or reservoir that falls within the definition of a dam or reservoir in this part by virtue of the amendment of Section 6002 or the addition of Section 6004.5 at the 1965 Regular Session of the Legislature and which the department finds was under construction and not 90 percent constructed on September 17, 1965, shall, except as provided in Section 6466, be subject to the same provisions in this part as a dam or reservoir commenced after that date. Every owner of such a dam or reservoir shall file an application with the department for the department's written approval of the plans and specifications of the dam or reservoir. Where an application for approval of the plans and specifications for a dam is pending before the department on September 17, 1965, such application shall be deemed to also constitute an application for approval of the plans and specifications of the reservoir which will contain the water impounded by the dam.

6466. 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 department approving the dam or reservoir or an order is received by the owner from the department 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.

6467. Such dams or reservoirs as are 90 percent or more constructed on September 17, 1965, 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 1965 Revisions

6470. The owners of completed dams or reservoirs and dams or reservoirs that are 90 percent or more constructed that are made subject to the provisions of this part by the amendment of Section 6002 or the addition of Section 6004.5 at the 1965 Regular Session of the Legislature shall not be required to pay a fee in relation to applications filed with the department for approval of their dams or reservoirs. Applications for the approval of dams or reservoirs that are made subject to this part by said amendment or addition that are found by the department to have been less than 90 percent constructed on September 17, 1965, shall be accompanied by fees as much less than provided for dams or reservoirs commenced after that date as the percentage of construction found by the department to have been completed on that date.

PART 2. FISHWAYS OVER DAMS

6500. Whenever an application for approval of plans and specifications for a new dam, or for the enlargement of any dam, in any stream in this State, is filed pursuant to Part 1 of this division, a copy of the application shall be filed with the Department of Fish and Game as required by the Fish and Game Code.

6501. The provisions for the installation of fishways over or around dams and for the protection and preservation of fish in streams obstructed by dams are contained in Chapter 3 (commencing with Section 5900), Part 1, Division 6 of the Fish and Game Code.

CALIFORNIA ADMINISTRATIVE CODE

Title 23. Waters

Chapter 2. Department of Water Resources

Subchapter 1. Dams and Reservoirs

Article 1. General Provisions

301. Definitions. As used in these regulations, the terms listed below shall have the meanings noted:

(a) Department. "Department" means the Department of Water Resources of the State of California.

(b) Dam. "Dam" means 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 the barrier, as determined by the department, or from the lowest elevation of the outside limit of the barrier, as determined by the department, 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.

Any such barrier which is or will not be in excess of 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 lower water therein or divert water therefrom, no levee, including but not limited to a levee on the bed of a natural lake the primary purpose of which levee is to control floodwaters, no railroad fill or structure, and no road or highway fill or structure, no circular tank constructed of steel or concrete or of a combination thereof, no tank elevated above the ground, and no barrier which is not across a stream channel, watercourse, or natural drainage area and which has the principal purpose of impounding water for agricultural use shall be considered a dam. In addition, no obstruction in the channel of a stream or watercourse which is 15 feet or less in height from the lowest elevation of the obstruction and which has the single purpose of spreading water within the bed of the stream or watercourse upstream from the obstruction for percolation underground shall be considered a dam.

(c) Reservoir. "Reservoir" means any reservoir which contains or will contain the water impounded by a dam.

(d) Owner. "Owner" includes any of the following who own, control, operate, maintain, manage, or propose to construct a dam or reservoir:

(1) The State and its departments, institutions, agencies, and political subdivisions.

(2) Every municipal or quasi-municipal corporation.

(3) Every public utility.

(4) Every district.

(5) Every person.

(6) The duly authorized agents, lessees, or trustees of any of the foregoing.

(7) Receivers or trustees appointed by any court for any of the foregoing.

"Owner" does not include the United States. (Sections 6002-6005, Water Code)

302. Purpose and Effect of Regulations. These regulations are adopted for the purpose of carrying out the provisions of Part 1 of Division 3 of the Water Code. Under no circumstances, and in no particular case, shall these regulations, or any of them, be construed as a limitation or restriction upon the exercise of any proper discretion that is vested in the department, nor shall they in any event be construed to deprive the department of any exercise of powers, duties and jurisdiction conferred by law, nor to limit or restrict the amount or character of data or information which may be required for the proper administration of the law. (Section 6078, Water Code)

304. Civil Engineering Plans and Specifications. Plans and specifications which are submitted to the department shall be prepared by, or under the direction of, a civil engineer who is registered pursuant to California law and authenticated by him as provided in the Business and Professions Code, or be prepared by such other person as may be permitted under the provisions of said code to prepare such plans and specifications, in which case satisfactory evidence of such other person's right to so act shall be submitted to the department when the plans and specifications are submitted. (Section 6078, Water Code)

305. Civil Engineering Supervision of Construction. The work of construction, enlargement, repair, alteration or removal of a dam or reservoir shall be under the responsible charge of a civil engineer who is registered pursuant to California law or of such other person as may be permitted under the provisions of the Business and Professions Code to assume responsible charge of such work. (Section 6078, Water Code)

306. Authority of Representative. When an application is filed by another person on behalf of an owner, satisfactory evidence of authority to represent the owner shall be filed with the application. (Section 6078, Water Code)

Article 2. Applications for Construction,
Enlargement, Repair, Alteration,
or Removal of Dams or Reservoirs.

310. Preparation of Application for Construction or Enlargement. This section shall apply to applications for the department's approval of plans and specifications for the construction or enlargement of dams and reservoirs.

(a) A separate application shall be made for each dam or reservoir and filed in duplicate with the department upon printed forms which will be furnished free upon request, except that only one application need be filed for a reservoir and all the structures which are necessary to impound the single body of water within that reservoir. The maps, plans, and specifications for the proposed construction or enlargement shall form a part of the application.

(b) The plans for the proposed construction or enlargement shall be filed in duplicate with the application in the form of paper prints. After having reviewed the plans, the department will notify the applicant of any required changes. Conferences may then be arranged with the objective of working out revisions of the plans which will meet the department's requirements. Following completion of such revisions, the department will designate which drawings will be required for approval as a part of the application. The drawings so designated shall then be filed in duplicate in the form of paper prints for the department's formal approval. One set of the prints will be returned to the applicant after approval. Microfilms of the other set will be retained in the files of the department.

(c) The size of all plans and maps filed with the department shall be not more than 28 by 40 inches and not less than 18 by 24 inches; provided, that when published maps are used to show the location of the dam or reservoir to be constructed or enlarged, these may be filed without alteration of size. A space about two and one-half inches by five inches shall be provided in or near the lower right hand corner of each drawing which is submitted for formal approval in which the applicant shall letter an approval form in accordance with a sample provided by the department.

(d) Plans and maps that are filed with the department shall be drawn with an adequate number of views, in proper dimensions, and to a sufficiently large scale so that the drawings may be readily interpreted and studied. Appropriate graphical scales shall be shown thereon.

(e) The plans shall show all details necessary for complete analysis of stresses in the structure and shall show the details of arrangement of outlet works and spillway in order that a complete study of these features may be made. The drawings shall include a plan view of the dam and reservoir superimposed on the topography of the site, a profile along the axis of the dam and a profile along the centerline of the spillway.

(f) Plans of a proposed enlargement shall be drawn in such a manner as to clearly distinguish the limits of the new and old work.

(g) Specifications concerning the proposed method of construction or enlargement shall be filed in duplicate with the application. The specifications shall include a detailed description of the methods to be used in performing each class of work and a statement of the requirements for the various types of material that will enter into the permanent construction.

(h) If not included in the specifications, the construction schedule and a statement of the sequence of construction operations shall be filed in duplicate with and form a part of the application.

(i) Engineering data providing the basis for design of the proposed construction or enlargement shall be filed in duplicate with the application. The required engineering data shall include such items as assumptions as to loads, limiting stresses adopted, methods of analyses used in determining working stresses, formulae and coefficients used in determining capacities of the spillways and outlets, and hydrologic data used in determining runoff from drainage areas.

(j) The following additional items shall be filed with the application:

(1) A topographic map of the reservoir site.

(2) Area and capacity curves of the proposed reservoir.

(3) A map of the drainage basin showing the general locality of the dam and reservoir in relation to some town or well-known stream, unless previously submitted. If quadrangle sheets of the United States Geological Survey or similar maps are available, these may be used for showing the drainage basin and general locality. If they are used, the location of the dam and reservoir and the drainage area above the dam should be shown thereon.

(4) Copies of any records that the applicant has of flood flows and precipitation for the region, unless previously submitted.

(5) Copies of maps and records of drill holes, exploration pits and tunnels and copies of geological and soil test reports when requested by the department or when the applicant otherwise has such material available.

(k) The department may require the filing of any additional information which, in its opinion, would have some bearing on the safety of the dam and reservoir. (Sections 6201-6206, inclusive, Water Code)

311. Drawings of Completed Dam or Reservoir. As soon as possible after the completion of the construction or enlargement of the dam or reservoir, the owner shall file in duplicate with the department supplementary drawings, in the form of paper prints, showing the dam or reservoir as actually constructed or, in connection with the enlargement of a dam or reservoir, showing the new work. Following completion of any required revisions, the department will designate which drawings shall be submitted in duplicate for signature by the department. One set of the prints will be returned to the owner after signature. Microfilms of the other set will be retained in the files of the department. (Sections 6350 and 6351, Water Code)

312. Notice of Completion. The owner shall file with the department notice of completion of the construction or enlargement of the dam and reservoir immediately upon completion thereof, which notice shall set forth the date of completion. (Section 6350, Water Code)

313. Statement of Actual Cost. As soon as possible after giving notice of completion, there shall be filed with the department a statement, certified by affidavit of the owner or his authorized representative, of the actual cost of the dam and reservoir or enlargement as completed on the date specified in the notice of completion. (Section 6352, Water Code)

314. Records to be Furnished. As soon as possible after the completion of the construction or enlargement of the dam or reservoir, there shall be filed with the department a record of any and all items which may be of permanent value and have a bearing on the safety of the dam or reservoir; provided, that in connection with the enlargement of a dam or reservoir, the supplementary matter need apply only to the new work. (Sections 6350 and 6351, Water Code)

315. Filing Fee. Payment of a filing fee is required by Section 6300 of the Water Code.

(a) Amount of Fee. The application for a new dam and reservoir or enlargement shall set forth the estimated cost 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:

(1) For the first one hundred thousand dollars (\$100,000) a fee of three percent of the estimated cost.

(2) For the next four hundred thousand dollars (\$400,000) a fee of one and one-half percent.

(3) For the next five hundred thousand dollars (\$500,000) a fee of one percent.

(4) For all costs in excess of one million dollars (\$1,000,000) a fee of two-fifths of one percent.

In no case, however, shall the minimum fee be less than one hundred dollars (\$100).

Examples of the amount of fee to accompany application:

(A) Estimated cost: \$1,000
 3% x \$ 1,000 = \$ 30
 Fee is \$100 as this is the minimum charge.

(B) Estimated cost: \$150,000
 3% x \$ 100,000 = \$3,000
 1.5% x \$ 50,000 = 750

Total fee \$3,750

(C) Estimated cost: \$2,000,000
 3% x \$ 100,000 = \$ 3,000
 1.5% x \$ 400,000 = 6,000
 1% x \$ 500,000 = 5,000
 0.4% x \$1,000,000 = 4,000

Total fee \$18,000

(b) Further Fee. In the event that the actual cost exceeds the estimated cost by more than 15 percent, a further fee will be required by the department before final approval and shall be 115 percent of the amount by which the original fee is less than it would have been had the cost it was based upon been the same as the actual cost. No further fee will be required, however, if such fee is to be computed at less than twenty dollars (\$20). (Section 6305, Water Code)

Below is an example of correcting a fee based on an estimate that was too low:

Estimated cost: \$800,000
 3% x \$100,000 = \$ 3,000
 1.5% x \$400,000 = 6,000
 1% x \$300,000 = 3,000

Fee that was paid \$12,000

Actual cost: \$950,000
 3% x \$100,000 = \$ 3,000
 1.5% x \$400,000 = 6,000
 1% x \$450,000 = 4,500

Correct fee \$13,500

Fee paid \$12,000

Error in fee \$1,500

Further fee to be paid = 115% x \$1,500 = \$1,725

If, in the foregoing example, the actual cost was \$920,000 or less, no further fee would be due because the actual cost would not have exceeded the estimated cost by more than 15 percent. (Sections 6300 and 6305, Water Code)

317. Preparation of Application for Repair or Alteration. This section shall apply to applications for the department's approval of plans and specifications for the repair or alteration of dams and reservoirs including alteration of a dam or reservoir so that it no longer constitutes a dam or reservoir.

(a) The application form indicates the information that in most cases will be required. If, under particular circumstances, the department requires additional information, it will so advise the applicant. If the department requires the filing of specifications, they shall form a part of the application.

(b) The proposed work shall be described in the appropriate space on the application form. In addition, plans for the proposed work shall be prepared and filed in duplicate and shall form a part of the application.

318. Preparation of Application for Removal. This section shall apply to applications for the department's approval of plans and specifications for the removal of dams and reservoirs.

(a) The application form indicates the information that in most cases will be required. If, under particular circumstances, the department requires additional information, it will so advise the applicant. If the department requires the filing of specifications, they shall form a part of the application.

319. Annual Fee. Payment of an annual fee is required by Section 6307 of the Water Code.

(a) Amount of Fee. The annual fee shall be thirty dollars (\$30) plus one dollar (\$1) per foot of height of the dam.

(b) Determination of Amount. The department shall determine the amount of the fee as of June 30 each year and shall inform each owner of that amount on or before October 31 of each year.

(c) Effective Dates of Annual Fee Provisions. Payment of the first annual fee shall be on or before December 31, 1970, for all dams substantially completed by or in operation on June 30, 1970. Thereafter, payment of annual fees shall be on or before December 31 of each succeeding year for all dams substantially completed by or in operation on June 30 of each succeeding year.

(d) Penalty for Delinquent Payment of Annual Fee. An owner who fails to pay any part of any annual fee within the required time shall be penalized in accordance with Section 6428 of the Water Code. (Section 6428, Water Code)

Section 320. Inoperative Dams. A dam will not be considered to be substantially completed or in operation, for annual fee purposes, where the Department determines that it has been rendered inoperative on other than a temporary basis. In making its determination the Department will consider the following circumstances, among others, with respect to the dam:

(a) Alteration of the outlet facilities to assure maximum possible uncontrolled water release through the outlet works.

(b) Absence of water impounding capability under reasonably foreseeable conditions, taking into account the size of the drainage area.

(c) Absence of benefit from the dam and reservoir to the owner or others.

The Department may determine that a dam is no longer inoperative when investigation reveals that conditions which rendered the dam inoperative on other than a temporary basis have changed. In this event the dam will be considered substantially completed or in operation on the date such determination is made, and the annual fee shall be charged on a prorata basis.

Senator Moss. Now, we have a problem, there is a vote starting and we still have a witness to hear, Mr. Holway, president-elect, Consulting Engineers. We will recess for 15 minutes, and then we will come back and hear Mr. Holway.

(Recess.)

Senator Moss. Our next witness is Mr. Holway from Oklahoma. He is from the Consulting Engineers Council in Tulsa, Okla.

We are very glad to hear you, Mr. Holway, and if you will proceed, I would appreciate it.

**STATEMENT OF WILLIAM N. HOLWAY, PRESIDENT-ELECT,
CONSULTING ENGINEERS COUNCIL, TULSA, OKLA.**

Mr. HOLWAY. I happen to be president of the Consulting Engineers Council of the United States, a national organization, and I happen to be principal engineer in a concern that is engaged in water supply.

We have filed a formal statement which I would like to read at this time.

Senator Moss. Fine.

Mr. HOLWAY. The Consulting Engineers Council of the United States, representing approximately 2,500 independent engineering firms engaged in all fields of engineering practice, appreciates this opportunity to comment on S. 3449. As designers of dams, levees, water reservoirs, canals, hydroelectric plants, flood control works, and similar projects, consulting engineers share with the Congress and all Americans an abiding concern for dam safety. In this regard, we are pleased to support the objectives of S. 3449.

There are, however, several elements of this legislation which we believe merit clarification or revision if the Federal Government is to expeditiously and effectively encourage State programs to assure the safety of dams and other water storage and control structures.

The success of such programs requires the prudent utilization of the entire civil engineering community. Contrary to statements in section 1 of the bill, technical competence in the design, construction, operation, and safety of water storage control structures is not restricted to Federal employees. Admittedly, agencies such as the Corps of Engineers and Bureau of Reclamation represent sizable resource of dam experts, but so also do several State government agencies, plus numerous contractors, universities, and independent consulting engineering firms. With all due respect, there are hundreds of qualified, award-winning engineers outside the Federal Government who are trained, experienced, available, and legally registered to significantly contribute to the success of this program.

In this connection, S. 3449 refers several times to State officials having engineering competence, yet fails to acknowledge the basic criteria for technical competence—legal registration in accord with State law. Safe design and construction calls for the highest order of technical knowledge, practical experience, and sound judgment. These elements are encompassed in the engineer licensing laws of the various States—laws which have been enacted for the purpose of protecting public health, safety, and welfare. Accordingly, the requirement of legal registration of all persons, Government and otherwise, claiming engineering competence, as well as extended

training and experience, should be added to section 4, paragraphs (a) (b) (c) and (e).

Furthermore, section 4, (b) of this proposal overlooks the availability of independent engineers, registered and qualified to design all types of dams, earth, rock, fill, concrete, timber, et cetera. As currently worded, section 4(b) limits construction and operation inspections of dams to "a State official having engineering competence." We find it difficult to believe that independent consultants capable of designing such facilities as the Niagara Power project, Priest Rapids Dam, Merced River Dam, Wanapum Dam, and hundreds of others, could not also be utilized for purposes of periodically inspecting such structures.

Consulting engineers are, in fact, already being retained for this work. Over 450 dams licensed by the Federal Power Commission are currently receiving complete safety inspections by outside consultants at 5-year intervals. A listing of more than 50 different engineering firms which have provided, and are providing, comprehensive safety studies can be obtained from the Division of Licensed Projects at the Federal Power Commission. This listing is only a fraction of the total number of registered, experienced and qualified consulting engineers performing this type of work.

FPC inspections are invariably conducted by consultants. We are retained to determine deficiencies, or potential deficiencies in the design, construction, maintenance or operation of project structures which might endanger public safety. These inspections are extremely comprehensive, with firms like my own, examining in detail such matters as settlement, movement, cracking of concrete, spillway adequacy, stability and reservoir shorelines. Of particular importance are records of structural behavior disclosed by installed instruments or displacement measurements. During inspections, attention is given to foundation conditions, leakage, erosion, and waterlogged problem areas.

Conditions not readily observable are checked by special methods, including examinations by divers, when necessary, of underwater structures subject to undermining. Dewatering of tunnels is sometimes scheduled to permit visual inspections of concrete linings. Sonic tests, or core sampling and testing, may be appropriate. Another area requiring careful investigation is the stability of reservoir slopes under high water, reservoir drawdown, and earthquake conditions.

As one who has personally participated in such inspections, I can assure you that we do find and report deficiencies which the FPC seeks to have quickly corrected. In some cases we have suggested modifications to existing structures to permit safe passage of probably maximum floods.

The Federal Power Commission licensing and inspection program is a good one. It is a program which has the benefit of being proven over the years. So far as our Council has been able to determine, there has never been a failure of an FPC-licensed dam. For this reason, it would seem appropriate to add the Federal Power Commission to the listing of Federal agencies set forth in section 2 of the bill and to exempt structures and facilities licensed by the FPC in the same manner as Federal facilities are exempted in section 6.

FPC can provide a valuable input to the technical personnel and facilities which are to be made available to States to implement a nationwide dam inspection program.

In addition, we believe that sections 2, 3(b) and 4(b), should be amended to specifically point out that inspections required by this bill may be performed by, or under, the responsibility and direction of registered, qualified, independent consulting engineers.

Furthermore, recognizing that dam safety begins with quality design and construction of new water impoundment facilities, our Council respectfully recommends that heavy emphasis be placed by the States participating in this program on the need for laws requiring that all new water storage and control structures, or modifications thereto, be designed and inspected during construction by independent, registered, professional engineers.

Under section 4, paragraph (e), we believe that Governors of States should not be restricted by S. 3449 to the designation of a particular State official in order to comply with the requirements of this act. They should be permitted, as an alternative, to designate an appropriate State agency with knowledgeable administrative personnel and staff to handle this program. To do otherwise may serve to detract from the intent of this legislation by reducing the State's incentive to name dam safety officials whose technical responsibilities must be prorated with other vital engineering administrative duties.

Section 6 particularly needs clarification. As it now reads, this section proposes to exempt all water storage structures which are below 25 feet in height, or impound less than 50 acre-feet of capacity. It seems confusing and superfluous to additionally state, as the bill now does, that barriers of less than 6 feet, or impounding capacities of less than 15 acre-feet, are not covered. Such structures are already excluded by the preceding sentences.

To facilitate Senate Interior and Insular Affairs Committee consideration of our Council's recommendations for revision, we have taken the liberty of marking up an actual copy of the bill. We hope this will prove useful to the committee and are pleased to submit this for the record.

(The document referred to follows:)

[S. 3449, 92d Cong., second sess.]

A BILL To authorize and direct the Water Resources Council to coordinate a national program to insure the safety of dams and other water storage and control structures, to provide technical support to State programs for the licensing and inspection of such structures, to encourage adequate State safety laws and methods of implementation thereof, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Safety of Dams Act".

SECTION 1. Congress, recognizing the responsibility of the Federal Government and the governments of the several States to provide for the public welfare, finds—

(a) that provisions for the licensing and inspection by the States of the construction and operation of structures for the storage and regulation of water vary widely among the several States and in a number of States are inadequate to insure the safety and welfare of the public;

(b) that even in States which do provide for State licensing and inspection of such structures, there frequently are not adequate funds, personnel, and technical ability to maintain an adequate schedule of inspection of dams and other water control structures with the frequency and detail necessary to insure their safety;

(c) that the Federal Government has accepted responsibilities for broad public protection from floods in programs for the direct Federal construction of flood control and waterway improvement works, Federal financial assistance for the construction of flood control works by others, regulation of the construction of impoundments on navigable streams, and programs of disaster relief for areas affected by floods;

(d) that the Federal water resource development agencies possess technical competence in many aspects of design, construction, operation, and safety of water storage and control structures which could be utilized at the level of State government;

(e) that there exists nationally a reservoir of experienced, independent, registered professional engineers whose technical competence can serve as a valuable source of expertise to both Federal and State Governments in providing technical assistance in connection with programs to assure the safety of water storage and control structures; and

(f) that the necessity for an expedited national program to insure the safety of water storage and control structures has been recently and tragically demonstrated in the cost of lives lost and property damaged and in reports which document the lack of safety in many such structures throughout the Nation.

SEC. 2. To implement an expedited national program to insure the safety of water storage and control structures, the Secretaries of the Interior, Army, and Agriculture, acting through the Water Resources Council, are authorized and directed to develop a program of technical assistance for the support of State programs for the licensing and inspection of dams and other water storage and control structures. The existing technical personnel and facilities of the Bureau of Reclamation, *Feder Power Commission*, Geological Survey, the Army Corps of Engineers, and the Soil Conservation Service and the technical resources and registered engineering personnel of qualified private sources shall be made available as otherwise provided in this Act to implement this program.

SEC. 3. Upon the establishment of the program authorized by section 2, and upon written application by the Governor of a State to the Water Resources Council (hereinafter referred to as the "Council"), the Council shall, in consultation with State officials designated by the Governor, prepare a technical assistance plan to insure the safety of water storage and control structures in the State. Federal assistance provided under the plan may include any or all of the following functions:

(a) technical review and recommendations to the appropriate State official concerning the adequacy of the designs of water storage and control structures which are proposed for State licensing or are currently under construction;

(b) field inspection guidelines for use in surveying existing water storage and control structures and recommendations to appropriate State officials concerning the standards of safety of such structures and remedial measures required to protect life and property from any inadequacies found therein;

(c) technical assistance to State officials on specific problems arising from State licensing and inspection of water storage and control structures; and

(d) technical assistance to State officials on the development of general criteria for the design, construction, operation, and maintenance of water storage and control structures.

SEC. 4. No State shall be eligible for assistance under this Act until it has shown to the satisfaction of the Council that—

(a) the State requires by law that the construction of new water storage and control structures, as defined in this Act, and the modification, enlargement, and removal of such existing structures must be approved in writing by an appropriate State agency having engineering competence;

(b) the State provides by law for the inspection by a State official or designated consultant duly registered in accord with State law, having engineering competence of water storage and control structures during construction and of existing structures periodically during operation;

(c) the State by law provides authority to an appropriate State official having professional engineering registration and competence to temporarily suspend construction work, to restrict operation, and to require repairs or modifications of water storage and control structures until defects are remedied to assure the protection of life and property;

(d) the State provides by law or regulation a procedure acceptable to the Water Resources Council for prompt and adequate consideration of complaints to the State by citizens who are or claim to be endangered or damaged by water storage and control structures; and

(e) the Governor of the State has designated a State official or State agency with engineering competence *legally registered engineering personnel* to administer the State laws and to represent the State in cooperation with the Council pursuant to this Act.

SEC. 5. Nothing in the Act shall add to or detract from the legal responsibility of the United States for damages caused by the partial or total failure of any water storage or control structure.

SEC. 6. For the purposes of this Act:

(a) A "water storage or control structure" means any artificial barrier including appurtenant works which does or will impound or divert water and which (1) is or will be twenty-five feet or more in height above the natural streambed or from the lowest elevation of the base of the barrier to the maximum elevation of impounded water, or (2) has or will have a maximum impounding capacity of fifty acre-feet or more, or (3) is a conveyance work designed to pass flood flows for the purpose of protecting life or property: *Provided*, That "water storage or control structure" shall include structures constructed, operated, or owned by the United States, *but shall not include those licensed by the United States*.

(b) A "State" includes the District of Columbia, Puerto Rico, and the territories of Guam, American Samoa, and the Virgin Islands.

SEC. 7. The Water Resources Council is authorized to make such rules and regulations as it may deem necessary or appropriate for carrying out the provisions of this Act.

SEC. 8. There are authorized to be appropriated to the Water Resources Council not more than \$5,000,000 annually for the five fiscal years beginning with the fiscal year of the date of enactment of this Act for the administration and for transfer to the agencies enumerated in section 2 of this Act to carry out the purposes of this Act.

In addition to the aforementioned recommendations, we would like to urge that your committee consider the inclusion in this bill of a program to establish national dam-inspection standards and an inventory of all water storage and control structures. Consulting Engineers Council believes that the Federal Government, in cooperation with appropriate agencies of the various States, and in consultation with interested and knowledgeable private organizations and individual consulting engineers, should establish national dam-inspection standards as soon as possible. Such standards would help insure proper safety inspections of all dams. They would also provide a means which would avoid the type of situation now existing, wherein various Federal agencies, the Corps of Engineers, the Bureau of Reclamation, the Soil Conservation Service, et cetera, have developed and promulgated their own separate, and different, dam-design standards. Such conflicts should be avoided in the development of inspection standards.

The establishment of consensus national dam-inspection standards is the first step in detailing the methods by which inspections of different types of water storage and control structures are to be conducted, the maximum time lapse between inspections, and qualifications of those charged with the responsibility of carrying out these inspections.

Further, States should be required, as a part of such standards, to maintain records and written reports on each dam inspection, with notations of any action taken pursuant to the findings of the inspections. Finally, every State should be required to maintain a current

inventory of all dams meeting or exceeding the 25-foot, 50-acre-foot criteria in section 6 of this bill.

The U.S. Commission on Large Dams, in concert with the American Society of Civil Engineers, and other organizations, has prepared a manual on current U.S. practices in the design and construction of arch dams, embankment dams, and concrete gravity dams. This manual covers many of the important points related to design of water-retention structures. While this publication is slanted to criteria pertinent to safe design of dams, it could be conveniently utilized as a basis for developing dam-inspection standards.

Subject to the several qualifications cited in this statement, the Consulting Engineers Council of the United States believes that S. 3449 can, and will, be an important addition to the dam-safety tools long sought by all design engineers. An in-depth inspection program, utilizing all available resources, including consulting engineers, is certain to increase public confidence that dams and water storage and control structures are soundly designed, well built, and adequately maintained, and that the possibility of failure or loss of life or property under any circumstances will be greatly minimized.

Mr. Chairman, we appreciate this opportunity to discuss this important subject with you and your committee and commend you for your leadership in seeking to upgrade U.S. dam safety programs.

Senator Moss. Thank you for appearing before the committee. Thank you very much. We are pleased to hear from the Consulting Engineers and we appreciate your coming here to testify before the proposed legislation before us.

Do you have any idea of how many of the dams which fall in the criteria of this bill were designed by Federal agencies, and how many by outside sources nationwide?

Mr. HOLWAY. I made a check yesterday of it. U.S. Coal Committee's report of 1963, and it is about 50-50 on the dams designed by private firms as they show in there against the Federal dams, taking out the soil conservation ones.

Senator Moss. It would break down to about 50-50?

Mr. HOLWAY. Yes.

Senator Moss. Has your organization undertaken studies related to dam inspection standards in an attempt to try to put together some standards that could be utilized?

Mr. HOLWAY. We would be very interested in helping on that. We have many competent members who could help on that.

Senator Moss. You mentioned in your statement that the Federal Power Commission uses some 50 consulting engineering firms to inspect their 450 licensed dams. I would assume there are more than 50 firms throughout the United States. Do you have any statement of the total number of firms capable to provide inspection services?

Mr. HOLWAY. I would have a very rough statement, we could furnish that. I would say somewhere between 250 or 300 firms are actively engaged and would be very qualified in this area.

Senator Moss. I see.

Are you currently aware of any dams anywhere in the United States with serious problems that are not being corrected?

Mr. HOLWAY. I am not actually aware of any serious problems. There is a great category I am concerned with in our area of the country, the municipal water supply dams. There are a number of

them in Oklahoma or Arkansas where there is no State agency or anyone interested in inspecting these dams.

A good many of them are earth filled that require maintenance and I am concerned about this category.

Senator Moss. Well, we appreciate your suggestions.

What would be the appropriate way to establish criteria for safety under State laws? Should minimums be promulgated by the Federal Government and then left to the States?

Mr. HOLWAY. This might be one way. I think probably the best way would be to get the agencies and some of the States that do have qualified people in the private sector to go and see if they can't come up with some type of minimum inspection standard.

Senator Moss. I believe you are involved in bridge safety. Can you tell me if there is a parallel there that you might utilize on dams?

Mr. HOLWAY. Yes; the general category of inspection. That was done by the Department of Transportation and the State Highway Officials Association and we helped.

Senator Moss. Well, your proposal that we use consultants is an additional facet of this that we will examine very carefully and look at. I recognize the validity of what you say. There is a vast reservoir of expertise in the private sector of consulting engineers and we ought to utilize the expertise wherever it is. It certainly isn't all concentrated in the Federal Government, which seems to be the impression which arises from this bill.

The States felt that we had slighted them somewhat and the private engineers, of course, have the feeling that we pointed to the Federal Government as having a corner on the expertise. So we welcome your suggestions and our problem is as to how it would be administered and how we can do this within the limitations that inevitably we have on financial resources. But we certainly appreciate your coming to testify and the fact that your association is concerned with the problem in giving a lot of thought to it. We welcome any communications from you as we continue to struggle with this problem.

Mr. HOLWAY. Thank you very much.

Senator Moss. Thank you very much, Mr. Holway.

This completes the list of witnesses that were to testify today. There were some statements submitted for the record, as I announced earlier. I don't believe I overlooked anyone who came prepared to testify.

Thank you very much; we will stand in recess.

(Whereupon, at 12 noon, the committee was recessed, to reconvene upon the call of the Chair.)

APPENDIX

(Under authority previously granted, the following statements and communications were ordered printed:)

Presentation at Session I, General Session, June 19, 1972 at the Symposium sponsored by the American Water Resources Association and Colorado State University on the subject: Watersheds in Transition

WATER RESOURCES IN THE WEST ¹

(By Walter U. Garstka ²)

Water resources development in the West is a part of the steady but ever-changing progress of civilization which has been defined by Will and Ariel Durant (1968) as a social order which promotes cultural creation. They state further, "It is political order secured through custom, morals, and law, and economic order secured through a continuity of production and exchange; it is cultural creation through freedom and facilities for the origination, expression, testing, and fruition of ideas, letters, manners, and arts. It is an intricate and precarious web of human relationships, laboriously built and readily destroyed."

The development of the water resources of the Western United States is an example of the application of human knowledge and experience to the management of an environment. Biswas (1970) traces the history of hydrology to about 3200 B.C. The early inhabitants of the American Southwest had built well-developed water resources utilization systems. One example of these developments is an extensive 125-mile irrigation canal system of the Hohokam Indians in the Salt River Valley in Arizona. They built 22 villages, irrigated about 140,000 acres of land, and prospered for about 1,400 years. About 600 years ago the Hohokam disappeared for reasons unknown. The Hohokam irrigation system depended upon diversions of streamflow. They had no carryover storage. The modern canals follow very closely those built about 2,000 years ago by the Hohokam as depicted by Hubert and Kemper.

We are privileged to live in an era unprecedented in the history of civilization insofar as water resources are concerned. Heretofore the many endeavors of mankind made use of water yielded by springs or diverted from running water and conveyed by force of gravity to the points of utilization. Dams which were built to divert flows into canals or to control water levels for navigation possessed a very minor carryover storage influence. However, with the construction of Hoover Dam a completely new era came into existence.

Now, for the first time in history, it became possible to impound flood waters, not for just a few months, but for many years. Advancing engineering technology has made it possible to lift vast quantities of water in distribution systems independent of gravity-impelled open-channel flows. Centers of population have developed at locations in areas of favorable climate hundreds of miles removed from the source of water. The massive carry-over facilities provided by the engineering works of this generation have made possible the growth of centers of education, culture, industry, and population, such as are now to be found in the coastal areas of Los Angeles and in the Salt River Valley of Arizona, to mention a few. The example set by our Government in creating the new era of massive carry-over storage is being followed all over the world.

¹ The opinions and interpretations presented in this paper are those of the author and do not necessarily reflect the thinking of Yale University or of Colorado State University.

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Since the climate of arid and semiarid regions offers many advantages, centers of population are now growing at a tremendous rate because water under the new era is no longer the critical and limiting factor in that environment. Lerner (1971) reports that the percent increase in population during the decade 1960-1970 in four major regions of the United States was: Northeast, 9.8; North Central 9.6; South, 14.2; and West, 24.1. In fact the attraction of the arid and semiarid regions has been so great that even in our generation we are approaching a point of total utilization of the transported water resources.

The demonstrated engineering capabilities of long-distance transport of tremendous tonnages of water has led to serious consideration of continental water redistribution plans. Cram (1968) describes, with special reference to their impact on Canadian needs, a number of colossal water-transfer proposals continental in their scope. A very recent proposal for extensive and long-distance transfer of water from the Fraser River in British Columbia to the western and south-western states is that presented by Smith (1972).

We are fortunate to be living in what is possibly one of the most pleasant portions of the new era. The dams are new and reservoirs are free of sediment. The geologists tell us that a lake is an evanescent feature; that all lakes, both large and small, will sooner or later, through the action of the never-ceasing forces of nature, become filled with sediment. The management of the watersheds producing the inflows to the reservoirs becomes therefore an extremely important function since it has been demonstrated that watershed-management practices can exert a major influence upon the sediment yield of streams.

Our agricultural practices, demanding as they do the nurture of pure stands of a single specie on a clean-cultivated soil, are distinctly not in keeping with the reduction of erosion. An acknowledgement of this problem led to the organization of the erosion experiment stations and the creation a few decades ago of the Soil Conservation Service. The excellent attainment of conservationists notwithstanding, there still remains a great difference between the sediment yield of streams from the cultivated agricultural areas and from the wildlands in which are included range lands and forests.

Very few drainage basins in the mid-continent will yield surface flows suitable for impoundment for water supply systems. Most cities of the mid-west, even those located on river banks, have been forced to secure their water supply from groundwater. Surface water impoundments in agricultural areas have resulted in the filling of reservoirs in several decades. In contrast the reservoir formed by Norris Dam on the Clinch River in the TVA country has a sediment life of about 2700 years. There is a negligible amount of farmland above the Clinch River, the area being almost completely forested.

Reservoirs far removed from the sources of water such as in the lower Colorado River have a different problem. The material available for bedload movement which is present in the channels in desert streams is probably more than sufficient to fill, given time, many of the reservoirs. Once a reservoir has been filled with sediment the project will lose many of its multiple-purpose benefits. However, perhaps 20 to 25 percent of the reservoir capacity will remain for storage of water. Under this condition it will be groundwater which will have to be pumped from a man-made alluvial plain.

There is no cause of immediate concern about the sediment rise of our dams located in the desert. Before the construction of Glen Canyon Dam, Lake Mead had a sediment life of about 375 years. Subsequent to the construction of Glen Canyon Dam, based upon surveys of 1967, Lake Mead has a sediment life of over 1,000 years. The length of the Colorado River is such that it should be possible through the construction of debris barriers (such as were built in California to control the movement of debris from the placer mining operations) to provide a life of many millennia for the reservoirs constructed in the desert.

Practically all of the water available and suitable for massive carry-over storage impoundments of the new era is yielded by the wildlands: the grasslands and forests. Water-yield management of the water-yielding areas is fundamental to the whole structure of society. Acknowledgment of this relationship is not new. The old world recognized the importance of watershed management very long ago. There are areas in Switzerland which have been under forest management for several centuries. For example, the Canton of Valais has had a strict forest conservation policy which has prohibited all cutting of existing forests in specific areas. Extensive research is being conducted on reforestation of the higher altitudes.

As the population increases there is an inevitable increase in the value of water and in the price people will be willing to pay to secure water. Conveyance losses now accepted will become intolerable. Sediment life of reservoirs will become a matter of increasing concern. In my professional judgment, the reservoirs of the future will be constructed at high altitudes near the source of the runoff. Reservoirs in the forest and grassland areas will not only have a greatly extended sediment life but they will offer many advantages for the efficient utilization of the water, for improvement of the environment, and especially for recreation. The existence of the Interstate Highway systems has made it possible for people to travel hundreds of miles for weekend recreation. Eisel (1972) concluded that outdoor recreational demands and benefits will be an increasingly important factor in the design of land-use activities. He used a systems approach analysis using a chance-constrained model of a watershed management-land use hypothetical example to reach his conclusion.

Our knowledge of the environment, especially with respect to climatology and hydrology of the water-yielding areas, is disturbingly inadequate. This is a natural result of the pioneering exploitation in the development of the water resources. To date precision of operation has been restricted to the hydraulics of conveyance and distribution systems. Relatively little hydrologic research has been conducted in the water resource-producing drainage basins in the wildlands.

The importance of this type of data has long been recognized. For example the world-famous Wagon Wheel Gap experiment, conducted by the Forest Service and the Weather Bureau in the headwaters of the Rio Grande in Colorado, began in 1909. Universities, state agricultural experiment stations, the Bureau of Land Management, and the Forest Service have increased in recent years research in forest influences and wildland hydrology. Within recent years the Regional Offices of the Forest Service have organized the so-called "Barometer Watershed" programs which will serve the watershed management experts in the same manner that the "pilot" plants serve the chemical engineers. There have been a number of timber sales designed to a considerable extent with regard to the watershed management and water-yield aspects of the forest.

By far the greater portion of the water-yielding lands is in the public domain chiefly the federal lands administered by the Bureau of Land Management, the Forest Service, the Park Service, and the Indian Service. It does not matter who administers the area or for what purpose be it rangeland, a national forest, a national park, or a wilderness, it is still a watershed. The fraction of the land surface directly contributing to the streamflow of the 17 western states is very small. For example, in Colorado practically all of the water found in the main streams of the major rivers comes from the melting of snow from elevations higher than about 10,000 feet above sea level. In many drainage basins the most important product of the watershed management could well become the drainage basin water yield.

When the West was being won very few people nurtured in humid environments had any appreciation of the forbidding nature of a desert. John Wesley Powell was not only a pioneer explorer of the Colorado River Basin but a visionary political philosopher far ahead of his time. Powell proposed what was then a revolutionary concept, that the system of government and the development of natural resources for the arid regions be based upon scientific knowledge of the needs, rather than upon experience in humid lands. Many of his concepts continue to this day, such as river basin planning, water districts as units of self-government, investment of millions of dollars in large dams to control major streams, land classification, and the anti-monopoly provision of the assignment of water rights to the individual owners of the land which still prevails in the 160-acre limitation at Reclamation projects.

It was Powell's concept that the system of government for the arid region should be based upon the requirements of the nature of the region and not upon the naive preconceptions of those who had spent all their lives in humid regions. In October, 1893 Powell told those in attendance at the International Irrigation Congress in Los Angeles that their optimistic plans of changing the whole West into a Garden of Eden were unworkable. Stegner (1962), in his biography of Powell, quotes him as saying, "I tell you gentlemen you are piling up a heritage of conflict and litigation over water rights, for there is not sufficient water to supply the land."

The doctrine of Prior Appropriation which originated with the gold miners in California in 1849 and which was first set forth with greater clarity with reference to the use of water for irrigation in Colorado, has two principles: one, that the

beneficial use of water, and not ownership of the land, is the basis of the right to use water; and, second, that priority in time of initiation of beneficial use is the basis of priority of right to water between appropriators in times of shortage. Saunders (1968) quoted an 1882 Colorado adjudication on water rights:

We conclude, then that the Common Law doctrine giving the riparian owner a right to the flow of water in its natural channel upon and over his lands, even though he makes no beneficial use thereof, is inapplicable to Colorado. Imperative necessity, unknown to the countries which gave it birth, compels the recognition of another doctrine in conflict therewith. And we hold that, in the absence of express statutes to the contrary, the first appropriator of water from a natural stream for a beneficial purpose has, with the qualifications contained in the Constitution, a prior right thereto, to the extent of such appropriation.

The doctrine of Prior Appropriation is also known as the Colorado Doctrine. It is the application of the Colorado Doctrine which gave rise to the acquisition of water rights upon the flow of the Colorado River by Southern California, even though less than 0.10 percent of the flow of the Colorado River is contribute by California. (Garstka, 1968). Sax (1967) has prepared a condensed and informative treatment of Federal Reclamation Law. The whole subject of water law has taken on increased importance as part of the environmental crusade.

The land area, exclusive of water area, of the 17 western states is almost 61 percent of the area of the conterminous United States. Of the approximately 1,830,000 square mile total area of the 17 western states only 68,500 square miles (43,862,000 acres) or 3.7 percent comprise the total area irrigated.

Bureau of Reclamation projects provide a full water supply for irrigation to 8,570,000 acres or 19.5 percent of the 43,862,000 acre area irrigated, or to only 0.7 percent of the total land area of the 17 western states. According to Kober (1972) the grand total of all irrigated areas for the 50 states is 49,305,000 acres.

Almost 26 percent of the 203 million plus people reported in the 1970 census live in the 17 western states (Lerner, 1971). Of the 52 and a half million people residing in this area 14.2 million are supplied by domestic water from Federal reclamation projects. An exact figure is not available but I estimate that between 80 and 85 percent of the domestic water for the 52 and a half million people comes from impoundments. The remaining 15 to 20 percent get their supply from groundwater or from the increasingly rare direct diversions from streamflow. This is in marked contrast to the mid-west where practically all of the municipal water comes from the groundwater rather than from surface sources, since the agricultural areas are apt to yield silt-laden water polluted with sewage and industrial effluents, biocides and fertilizers.

Impoundments often provide municipal water in the Appalachian Mountain area. However there is a great difference between impoundments in the East and those in the West since most eastern reservoirs have very limited carry-over storage capacity. Deficient rainfall for several months results in concern about the water supply.

The concentrations of population such as in Denver, Salt Lake City, Phoenix the Los Angeles Metropolitan area and the San Francisco Bay area, for example, are assured of domestic and municipal water because of the existence of massive, carry-over storages at times hundreds of miles away from the point of water demand. These concentrations of populations survive and prosper in an environment hydrologically and ecologically totally unsuited for their form of civilization.

The fundamental physical data upon which water resources developments are based consist essentially of hydrologic, meteorologic, climatologic, geologic, ecologic, biologic and pedologic observations secured at great expenditure of time and effort in the water-yielding drainage basins and in the project development areas. Since most of the streamflow in the West is the result of the melting of snow, there are about 1,400 snow courses in the western United States and Canada.

These excellent programs received a serious set-back as a result of the passage of the Wilderness Act, Public Law 88-577 of September 3, 1964. Regulations pertinent to the execution of the Wilderness Act by the Department of the Interior were signed by Stewart L. Udall, Secretary of the Interior, February 17, 1966, and published in the Federal Register February 22, 1966. Regulations of the Department of Agriculture of which the Forest Service is a part, were signed by Orville L. Freeman, Secretary of Agriculture, on May 31, 1966 and published in the Federal Register on June 3, 1966. The Wilderness Act, and the Department of Interior's and Department of Agriculture's interpretations of the Act have brought practically to a halt the gathering of any scientific information on the environment of the areas locked up in a "wilderness".

This has had an especially devastating effect on hydrologic research and operational-hydrologic data gathering. I am sure that the idealistic supporters of the Wilderness Act had no conception of the devastating impact the passage of that Act would have on scientific and engineering information fundamental not only to their well being but possibly to their survival.

Within a few months after the publication of the regulations in the Federal Register hydrologists became aware of the problems created by the Wilderness Act. An appraisal of disquieting developments was made by van de Erve (1969).

The sincere but uninformed proponents of more and more Wilderness areas appear to have completely overlooked the fact that most of the people in the Western states secure their water from the wildland drainage basins. With increasing demands for high-quality water there is a need for a greater number and more technologically sophisticated data gathering observation stations. The actual trend is the opposite of this since as soon as an area is set aside as a Wilderness the existing hydrologic stations, many of them of many decades standing, are terminated.

It has been established beyond reasonable doubt that the forests have an impact on water yield and on floods. A forest will absorb completely small rains of low intensities. Forests may modify very considerably the hydrograph of floods produced by the average types of storms. However, the forest will have practically no effect on the peak rates of runoff of major floods. Both the forests and grasslands will very greatly reduce the sediment transport. Therefore flood waters yielded from wildlands covered with vegetation are apt to be extremely aggressive when they reach the lowlands.

The continuation of prohibition of hydrologic installations in Wilderness areas could prevent any progress in improvement of the management of water resources. In many drainage basins in which the streamflow is fed by the water yielded by Wilderness areas, there is a distinct possibility of extensive damage because of the absence of hydrologic information. This does not mean that the damage is certain. It could indicate that extensive and expensive protective engineering works will have to be provided downstream of the Wilderness area.

If a sufficiently large dam were to be built in the stream bottom just below a Wilderness boundary, there would be no need for detailed hydrologic observations upstream. An alternative to flood-control structures would be to enforce in the valleys downstream of Wildernesses the concepts so eloquently proposed by Gilbert F. White (1964).

The concept that the setting aside of an area as a Wilderness will preserve for " * * * present and future generations the benefits of an enduring resource of wilderness", is scientifically unsound when coupled with the permission granted to the Secretary of Agriculture, Sec. 4, (d)(1) in the Wilderness Act that " * * * measures may be taken as may be necessary in the control of fire, insects, and diseases * * *". It is based on a misconception of the ecology of wildlands. Simply because a drainage basin is now occupied by a combination of species forming an ecologic complex which is pleasing to us does not mean that it will be that way forever. Ecologists and silviculturists know that it is extremely difficult to find any wildland area occupied by vegetation which has not at one time been burned over. In fact, many of the pure stands of virgin timber in areas considered among the most beautiful are the result of extensive and repetitious fires of the past.

If one were to preserve the Wilderness there should be no interference whatsoever with the forces of Nature. Therefore if the concept of the Wilderness were to be applied with philosophical and scientific honesty, there should be no fire-fighting, no insect or plant disease control permitted in the Wilderness area. Travel and access, for whatever purpose, should be only on foot. Only then can we preserve the Wilderness in its dynamically natural state for future generations. If, under the terms of the Wilderness Act the area is to be locked up so that scientists and engineers cannot secure observations, why should access be permitted to control fire, insects, and disease? How will future generations know what a Wilderness was like when our generation locked it up?

Drucker (1972) in reviewing a report about the saboteurs of the environmental crusade says, " * * * Paradoxically, the most fervent environmentalists may be among the chief wreckers. Many are confused about the cause of our crisis and the ways in which we might resolve it. They ignore the difficult decisions that must be made; they splinter the resources available for attacking environmental problems. Indeed, some of our leading crusaders seem almost perversely determined to sabotage their cause—and our future."

There are many high-altitude areas of such importance as drainage basins for water yield that continued protection of their watersheds transcends any benefits which might be reaped by timber cutting. Such protection cannot be practiced if the drainage basins are locked up as Wilderness areas, whereas practically all of the benefits of the Wilderness concept can be attained, improved, and sustained forever with proper watershed management.

I find no relationship between the Wilderness movement and the crusade for improvement of the environmental quality. Is it possible that too many areas already functioning as contributors to the Nation's present and future environment are being pushed for Wilderness designation with no regard to the impact of the loss of their contributions?

The National Environmental Policy Act, "NEPA" Public Law 91-190, 83 Stat. 852 created the three-man Council on Environmental Quality. This Council is part of the Executive Office of the President. Sec. 102(2)(C) requires the preparation of environmental statements. The agency proposing a program which may have an impact on the environment is required to prepare a draft statement and submit it to federal, state, local, and private agencies and organizations which may be affected even remotely by the proposed course of action. The action agencies must recognize and consider, but not necessarily agree with review comments and criticisms and then submit a final statement to the Council on Environmental Quality. It is a requirement that the CEQ have the final statement available for at least 30 days before the action agency may proceed with its proposal.

If any of the reviewing agencies are not satisfied with the final statement they may go to Court. There are at present probably hundreds of lawsuits concerning the environmental impact. The CEQ has no authority to approve or disapprove a program. However, the Executive Office of the President may decide that approval may not be in the public interest and such a decision usually will stop the action agency from proceeding.

Under the Wilderness Act the study and submittal of statements comes from the Federal agency currently responsible for the management of land under consideration for inclusion in a Wilderness. This sets up a very strange situation in which the Federal action agencies are required to do all the analyses while the Wilderness proponents sit back preparing for lawsuits. This is an inconsistency which requires correction, possibly in a revision of the Wilderness Act, so that the supporters of an area under consideration for Wilderness status would be required to prepare a thorough Sec. 102 environmental statement.

It is a fascinating characteristic of the human race that it attempts to improve its living conditions and its environment. Each generation strives for the betterment of mankind through exerting an effort for a noble cause. A current and undoubtedly lasting cause is that of the concern about our environment which has resulted in NEPA. This is not new as has been set forth in great detail by Marsh (1864 and 1965). He traces in great detail the impact of man upon the earth's environment, in many instances back to ancient time. The locale of many of his examples of deterioration look good to us now. Nature is forgiving only in the temperate zones but not in the fragile environments of the arid and arctic zones.

Vast amounts of readily available and widely-distributed electric power are absolutely necessary if we are to make any real progress in the control of both water and air pollution.

The Water Resources Council released its first national assessment in 1968 in a very comprehensive and readable report entitled, "The Nation's Water Resources", in which numerous projections nationally and by regions are presented through the year 2020. Chapter 3 deals with electric power in relation to the water resource. Although only about one-third of the potential hydropower in the United States has been developed to date much of the remaining two-thirds will not and in many instances should not be developed.

At present our electric energy comes chiefly from the combustion of fossil fuels, petroleum, and coal. The end is in sight for ready availability of natural gas and oil, as discussed by Hubbert in "Resources and Man" (1969). Until the nuclear scientists demonstrate the fast breeder reactor or until controlled fusion or some other means of securing electric power through physical phenomena not requiring combustion has been attained, not only our Nation but the world will become dependent on coal. This trend will be accelerated by rising costs and increasing intricate international complexities of securing petroleum from other lands.

Wolf (1972) presents a comprehensive analysis of the environmental degradation resulting from the operation of the Arizona Public Service Company's Four Corners power plant near Shiprock, New Mexico. Many of the pollution control

problems result from the fact that the Four Corners coal is almost one-quarter ash thus aggravating the control of emission of particulates in addition to the usual problem of dealing with sulphur and nitrogen.

High-purity coals are found in parts of Montana and Wyoming in the Missouri River Basin. Deposits of coal in this area may be over 100 feet thick and the layers are so close to the surface that they can most effectively be mined by either strip- or open-pit mining. According to a study described in a preliminary report entitled, "Appraisal Report on Montana-Wyoming Aqueducts," (1972) the development of the deposits of over 34 billion tons of strippable coal deposits will result in unprecedented watershed-management problems even though a very small percentage of the area is turned over. Considering the accelerating depletion of the rare and convenient fuels, liquified petroleum and natural gases, it is inevitable that the synthesizing of combustible gas and liquid fuels from coal, an attainment already documented, will increase greatly. In the Montana-Wyoming area the projected water demands to meet the expected level of development are 2,600,000 acre feet annually.

The increase in generation of vast blocks of electric energy will have to take place not only to maintain a standard of living but especially to provide the energy for improvement and intelligent management of an environment in our country where the expected population by the year 2000 is projected to be 300 million people, or one additional person for each two reported in the 1970 census. Unquestionably there will have to take place accelerated mining of coal in many other parts of the United States. There is no doubt that in the past there has been painful devastation of the environment resulting primarily but not exclusively from strip mining. The mining of coal by whatever process has an immediate impact on the environment and on the quantity and quality of the water resource, and especially on watershed management.

Hayakawa (1972) points out that the youth of the country is prevented from experiencing the challenges and thrills of personal attainment by exclusionary rules, child labor laws, minimum wage laws, and social and legal pressures. There is a tremendous backlog of work which needs to be done in connection with the restoration, improvement and sustained management of our environment. We are still the beneficiaries of the Civilian Conservation Corps of four decades ago.

The Job Corps administered under the U.S. Department of Labor had as its objective education in the basic three "R's" and training in a skill such as carpentry, welding, masonry, and heavy equipment operation. There are now only about 20 Civilian Conservation centers of the Job Corps operated mostly in collaboration with the Departments of Interior and Agriculture with private industry taking an active part. There were city-oriented residential manpower Job Corps training centers for men and women, operated separately, aimed at training mechanics and those interested in the culinary arts and related activities.

The total number of enrollees in the United States participating in major programs of ACTION, an agency which came into being on July 1, 1971, amount to less than 20,000. The approximately 8,500 members of the Peace Corps do not serve in the United States and are not included in the 20,000. Vista, at present, has less than 4,500 volunteers. The objectives and the sources of recruitment for Job Corps and ACTION programs have been oriented primarily at working with ethnic, minority, and under-privileged segments of our people.

According to the latest information as given in the "Digest of Education and Statistics, 1970", a total of 2,522,000 youths graduated from the public high schools and 310,000 from non-public schools for the school year 1968-69. Some of these have gone to college but the unemployment figures of those who did not go to college is extremely high. Many of the young graduating from high school have no specific ambition or objective in mind and they are being forced to reach manhood and womanhood in a vacuum.

Public Law 91-378, 91st Congress, S. 1076, approved by President Nixon on August 13, 1970, established the Youth Conservation Corps. The following sentence is quoted from Section 1 of the Act. "Accordingly, it is the purpose of this Act to further the development and maintenance of the natural resources of the United States by the youth, upon whom will fall the ultimate responsibility for maintaining and managing these resources for the American people."

This Corps was established as a three-year pilot program to be administered jointly by the Departments of Interior and Agriculture. It is open to the youth of both sexes to be selected from all social, economic, and racial classifications who have attained age 15 but have not attained age 19. Employment in the YCC is limited not to exceed 90 days in any single year. The Law specifies that the Youth

Corps activities are limited to the summer months. During the summer of 1972 about 3,000 Corps members will be employed in activities both in the areas in which they live or in camps nearby.

It is my understanding that the activities of the YCC in the summer of 1971 were so outstandingly successful that the number of applicants far exceeds the positions available for the current summer of 1972. Taking into account the two and three-quarters million high school graduates per year and considering the number of those currently participating in all of the youth-oriented training and action programs, it is evident that a disturbingly small number of the youth have any opportunity to approach maturity under circumstances other than those in their immediate environments.

There has been extensive attention paid to the "protection," "conservation," and "preservation" of various aspects of our environment. These were all excellent for their purposes and at their time but we are now embarking on an era in which we must "manage" the environment. Nowhere in this world can be found now a truly natural ecosystem untouched in any way by man's activities.

I propose the creation of an environmental resource management organization which would be open to all young people who wish to enroll without regard to the economic and social status of their parents. The ERMO enrollees would be provided with travel, subsistence and limited pay. They could be assigned to temporary camps and live away from home under rigorous conditions close the environment not necessarily only during the summer. The work that they would do would expose them to the elements and it would be organized so as to require the expenditure of mental and muscular effort.

Krendel (1967) presents equations for the computation of power generated by man and animals. Although in a short burst of energy of less than one second duration a man may generate up to six horsepower, a normal 35 year-old European man's production of power for useful work over an 8-hour day and a 48-hour week is about one-tenth horsepower or about 75 watts. Depending upon the age of the man, the average power production may be about 60 watts for steady useful work. Although this appears to be a very small output in comparison with commonly available internal combustion and electrical power generation (one horsepower is equivalent to 746 watts) there is no substitute for manpower under natural conditions in the fields, forests, and along waterways including brooks, rivers, lakes and shorelines.

Vast efforts should be expended in land use-cleanup programs in restoration of water resource-related environments of channels and shorelines, improving the ever increasing number of recreational facilities, in watershed-management activities including the restoration of abandoned and degraded lands such as strip-mined areas, and in the removal of debris from over-mature forests in headwaters drainage basins where the use of controlled burning would be undesirable.

Experience in ERMO would provide an opportunity to learn at first hand what life under relatively primitive conditions is like and to develop abilities to use intellectual and physical powers for the common good while working together close to nature. The accomplishments of a program of this type would contribute to the transition of watersheds and to a permanently improved environment in an increasingly complex world.

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