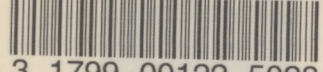


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**STATE ENGINEER'S
SEVENTH ANNUAL REPORT TO THE
COLORADO GENERAL ASSEMBLY
ON DAM SAFETY FOR
F.Y. 89-90**

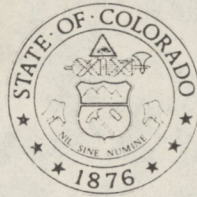
November 1, 1990

**OFFICE OF THE STATE ENGINEER
DIVISION OF WATER RESOURCES**



Jeris A. Danielson
State Engineer

ROY ROMER
Governor



JERIS A. DANIELSON
State Engineer

OFFICE OF THE STATE ENGINEER
DIVISION OF WATER RESOURCES

1313 Sherman Street-Room 818
Denver, Colorado 80203
(303) 866-3581

November 7, 1990

The Honorable Roy Romer
Governor, State of Colorado
State Capital Building
Denver, Colorado 80203

Dear Governor Romer:

Pursuant to Section 37-87-114.4, C.R.S. (1990 Repl. Vol.), I am pleased to submit the attached report covering the activities of the State Engineer on dam safety in Colorado for fiscal year 1989-1990.

Colorado's dam safety program has continued to improve through the promulgation of regulations and the decentralization of the personnel conducting the safety inspections to our Division offices. The regulations will bring the condition of the structures up to modern standards, and the residence of the dam safety engineers has made the program more efficient and effective.

I believe our dam safety program's legislation needs to be improved in the area of emergency action. The Association of State Dam Safety Officials' (ASDSO) Model State Dam Safety Program recommends that a state have the authority to take emergency actions to prevent a dam failure in the event an owner of a dam is unable or refuses to take action themselves. Our present reservoir statutes are deficient in this area.

Colorado's dam safety program has been strong and a leader among the states as a result of resources made available by the General Assembly. We will strive to maintain this performance to ensure the public safety of the citizens of the state.

If you have any questions or would like additional information, please fee free to call upon me at anytime.

Sincerely,

Jeris A. Danielson
State Engineer

JAD/AEP:glA/3915I

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**STATE ENGINEER'S
SEVENTH ANNUAL REPORT TO THE
COLORADO GENERAL ASSEMBLY
ON DAM SAFETY FOR
F.Y. 89-90**

November 1, 1990

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STATE ENGINEER'S ANNUAL REPORT
TO THE
GENERAL ASSEMBLY
ON
DAM SAFETY
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This report is submitted in compliance with Section 37-87-114.4, C.R.S. (1990 Repl. Vol.) concerning the dam safety activities of the State Engineer and the Division of Water Resources relating to Section 37-87-105 to 37-87-114, C.R.S. (1990 Repl. Vol.).

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Each Unit is led by a Supervising Water Resource Engineer. (See Appendix A for tables and charts for the personnel and organization of the Branch.)

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- APPENDIX A - DAM SAFETY BRANCH PERSONNEL
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1 Per Section 37-87-107, C.R.S. (1990 Repl. Vol.)
 2 Per Section 37-87-105(4), C.R.S. (1990 Repl. Vol.)
 3 Per Section 37-87-109, C.R.S. (1990 Repl. Vol.)

STATE ENGINEER'S SEVENTH ANNUAL REPORT
TO THE
GENERAL ASSEMBLY
ON
DAM SAFETY
FOR
FISCAL YEAR 1989-1990

INTRODUCTION

Statutory Provisions

Colorado's Dam Safety Program is administered by the State Engineer in accordance with Title 37, Article 87, of C.R.S. (1990 Repl. Vol.), and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. (1973), as amended. Rules and Regulations for Dam Safety and Dam Construction, and standard specifications for Livestock Water Tanks and Erosion Control Dams, establish the procedures and requirements of the State Engineer for administration of these statutes.

This report is submitted in compliance with Section 37-87-114.4, C.R.S. (1990 Repl. Vol.) concerning the dam safety activities of the State Engineer and the Division of Water Resources relating to Section 37-87-105 to 27-87-114, C.R.S. (1990 Repl. Vol.).

Organization

Implementation of the Dam Safety Program is done by the State Engineer through the Dam Safety Branch.

The Branch is organized into three Units, two being Dam Safety Engineering Units (DSEU), and the Design Review and Construction Inspection Unit (DRCIU). Each Unit is led by a Supervising Water Resource Engineer. (See Appendix A for tables and charts for the personnel and organization of the Branch.)

The Dam Safety Engineering Units' principal duties are to conduct safety inspections of existing dams (SEED),¹ design review and construction inspection of repairs and alterations², and investigation of complaints on the safety of dams.³ They investigate the construction of dams in violation of Section 37-87-105(1) and (4), C.R.S. (1990 Repl. Vol.), assist the Department of Health in the inspection of tailing dams, and conduct training on the inspection of dams for division personnel, dam owners, interested agencies, engineers, and the public. They also do other related work as assigned.

The Design Review and Construction Inspection Unit's principal duties are to review the plans and specifications for the construction, alteration, modification, repair, and enlargement of reservoirs or dams in accordance with

¹Per Section 37-87-107, C.R.S. (1990 Repl. Vol.)

²Per Section 37-87-105(4), C.R.S. (1990 Repl. Vol.)

³Per Section 37-87-109, C.R.S. (1990 Repl. Vol.)

Section 37-87-105, C.R.S. (1990 Repl. Vol.) (This involves a comprehensive engineering review of the plans and specifications to assure that a safe design has been developed), and to inspect the construction of the work. It processes the Livestock Water Tank and Erosion Control Dam applications per Section 35-49-101 through 116, C.R.S. (1973) and Section 37-87-122, C.R.S. (1973). The Unit assists the Department of Health in the technical evaluation of tailing impoundments through a "Memorandum to Understanding," and participates in the state's "Joint Review Process" with the Department of Natural Resources. They also do other related work as assigned.

Goals and Objectives of the Program

The mission of the program is to prevent loss of life and property damage from the failure of dams. The primary goal of the State Engineer with respect to dam safety is to provide maximum public safety against dam failures within the resources of his office. Towards this goal, the resources are directed at the safety inspection of each Class I and Class II hazard nonfederal dam and reservoir on an annual basis, and the safety inspection of each Class III hazard nonfederal dam and reservoir on a five year basis. The program concentrates on "jurisdictional" dams and reservoirs as defined in Section 37-87-105, C.R.S. (1990 Repl. Vol.) which are greater than ten feet high at the spillway, or greater than twenty acres in surface area at the high water line, or greater than 100 acre-feet in capacity at the high water line. Because of their non-hazardous situation, Class IV dams are not inspected regularly, but observed for changes in hazard class periodically.

Safety inspections are made of U.S. Bureau of Reclamation and U.S. Corps of Engineers dams on a cooperative basis, their safety inspections being carried out in accordance with the "Federal Guidelines for Dam Safety." Arrangements are made with other federal agencies for the safety inspection of their dams by the Bureau of Reclamation, the Corps of Engineers, their own forces, consulting engineers, or by the State Engineer. When other than State Engineer personnel conduct the safety inspections, the agencies submit the findings/recommendations and follow-up to the State Engineer in order to assure the safety of these dams.

A Memorandum of Understanding has been formulated with the Bureau of Reclamation relating to dam safety activities in Colorado. It provides for the exchange of safety-related information of dams under each agency's jurisdiction.

A related objective is the inspection of construction for compliance with approved plans, and to assure that plans are adequate for the site conditions. Inspections are made of the foundation, outlet works, spillways, and final construction as a minimum. Interim inspections are made as necessary.

An adjunct to the inspection objectives, but an important element of the dam safety program, is the goal to have each owner of Class I and Class II hazard dams prepare an Emergency Preparedness Plan to combat any incident which would jeopardize the safety of the dams, and to give warning to appropriate emergency preparedness agencies/officials so they may mobilize their plans for mitigating the consequences of dam-break flooding. An inundation map is required for Class I dams.

The following Table 1 shows the ownership of jurisdictional dams in Colorado by owner; and Table 2 shows the distribution of dams in the state by Water Division and hazard rating.

TABLE 1

JURISDICTIONAL¹ DAM OWNERSHIP STATUS
IN COLORADO

HAZARD RATING	TYPE OF OWNER				TOTAL
	FEDERAL	STATE	OTHER GOVT.	PRIVATE	
Class I	39	12	80	128	259
Class II	13	23	80	211	327
Class III	54	33	139	976	1202
Class IV	<u>10</u>	<u>0</u>	<u>3</u>	<u>27</u>	<u>40</u>
TOTAL	116	68	302	1342	1828

¹Greater than ten feet high to spillway, or twenty acres in surface area at the high water line, or 100 acre-feet in capacity at the high water line.

Class I - Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.

Class II - Significant damage to improved property is expected in the event of failure of the dam while the reservoir is at the high water line, but no loss of human life is expected.

Class III - Loss of human life is not expected, and damage to improved property is expected to be small in the event of failure of the dam while the reservoir is at the high water line.

Class IV - Loss of human life is not expected, and damage will occur only to the dam owner's property in the event of failure of the dam while the reservoir is at the high water line.

TABLE 2

DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/CLASS

<u>DIVISION</u>	<u>NONFEDERAL</u>				<u>FEDERAL</u>				<u>TOTAL</u>			
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
1	115	129	474	7	13	8	11	8	128	137	485	15
2	33	52	197	15	6	3	17	0	39	55	214	15
3	9	15	36	2	1	0	4	1	10	15	40	3
4	23	39	159	0	8	0	7	0	31	39	166	0
5	20	45	129	4	7	0	9	0	27	45	138	4
6	10	15	111	1	0	2	5	1	10	17	116	2
7	<u>10</u>	<u>18</u>	<u>43</u>	<u>1</u>	<u>4</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>14</u>	<u>18</u>	<u>44</u>	<u>1</u>
	220	313	1149	30	39	13	54	10	259	326	1203	40
TOTALS			1712				116				1828	

- Class I - Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.
- Class II - Significant damage to improved property is expected in the event of failure of the dam while the reservoir is at the high water line, but no loss of human life is expected.
- Class III - Loss of human life is not expected, and damage to improved property is expected to be small in the event of failure of the dam while the reservoir is at the high water line.
- Class IV - Loss of human life is not expected, and damage will occur only to the dam owner's property in the event of failure of the dam while the reservoir is at the high water line.

APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF DAMS AND RESERVOIRS

During FY 89-90, the State Engineer received plans for nine new dams, and 47 plans for alteration, modification, repair, or enlargement. Eight separate hydrology/hazard studies were also approved for determination of the inflow design flood for spillway design or hazard classifications. Estimated cost of construction for the submitted plans was \$11,116,841.00. Five thousand two hundred and four dollars (\$5,204.00) was collected for the examination and filing of the submitted plans.

Thirty-eight sets of plans and specifications were approved by the State Engineer for construction during FY 89-90. (See Appendix B for lists of dams which were approved by Water Division/District, and use.) In order to expedite the approval of repair plans for dams, the State Engineer has modified the review process for these type of plans by having the dam safety engineers review them. This enables the owners to repair their dams sooner by shortening the review time. Since these types of repairs are usually simple procedures, they do not require the same detailed review as plans for new dams.

Five special studies associated with dams were also performed, including geotechnical reports, feasibility reports, subdivision plans, and requests from the Department of Health and Division of Mined Land Reclamation.

Upon completion of construction, the owner's engineer submits copies of the "AS-CONSTRUCTED" plans showing the changes made during construction. These plans are reviewed by the engineer who monitored the construction for completeness before being accepted for filing. The superseded plans are disposed of and the "AS-CONSTRUCTED" plans serve as the public record as provided by the statutes.

In order to provide for the quality control of the design review work, the supervisor reviews the work, design review memoranda, and construction inspection of the unit. The supervisor also provides expert guidance to the unit, as well as the dam safety engineers when they are involved with design and construction.

Section 37-87-114.5, C.R.S., (1990 Repl. Vol.) exempts certain structures from the State Engineer's approval. They are, structures not designed or operated for the purpose of storing water, mill tailing impoundments permitted under Article 32 or 33 of Title 34, C.R.S. (Minerals or Coal Mines), uranium mill tailing and liquid impoundment structures permitted under Article 11 of Title 25, C.R.S. siltation structures permitted under Article 33 of Title 34, C.R.S. (Coal Mines), and structures which store water only below the natural surface of the ground.

In order to prevent administrative problems arising from the construction of small dams which do not fall under the jurisdiction of the State Engineer's review and approval, Section 37-87-125, C.R.S. (1990 Repl. Vol.) requires that a Notice of Intent to Construct a Nonjurisdictional Water Impoundment Structure must be submitted to the State Engineer prior to beginning construction. The State Engineer provides a form for submitting the notice, which is directed to the Division Engineer of the Division that the impoundment is located in for processing. The notification also serves to address any dam safety issues which are evident.

SAFETY INSPECTIONS AND CONSTRUCTION OBSERVATION

Scheduling

Jurisdictional dams identified for inspection in accordance with the objectives of the State Engineer are assigned to the dam safety engineers on a geographic and hazard related basis. Divisions 2, 3, 4, 5, 6, & 7 are assigned to the resident dam safety engineers. The engineers each schedule the inspection of approximately 70 to 100 separate dams each "inspection season," which begins about April 1 and ends about November 1. Subsequent follow-up and problem solving results in additional inspections each year. Within the planned schedules are the inclusion of all the Class I and Class II hazard dams, and

approximately one-fifth of the Class III ones. Inspection of federal dams are integrated with these schedules. The State Engineer has executed a Memorandum of Understanding (MOU) with the Regional Forester, Rocky Mountain Region, USDA Forest Service, concerning the statutory obligations each has in regard to the administration and safety of dams on National Forest lands in Colorado. The Memorandum of Understanding provides for the exchange of information, assuring access to dams (e.g. wilderness areas), scheduling of the inspection of forest service dams, and the joint review for approval of plans and specifications: The State Engineer has also executed an MOU with the Bureau of Reclamation (Upper Colorado Region and Great Plains Region). The MOU provides for the exchange of information at an annual meeting; or when requested on Reclamation dams, and non-federal dams which may affect Reclamation dams; the observation of the construction at Reclamation dams; the notification of emergency conditions at mutually affected dams; and the access to technical expertise when requested. An MOU has been submitted to the Bureau of Land Management, but they have declined to pursue one. The Dam Safety Engineering Units, therefore, collectively conduct about 900 safety inspections on an "inspection season" basis.

In order to track potential problems which could develop at Class III dams between their five year engineered inspections, the Division's water commissioners are assigned Class III dams to observe and to fill out a report. The report is submitted to the Branch for review, and a copy is furnished to the owner for their information and to implement any recommendations for maintenance and repair. A copy of the WATER COMMISSIONER DAM OBSERVATION REPORT is in Appendix C.

Scope

A safety inspection involves more than just a visit to the dam. The site visit is preceded by a review of the file and history of performance, and coordination with the owner, division staff, and other interested parties so they may take part in the inspection. (The statute specifies that a safety inspection include the review of previous inspection reports and drawings, site inspection of the dam, spillways, outlet facilities, seepage control and measurement system, and permanent monument or monitoring installations.)

A safety inspection also includes an evaluation of the adequacy of the spillway to pass the appropriate magnitude flood for the dam's size and hazard class, to make an evaluation of the dam's hazard classification and whether it has been affected, and to assess the several emergency preparedness plans for the dams. More recently, the internal inspection of the outlet, and evaluation of instrumentation have been added to the workload.

The findings of the inspection are documented on a report form which rates the conditions observed of the several components of the dam and reservoir. The overall conditions are rated as satisfactory, conditionally satisfactory, or unsatisfactory (unsafe) for full storage, and a recommendation is made on the safe storage level. The report also enumerates the several repair and maintenance items which the owner must attend to, and specifies the several engineering and monitoring requirements necessary to assure the safety of the dam. (A copy of the ENGINEERS INSPECTION REPORT is in Appendix D.)

In order to assure the quality control of the safety inspections of the several hundred reports generated each year, the supervisors of the dam safety engineering units review the findings and conclusions of each report. They also provide guidance and direction on problems and questions that the dam safety engineers have. Due to a shortage of manpower due to vacancies and by legislative mandate, the supervisors also conduct safety inspections.

An invoice for the cost of the inspection is also prepared in accordance with the provisions of the statutes, the payment being due within thirty days of receipt by the owner. (The fees for safety inspections has been repealed by HB 90-1130, effective July 1, 1990, See Appendix E.)

If the safety inspection finds that the overall conditions are unsafe, an order is written by the State Engineer restricting the storage in the reservoir to a safe level. If the findings are conditionally satisfactory, full storage is recommended contingent upon appropriate monitoring provisions being provided by the owner. Restriction orders are accompanied by orders to rehabilitate the dam to make it safe for full storage, or to breach the dam.

Orders to repair or maintain the dam usually require the reinspection of the dam in order to verify that the work has been done in a workmanlike manner. Reinspections also occur to assure follow-up of the State Engineer's orders, or by request from the owner.

In the event the owner fails to comply with an order to make a dam safe, a breach order is issued to remove the hazard created by the dam and reservoir. This subject will be covered in more detail later in this report under RESULTS OF SAFETY INSPECTIONS AND ENFORCEMENT ORDERS AND PROCEEDINGS, where the Attorney General is requested to commence proceedings against owners refusing to obey the written orders of the State Engineer.

Number of Inspections

During FY 89-90, a total of 773 safety inspections were conducted (and 52 construction inspections) for a total of 825. This included 225 safety inspections of Class I hazard dams, 300 safety inspections of Class II hazard dams, 237 safety inspections of Class III hazard dams, and 11 safety inspections of Class IV hazard dams (including federal dams). The objective of inspecting all Class I and Class II hazard dams on an annual basis is an "inspection season" objective versus a fiscal year one. This objective was reached for "inspection season" 1989, with the assistance of the dam safety unit supervisors. The five year schedule for Class III dams was also accomplished. The number of inspections was reduced partly due to accelerated scheduling of Class III dams in former years. Vacancies also affected the total number of inspections.

Decentralization

It is the State Engineer's policy to relocate members of the division to the field division offices in order to make our services to the public more responsive and timely. This policy has been followed extensively in dam safety with dam safety engineers transferred to Durango, Glenwood Springs, Montrose, Pueblo, and Steamboat Springs in the past several years.

The transfers have resulted in more efficient services in dam safety, with the savings in operating and travel providing for more training and acquisition of computer support. We are also able to serve the dam owners better by being more available to them and their engineers for support.

Assistance to Dam Owners

During the year the dam safety engineers had several occasions to assist dam owners in the repair and maintenance of their dams. Following are examples of the assistance provided.

1. In Boulder County, the owners of Foothills dam and Allen Lake dam were provided details for installing toe drains for their dams.
2. In Larimer County, the owner of Loveland Water Storage dam was shown how to install leakage measuring devices.
3. In Sedgewick County, the owner of the Julesburg dams was provided with details for measuring leakage.
4. In Teller County, the dam safety engineer was expeditious in locating the owner of the Jordan #1 dam and advising them of the poor condition of the dam, especially the leakage conditions at the outlet. Approximately one and one-half months later, a piping condition developed along the outlet. Due to the owners recent vigilance, which was prompted by the safety inspection, the dam was prevented from failing.
5. In Delta County, the division engineer and the dam safety engineer assisted the emergency coordinator with a county wide emergency action plan for the flooding resulting from dam failures.
6. In San Miguel County, the division and dam safety engineer recognized the owners of the Gurly Ditch and Reservoir Company by awarding them a special award for their efforts in the safety of their dam.
7. In Division Four, the dam safety engineer assisted several dam owners with the establishment of monitoring points for leakage.
8. In Eagle County, the dam safety engineer advised the owner of Noecker dam of the several maintenance and repair items necessary to remove the restriction.

Results of Safety Inspections

The 773 safety inspections resulted in the issuance of 16 restriction orders due to unsafe conditions during FY 88-89. Nineteen former restrictions were removed, and two revised.

As of June 30, 1990, there were a total of 237 restriction orders in effect. The following tables show the cause for restriction by category and hazard class in Table 3, and by category and Irrigation Division in Table 4.

TABLE 3

CAUSE FOR RESTRICTION BY CATEGORY/HAZARD¹

HAZARD	A	B	C	D	TOTAL
CLASS I	8 (-20) ²	5 (67)	12 (+20)	3 (-40)	28 (0)
CLASS II	16 (-6)	22 (-12)	11 (0)	5 (0)	54 (-7)
CLASS III	52 (-16)	66 (4)	20 (+54)	11 (-27)	149 (-6)
CLASS IV	<u>3</u>	<u>2</u>	<u>0</u>	<u>1</u>	<u>6</u>
TOTAL	79 (-10)	95 (-2)	43 (+26)	20 (-20)	237 ³ (-3)

TABLE 4

CAUSE FOR RESTRICTIONS BY CATEGORY/IRRIGATION DIVISION

DIVISION	CATEGORY				TOTAL	NO. OF NONFEDERAL DAMS
	A	B	C	D		
1	36	42	24	8	100	725
2	12	24	3	4	43	297
3	3	1	0	0	4	62
4	9	9	6	3	27	221
5	13	10	8	1	32	198
6	5	6	1	3	15	137
7	<u>1</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>7</u>	<u>72</u>
TOTAL	79	95	43	21	225 ³	1712

A - Inadequate Spillway/Freeboard

B - Structural Problem (Deteriorated appurtenances, cracking, erosion, scarps, sinkholes, deteriorated riprap, etc.)

C - Leakage/Piping Conditions

D - Stability (Slides, saturated slopes)

The approximate amount of storage lost due to restrictions is 151,354 acre-feet, a reduction of 31,704 acre-feet from the previous year. The number of restrictions has been reduced, reflecting the repairs the owners are making to their dams, or breaching. A list of the storage restrictions by name, former Water District, amount of restriction, date reason, hazard rating, and approximate storage lost is contained in Appendix F.

¹ In effect as of June 3, 1990

² (%) change from FY 88-89

³ All nonfederal dams

The greatest problems for unsafe dams according to the tables are inadequate spillway capacity, insufficient freeboard (freeboard is the vertical distance between the bottom of the spillway and the crest of the dam), and structural deficiencies. As a single category, inadequate spillway capacity represents almost half of these deficiencies; it being judged by hydrologic standards related to a dam's "hazard" to the flood plain. The State Engineer's hydrologic requirements for spillway flood capacity range from the 100-year flood to the Probable Maximum Precipitation (PMP) Flood; any spillway capacity less than specified requiring demonstration that the overtopping failure of the dam will be insignificant on the floodplain. The number of leakage and piping problems increased materially for class I and III dams. There were significant decreases in other categories however, such as stability problems with Class I and Class III dams.

With inadequate spillways identified as a frequent deficiency concerning the safety of dams in Colorado, a large number of orders issued by the State Engineer to dam owners is the need to repair and enlarge spillways. For "inspection season" 1989, Class I dams began to be evaluated for hydrologic adequacy in accordance with the regulations. Due to a controversy related to the generalized estimates of PMP rainfall above 7500 feet in Hydrometeorological Report 55A (National Weather Service), the State Engineer has postponed evaluation of spillways for existing dams above 7500 feet on the east slope of the Rocky Mountains until the matter can be resolved. In order to effect some type of solution to the problem, the Colorado Water Resources Research Institute was requested to evaluate the PMP methodologies, and to recommend policies and research needed for estimating PMP in Colorado (above 7500 feet on the east slope). No concrete results were obtained, but several recommendations were made. They are:

1. That the State Engineer was not taking an unreasonable risk by postponing evaluations of spillways, because the exceedance probability of these events was small (over the short term).
2. There remains considerable controversy about HMR55A.
3. United States Geological Survey research has not observed floods of the magnitude predicted by HMR55A at elevations above 7500 feet in Colorado. (Jarrett et.al)
4. Available meteorological research is not adequate to account for the variations of PMP with elevation in Colorado above 7500 feet.
5. A manual of practice should be developed for predicting rare floods above 7500 feet in Colorado. (The estimates of PMP below 7500 in HMR55A are adequate).

No source of funding was determined, but it was suggested that possible sources of funding for research are from federal or state sources. See Hydrologic Aspects of Dam Safety. Report of workshop, November 16, 1989, Edited by Niel Grigg. CWRI.

In cases where the restriction orders cannot be enforced during flooding due to inadequate outlet capacity, and the owner has not complied with the orders to rehabilitate the dam, orders are issued to partially breach the dam by cutting the spillway down to the restricted level. The work must be done under the supervision of a registered professional engineer, and the spillway must be able to pass the 100-year flood.

In the event the owner does not comply with any of the above orders, another order is issued to completely breach the dam. The breach must be of sufficient width to pass abnormal flood flows without surcharging the reservoir basin by passing the 100-year event at less than five feet of depth.

USE OF APPROPRIATED FUNDS

The legislature, for FY 89-90, budgeted \$806,364.00 for dam safety personnel services. The Division of Water Resources allocated \$34,800.00 for both operating costs and for travel and subsistence to the Dam Safety Branch.

Dam Safety personal services expenditures for the fiscal year were \$811,591.00. Total operating and travel and subsistence expenditures were \$34,187.00. \$1,500.00 was expended for purchase of an air monitoring instrument and emergency resuscitator for inspecting in confined spaces. In order to more effectively and efficiently administer the program, the State Engineer has transferred five field engineers to the Division offices in Durango, Glenwood Springs, Montrose, Pueblo, and Steamboat Springs. The engineer in Durango also supports the program in the Alamosa Division office. Besides realizing a savings of approximately six thousand dollars in travel costs to administer the program in these areas, another benefit being achieved is availability to the dam owners to assist them with the maintenance and repair of their dams.

Unfortunately, the loss of an FTE in 1988 and another in FY90 is beginning to affect the ability to conduct safety inspections as required due to excess workload for the remaining field engineers on the east slope (Division 1). The majority of dams exist on the east slope, especially class I and II hazard dams. It is not possible to do a comprehensive safety inspection as previously described with more than an 85 dam workload.

Whenever possible, the members of the Dam Safety Branch are provided or given administrative leave to take training. Several members have attended meetings of the Association of State Dam Safety Officials, taken university courses, the state's Supervisory Certificate Program, and computer-related courses. Funds for these, however, must be gleaned from the operating budget, because there is no cost center for training. The funds saved by decentralization have been used to provide this training.

RECEIPTS GENERATED FOR COSTS OF INSPECTION AND FILING OF PLANS

Fees collected by the State Engineer and deposited in the General Fund for dam safety were \$29,694.03 for safety inspections and construction observation, and \$5,151.97 for filing plans and inspections during the period. The reduction in safety inspection fees is partly due to the decentralization program and reduced expenses for conducting safety inspections, especially on the west slope.

ENFORCEMENT ORDERS AND PROCEEDINGS

During the fiscal year, the State Engineer was involved in enforcement proceedings under Section 37-87-114, C.R.S. (1990 Repl. Vol.). Following is a brief description of the case.

Oberon No. 1 Dam

Oberon No. 1 Dam is located in Section 3, Township 3S, Range 69W, in the vicinity of 68th Avenue and Independence Street, Arvada, Colorado. It is a thirty-foot high, 54-acre-foot, Class II hazard dam.

On July 8, 1985, an order was written by the State Engineer to the dam owner to provide an acceptable spillway or breach the dam. On January 21, 1987, the Urban Drainage and Flood Control District communicated their interest, along with the City of Arvada and Jefferson County, in modifying the dam to conform with a master plan of improvements for Hays Lake (aka Oberon No. 1), and the contiguous flood plain. The plan was previously approved by the State Engineer, which would alter the dam to nonjurisdictional size and eliminate the hazard.

Subsequent attempts to accomplish the alteration by the several parties was unsuccessful due to the Oberon Water Company failing to participate in the joint venture within the prescribed time (several extensions were granted from 1985 to 1988). On April 1, 1988, the dam owner was notified of the State Engineer's intent to proceed with legal action to enforce his order. Case No. 89CV460, Division 7, in District Court, Jefferson County, Colorado. The above order came for trial on November 21, 1989, and the parties reached agreement before conclusion of the trial. The court ordered the following:

As soon as possible, but no later than February 15, 1990, Oberon Water Co., Arvada, and the Denver and Rio Grande Western Railroad Company shall deposit sufficient funds in escrow to accomplish the alteration of the dam to nonjurisdictional size; and other administrative requirements to effect the above. See order by District Judge Christopher Munch, dated February 7, 1990.

EMERGENCY PREPAREDNESS PLANS

During the National Dam Safety Program's inspection and Phase I findings/recommendations on Class I hazard dams, the preparation and maintenance of plans to combat incidents at dams, and to give warning to the floodplain area downstream, became a common recommendation of the reviewing professional engineers. At the conclusion of the National Dam Safety Program in 1981, the State Engineer requested that all owners of Class I hazard dams prepare emergency preparedness plans (EPP's) and provided a guideline for them to follow. EPP's became a requirement for Class I and II dams in the regulations adopted in September 1988.

As of September 5, 1990, a total of 151 plans for Class I hazard dams have been filed with the State Engineer out of the 259 federal and nonfederal Class I hazard dams on file. Of the 151, twenty-eight are for federal dams, primarily of the Bureau of Reclamation. This was an increase of 15 plans from the previous period. In addition, plans have been submitted for forty-nine moderate hazard dams (four federal), and twenty-two low hazard dams (one federal). An increase of 15 plans also. During FY 90-91, the State Engineer plans to return comments on submitted EPP's to the owners for updating, and to

request the balance of the Class I hazard dam owners and the Class II hazard dam owners to prepare plans and file them with the State Engineer in accordance with the regulations. The owners will also be requested to coordinate with the Division of Disaster Emergency Services and local disaster coordinators. Owners who refuse to prepare plans will be subject to court proceedings enforcing the State Engineers orders under C.R.S. 37-87-114(2) (1990 Repl. Vol.).

During the evening of June 25, 1990, an incident occurred at Handy dam in Larimer County. A sinkhole developed over one of the outlets while it was being used to deliver water to their irrigation canal. In accordance with their EPP, the owner notified the local emergency officials (sheriffs office), called their engineer to investigate, and notified the State Engineer's Dam Safety Branch. The outlet was closed and a repair made in due time. This is a good example of the value of Emergency Preparedness Plans.

DAM SAFETY DATA BASE MANAGEMENT SYSTEM

During FY 89-90, the Dam Safety Branch continued to enter data and make corrections to the data base, primarily being done by the several dam safety engineers and a secretary. The FOCUS data base management software was acquired and installed in late June 1986. It was tested to learn its features and capabilities, but was found to be unsatisfactory. Part of the data base (VS-300) was transferred to a dBase III format in the Branch's personal computer in order to prepare reports and print the headings for our inspections forms. Beginning in fiscal year 91, the data base will be permanently transferred to a personal computer using a dBase IV management system acquired under the auspices of a National Dam Inventory Project (NATDAM) in association with the Association of Dam Safety Officials (ASDSO) and the Federal Emergency Management Agency (FEMA).

The State Engineer entered into a memorandum of agreement with ASDSO to update the national inventory of dams. The state will be reimbursed with computer equipment in lieu of funding for the project through 1992. The new system will greatly enhance the dam safety branch data base management system. The manpower however, will need to be provided from the personnel in the branch.

EFFECTIVENESS OF PROGRAM

As expressed by the goals and objectives of the State Engineer, the program's effectiveness can be measured by the prevention of dam failures. No significant failures occurred during the period since 1985 (Sage Creek Dam, Routt County). Another example of the effectiveness of the Dam Safety Program is shown in the tables of causes for restriction and the restriction list in the appendix. The identification of the unsafe conditions at the several dams and reservoirs and the subsequent restrictions to safe storage levels prevented inevitable failures of these structures and the costly consequences thereof. The enforcement of the State Engineer's orders also plays a role in assuring the effectiveness of the program. The combination of the State Engineer's safety inspection, restrictions, Emergency Preparedness Plans, and programs to make the dam owners more knowledgeable about the safe operation and maintenance of their dams through the State Engineer's "Dam Safety Manual," makes Colorado's Dam Safety Program one of the most effective in the United States.

As a service to dam owners, the State Engineer has produced and is making available at no charge a brochure on the construction and operation of dams in Colorado (June 1989). It contains general information regarding requirements for approval of dams, water rights, financing, liability, and insurance, emergency preparedness plans, statutes, publications, and division and water court addresses.

Most of the members of the Dam Safety Branch are members of the Association of State Dam Safety Officials (ASDSO) and actively participate in its program. The purpose of ASDSO is to provide a forum for the exchange of ideas and experiences on dam safety issues; foster interstate cooperation; provide information and assistance to state dam safety programs; provide representation of the state interests before Congress and federal agencies for dam safety; and improve efficiency and effectiveness of state dam safety programs.

The State Engineer is the past president of the association and has been an officer and founding participant since 1984, when Colorado hosted the organizing meeting. The State Engineer nominated the Denver Water Board to ASDSO to receive special recognition for their development and maintenance of a comprehensive, in-house dam safety program. They received recognition at ASDSO's annual meeting in Albuquerque, New Mexico in October 1990.

The chief of the branch has been serving on the Technical Activities Committee of a program for developing training in dam safety. This is a joint effort of the ASDSO and the federal dam building agencies. It is used to provide low cost training to states, and others associated with dams, in order to increase the safety of dams nationwide.

LEGISLATION

House Bill 90-1130 by Representatives Masson, Ratterree, and D. Williams, also Senator De Nier was signed into law by Governor Romer on April 12, 1990. It became effective July 1, 1990. The bill amended several fee statues related to dams. It eliminated the fees for safety inspection; and increased the fees for filing plans to \$3.00 per \$1,000.00 dollars of the cost, with a minimum of \$100.00 and a maximum of \$3,000.00. The fees for applying for a Livestock Water Tank or Erosion Control Dam were increased to \$15.00.

RECOMMENDED LEGISLATION

Program Funding

Increased funding is recommended for several areas of the Dam Safety Program in order to maintain and improve it. One area is increased full-time employees (FTE). With the transfer of the dams data base from the DNR WANG VS-300 computer to a personal computer and data base management system, in order to produce comprehensive management and report data, there is a need for an FTE to support the data base, the Branch, and to achieve its objectives. We presently have to rely on our dam safety engineers to provide computer support at the expense of safety inspections.

Rapid changes occur in the field of dam safety engineering and related disciplines. New designs of dams (and rehabilitation of dams) are utilizing new material whose behavior and properties are unknown to the staff, and several conferences are held throughout the country with the object of sharing

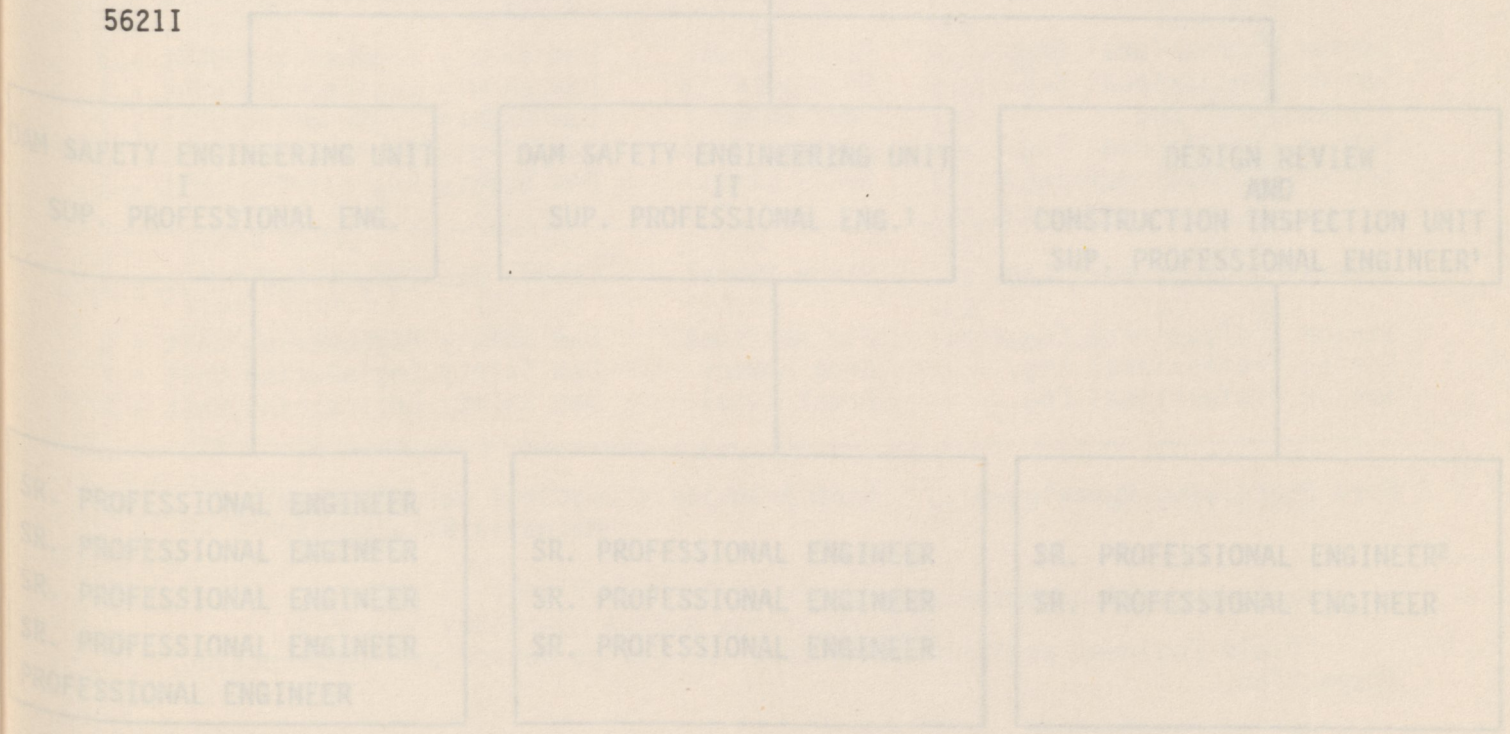
knowledge and experience in the field of dam safety. It is proposed to establish a training plan to send our dam safety engineers to these training programs in order to maintain a knowledge of the state-of-the-art of dam safety. The estimated first year's cost for such a program would be about \$5,000.

Another area is the rental of "All-Terrain Vehicles" (ATV's) and helicopters to allow fast and efficient access to many dams in remote areas. It is proposed to reserve about one-fourth of the helicopter time for emergency use. Estimated first year's cost for this program is \$30,000.

Emergency Actions

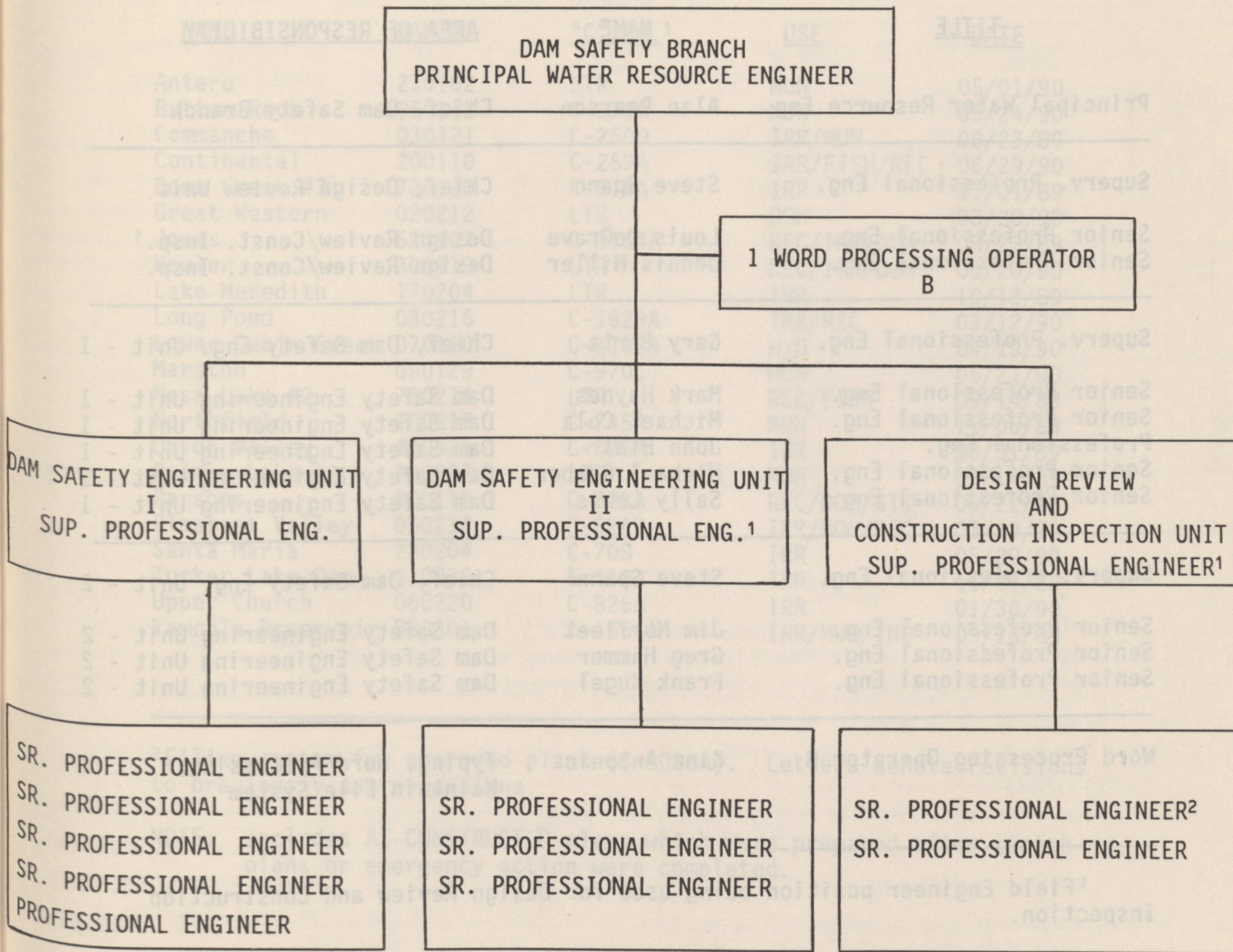
The Association of State Dam Safety Officials developed a publication called the Model State Dam Safety Program in April 1987. It is meant to outline the key components of an effective dam safety program. Colorado's dam safety law and program meet the model in the most important aspects, except in the area of enforcement capability during life threatening emergencies. There are no provisions for the State Engineer to take emergency actions or to pay for the costs associated in the event the owner of a dam refuses to or is unable to finance the action themselves.

56211



supervisor for both units
 field engineer position being used for design review and construction inspection

APPENDIX A
 PERSONNEL
 DAM SAFETY BRANCH



¹One supervisor for both units

²Field engineer position being used for design review and construction inspection

APPENDIX A
PERSONNEL
DAM SAFETY BRANCH

<u>TITLE</u>	<u>NAME</u>	<u>AREA OF RESPONSIBILITY</u>
Principal Water Resource Eng.	Alan Pearson	Chief, Dam Safety Branch
Superv. Professional Eng.	Steve Spann	Chief, Design Review Unit
Senior Professional Eng.	Louis DeGrave	Design Review/Const. Insp. ¹
Senior Professional Eng.	Dennis Miller	Design Review/Const. Insp.
Superv. Professional Eng.	Gary Barta	Chief, Dam Safety Eng. Unit - 1
Senior Professional Eng.	Mark Haynes	Dam Safety Engineering Unit - 1
Senior Professional Eng.	Michael Cola	Dam Safety Engineering Unit - 1
Professional Eng.	John Blair	Dam Safety Engineering Unit - 1
Senior Professional Eng.	Michael Graber	Dam Safety Engineering Unit - 1
Senior Professional Eng.	Sally Lewis	Dam Safety Engineering Unit - 1
Superv. Professional Eng.	Steve Spann ²	Chief, Dam Safety Eng. Unit - 2
Senior Professional Eng.	Jim Norfleet	Dam Safety Engineering Unit - 2
Senior Professional Eng.	Greg Hammer	Dam Safety Engineering Unit - 2
Senior Professional Eng.	Frank Kugel	Dam Safety Engineering Unit - 2
Word Processing Operator B	Gina Antonio	Typing, Word Processing, Maintain File System

¹Field Engineer position being used for Design Review and Construction Inspection.

²Supervising two units.

APPENDIX B

APPROVED PLANS AND SPECIFICATIONS FOR ALTERATIONS,
ENLARGEMENTS, OR REPAIR OF EXISTING DAMS

<u>NAME</u>	<u>DAMID</u>	<u>"C" No.¹</u>	<u>USE</u>	<u>DATE</u>
Antero	230102	LTR	MUN	05/01/90
Button Rock	050112	C-970A	MUN	05/24/90
Commanche	030121	C-250D	IRR/MUN	08/23/89
Continental	200110	C-259A	IRR/FISH/REC	06/29/90
Coon Creek #3	720120	C-914A	IRR	11/01/89
Great Western	020212	LTR	DOM	03/20/90
Jones	520107	C-1164A	REC/IRR/DOM	08/23/89
Keeler	300110	LTR	REC/IRR/DOM	03/20/90
Lake Meredith	170204	LTR	IRR	10/13/89
Long Pond	030216	C-1623A	IRR/REC	03/12/90
Lower Cabin Creek	070110	C-1111A	HYD	04/19/90
Marston	090129	C-970C	MUN	05/21/90
Mesa Lake #2	720214	LTR	REC/FISH	09/14/89
Northfield	100217	C-745A	MUN	11/06/89
Onion Valley	400421	C-695A	IRR	08/31/89
Palmer Lake #2	100227	LTR	MUN	09/14/89
Parsons	500118	C-603A	REC/DOM/STK	06/22/90
Pleasant Valley	050234	C-526B	IRR/DOM/REC	03/19/90
Santa Maria	200204	C-70B	IRR	06/29/90
Tucker Lake Dam	070232	C-410A	IRR	11/01/89
Upper Church	060220	C-826A	IRR	01/30/90
Yamcola Reservoir	580301	C-1554A	IRR/MUN/IND	09/14/89

²Filing system for approved plans (C-1008A). Letters denote revisions to previously approved plans.

NOTE: Includes AS-CONSTRUCTED plans which were prepared after sketch plans or emergency action were completed.

LOCATION OF PROBLEMS & COMMENTS

MAINTENANCE - MINOR REPAIRS - MAINTENANCE -- ACTION REQUIRED BY OWNER TO ASSURE THE SAFETY OF THE DAM

- (10) PROVIDE ADDITIONAL EROSION
- (11) EMERGENCY AND OPERATE OUTLET WORKS THROUGH FULL CYCLE
- (12) CLEAR TREES AND/OR GRASS FROM
- (13) INITIATE INCENT CONTROL PROGRAM AND PROPERLY MAINTAIN TESTING HOLES
- (14) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE
- (15) IMPROVE SURFACE DRAINAGE FOR
- (16) REPAIR
- (17) OTHER
- (18) OTHER

DO NOT SIGNIFY INSPECTION BY A FIELD ENGINEER

FIELD ENGINEER? SIGNATURE

APPENDIX B

APPROVED PLANS AND SPECIFICATIONS FOR NEW DAMS
OR OLD DAMS NOT PREVIOUSLY APPROVED

<u>NAME</u>	<u>DAMID</u>	<u>"C" No.¹</u>	<u>USE</u>	<u>DATE</u>
Boomerang	030518	C-1714	IRR/AUG	05/01/90
Lake Gloria	430207	C-1706	IRR	11/17/89
Lundvall #2	030514	C-1710	IRR	04/17/90
Lundvall #3	030515	C-1711	IRR	04/17/90
Lundvall #4	030516	C-1712	IRR	04/17/90
Lundvall #5	030517	C-1713	IRR	04/17/90
North Poudre #17	030306	C-1701	IRR	09/27/89
Regency Park	100449	C-1715	FLOOD	05/01/90
Riss - East	120237	C-1705	FISH	11/15/89
Riss-North	120236	C-1704	FISH	11/15/89
Riss - South	120235	C-1703	FISH	11/15/89
Ryan Gulch	040211	C-1716	IRR	05/21/90
Sedgwick S.S 8.5	640211	C-1709	EROS/FLOOD	03/30/90
Vancil	010720	C-1702	IRR/AUG	11/06/89
Westerly Creek	020616	C-1707	FLOOD	12/18/89
Wilson	440212	C-1708	FSH/IRR	01/18/90

¹Filing system for approved plans (C-1651). Assigned to new dams and existing dams without previously approved plans which are being altered, enlarged, or repaired. (Includes AS-BUILT drawings).

SAS:gla/3264I

DAM NAME
DAM ID
OWNER NAME
ADDRESS
CONTACT NAME
CLASS
CURRENT F
FIELD CONDITION OBSERV
PROB
SLOPE
CREST
PROB
SLOPE
SEEPAGE
PROB
DRAIN
PROB
OUTLET
PROB
INTER
PROB
SPILLWAY
PROB
MAINTENANCE
PROB
PROB
PROB
The State Engineer, by providing this dam safety observation report, is not providing a warranty or guarantee of any kind for the safety of this dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages to the dam.

APPENDIX C
WATER COMMISSIONER • DAM OBSERVATION REPORT • OFFICE OF THE STATE ENGINEER

DAM NAME _____ W. DIV. _____ W. DIST. _____ DATE OF INSPECTION ____/____/____
 DAM ID _____ FILE NO. C- _____ FOREST I.D. _____ DATE OF LAST INSPECTION ____/____/____
 OWNER NAME _____ OWNER PHONE _____
 ADDRESS _____ ZIP CODE _____
 CONTACT NAME _____ CONTACT PHONE _____
 CLASS _____ CAPACITY _____ AF SURFACE AREA _____ AC. HEIGHT _____ FT. CREST LENGTH _____ FT. CREST WIDTH _____ FT.
 CURRENT RESTRICTION (NO) (YES) LEVEL _____ EPP ON FILE (NO) (YES) SPWY WIDTH _____ FT. FBD. _____ FT. Z _____
FIELD CONDITIONS OBSERVED WATER LEVEL: BELOW DAM CREST _____ FT., BELOW SPILLWAY _____ FT., GAGE ROD READING _____
 GROUND MOISTURE CONDITION: DRY _____ WET _____ SNOWCOVER _____ OTHER _____

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY.

SLOPE PROBLEMS NOTED: (0) NONE (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED (2) WAVE EROSION-WITH SCARPS
 (3) CRACKS-WITH DISPLACEMENT (4) SINKHOLE (5) APPEARS TOO STEEP (6) DEPRESSIONS OR BULGES (7) SLIDES
 (8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED (9) OTHER _____

CREST PROBLEMS NOTED: (10) NONE (11) RUTS OR PUDDLES (12) EROSION (13) CRACKS - WITH DISPLACEMENT (14) SINKHOLES
 (15) NOT WIDE ENOUGH (16) LOW AREA (17) MISALIGNMENT (18) IMPROPER SURFACE DRAINAGE
 (19) OTHER _____

SLOPE PROBLEMS NOTED: (20) NONE (21) LIVESTOCK DAMAGE (22) EROSION OR GULLIES (23) CRACKS - WITH DISPLACEMENT (24) SINKHOLE
 (25) APPEARS TOO STEEP (26) DEPRESSION OR BULGES (27) SLIDE (28) SOFT AREAS
 (29) OTHER _____

SEEPAGE PROBLEMS NOTED: (30) NONE (31) SATURATED EMBANKMENT AREA (32) SEEPAGE EXITS ON EMBANKMENT
 (33) SEEPAGE EXITS AT POINT SOURCE (34) SEEPAGE AREA AT TOE (35) FLOW ADJACENT TO OUTLET (36) SEEPAGE INCREASED/MUDDY
 DRAIN OUTFALLS SEEN ___ No ___ Yes (37) FLOW INCREASED/MUDDY (38) DRAIN DRY/OBSTRUCTED
 (39) OTHER _____

OUTLET PROBLEMS NOTED: (40) NONE (41) NO OUTLET FOUND (42) POOR OPERATING ACCESS (43) INOPERABLE
 (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED (45) OUTLET NOT OPERATED DURING INSPECTION
 INTERIOR INSPECTED (120) NO (121) YES (46) CONDUIT DETERIORATED OR COLLAPSED (47) JOINTS DISPLACED (48) VALVE LEAKAGE
 (49) OTHER _____

SPILLWAY PROBLEMS NOTED: (50) NONE (51) NO EMERGENCY SPILLWAY FOUND (52) EROSION-WITH BACKCUTTING (53) CRACK - WITH DISPLACEMENT
 (54) APPEARS TO BE STRUCTURALLY INADEQUATE (55) APPEARS TOO SMALL (56) INADEQUATE FREEBOARD (57) FLOW OBSTRUCTED
 (58) CONCRETE DETERIORATED/UNDERMINED (59) OTHER _____

MAINTENANCE PROBLEMS NOTED: (60) NONE (61) ACCESS ROAD NEEDS MAINTENANCE (62) CATTLE DAMAGE
 (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE
 (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE (66) DETERIORATED CONCRETE-FACING, OUTLET, SPILLWAY
 (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE (68) OTHER _____

Conditions Observed		
GOOD	ACCEPTABLE	POOR
		UPSTREAM SLOPE
		CREST
		DOWNSTREAM SLOPE
		SEEPAGE
		OUTLET
		SPILLWAY
		MAINTENANCE

See Guidelines on Back of this Sheet

DIRECTIONS: ENTER PROBLEM NUMBER () THEN LOCATION DIMENSIONS, DEGREE, ETC.

LOCATION OF PROBLEMS & COMMENTS: _____

MAINTENANCE - MINOR REPAIR - MONITORING - ACTION REQUIRED OF OWNER TO IMPROVE THE SAFETY OF THE DAM.

- (80) PROVIDE ADDITIONAL RIPRAP: _____
- (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE: _____
- (82) CLEAR TREES AND/OR BRUSH FROM: _____
- (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES. _____
- (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE: _____
- (85) PROVIDE SURFACE DRAINAGE FOR: _____
- (86) MONITOR: _____
- (88) OTHER: _____
- (89) OTHER: _____

DAM REQUIRES INSPECTION BY A FIELD ENGINEER

FIELD DIMENSIONS SHOWN ON BACK

The State Engineer, by providing this dam safety observation report, is not liable for the safety of the subject dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages caused by leakage or overflow of waters from the reservoir or floods resulting from a failure of the dam.

ENGINEERS INSPECTION REPORT

OFFICE OF THE STATE ENGINEER-DIVISION OF WATER RESOURCES - DAM SAFETY BRANCH
1313 Sherman Street, Room 818, Denver, CO 80203, (303) 866-3581

DAM NAME _____ W. DIV. _____ W. DIST. _____ DATE OF INSPECTION ____/____/____
 DAM ID _____ FILE NO. C _____ FOREST I.D. _____ DATE OF LAST INSPECTION ____/____/____
 OWNER NAME _____ OWNER PHONE _____
 ADDRESS _____ ZIP CODE _____
 CONTACT NAME _____ CONTACT PHONE _____
 CLASS _____ CAPACITY _____ AF SURFACE AREA _____ AC. HEIGHT _____ FT. CREST LENGTH _____ FT. CREST WIDTH _____ FT.
 CURRENT RESTRICTION (NO) (YES) LEVEL _____ EPP ON FILE (NO) (YES) SPWY WIDTH _____ FT. FBD. _____ FT. Z _____
 INSPECTION PARTY REPRESENTING _____

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY. GIVE LOCATION AND EXTENT WITH NUMBER REFERENCE I.E. (25) ALL ALONG SLOPE, OR SHOW IT ON SKETCH.

FIELD CONDITIONS OBSERVED

WATER LEVEL - BELOW DAM CREST _____ FT. BELOW SPILLWAY _____ FT. GAGE ROD _____
 GROUND MOISTURE CONDITION: DRY _____ WET _____ SNOWCOVER _____ OTHER _____

UPSTREAM SLOPE

PROBLEMS NOTED: (0) NONE (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED (2) WAVE EROSION-WITH SCARPS
 (3) CRACKS-WITH DISPLACEMENT (4) SINKHOLE (5) APPEARS TOO STEEP (6) DEPRESSIONS OR BULGES (7) SLIDES
 (8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED (9) OTHER _____
 Comments: _____

CREST

PROBLEMS NOTED: (10) NONE (11) RUTS OR PUDDLES (12) EROSION (13) CRACKS - WITH DISPLACEMENT (14) SINKHOLES
 (15) NOT WIDE ENOUGH (16) LOW AREA (17) MISALIGNMENT (18) INADEQUATE SURFACE DRAINAGE
 (19) OTHER _____
 Comments: _____

DOWNSTREAM SLOPE

PROBLEMS NOTED: (20) NONE (21) LIVESTOCK DAMAGE (22) EROSION OR GULLIES (23) CRACKS - WITH DISPLACEMENT (24) SINKHOLE
 (25) APPEARS TOO STEEP (26) DEPRESSION OR BULGES (27) SLIDE (28) SOFT AREAS (29) OTHER _____
 Comments: _____

SEEPAGE

PROBLEMS NOTED: (30) NONE (31) SATURATED EMBANKMENT AREA (32) SEEPAGE EXITS ON EMBANKMENT
 (33) SEEPAGE EXITS AT POINT SOURCE (34) SEEPAGE AREA AT TOE (35) FLOW ADJACENT TO OUTLET (36) SEEPAGE INCREASED/MUDDY
 DRAIN OUTFALLS SEEN ___No ___Yes (37) FLOW INCREASED/MUDDY (38) DRAIN DRY/OBSTRUCTED
 (39) OTHER _____ Show location of drains on sketch and indicate amount and quality of discharge.
 Comments: _____

OUTLET

PROBLEMS NOTED: (40) NONE (41) NO OUTLET FOUND (42) POOR OPERATING ACCESS (43) INOPERABLE
 (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED (45) OUTLET NOT OPERATED DURING INSPECTION
 INTERIOR INSPECTED (120) NO (121) YES (46) CONDUIT DETERIORATED OR COLLAPSED (47) JOINTS DISPLACED (48) VALVE LEAKAGE
 (49) OTHER _____
 Comments: _____

SPILLWAY

PROBLEMS NOTED: (50) NONE (51) NO EMERGENCY SPILLWAY FOUND (52) EROSION-WITH BACKCUTTING (53) CRACK - WITH DISPLACEMENT
 (54) APPEARS TO BE STRUCTURALLY INADEQUATE (55) APPEARS TOO SMALL (56) INADEQUATE FREEBOARD (57) FLOW OBSTRUCTED
 (58) CONCRETE DETERIORATED/UNDERMINED (59) OTHER _____
 Comments: _____

See Guidelines on Back of this Sheet

Conditions Observed			
GOOD	ACCEPTABLE	POOR	UPSTREAM SLOPE
GOOD	ACCEPTABLE	POOR	CREST
GOOD	ACCEPTABLE	POOR	DOWNSTREAM SLOPE
GOOD	ACCEPTABLE	POOR	SEEPAGE
GOOD	ACCEPTABLE	POOR	OUTLET
GOOD	ACCEPTABLE	POOR	SPILLWAY

GUIDELINES FOR DETERMINING CONDITIONS

CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, OUTLET, SPILLWAY

GOOD	ACCEPTABLE	POOR
In general, this part of the structure has a near new appearance, and conditions observed in this area do not appear to threaten the safety of the dam.	Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.	Conditions observed in this area appear to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO SEEPAGE

GOOD	ACCEPTABLE	POOR
No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.	Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in seepage. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.	Seepage conditions observed appear to threaten the safety of the dam. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment, i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage or ponding appears to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO MONITORING

GOOD	ACCEPTABLE	POOR
Monitoring includes movement surveys and leakage measurements for all dams, and piezometer readings for Class I dams. Instrumentation is in reliable, working condition. A plan for monitoring the instrumentation and analyzing results by the owner's engineer is in effect. Periodic inspections by owner's engineer.	Monitoring includes movement surveys and leakage measurements for Class I & II dams; leakage measurements for Class III dams. Instrumentation is in serviceable condition. A plan for monitoring instrumentation is in effect by owner. Periodic inspections by owner or representative. OR, NO MONITORING REQUIRED.	All instrumentation and monitoring described under "ACCEPTABLE" here for each class of dam, are not provided, or required periodic readings are not being made, or unexplained changes in readings are not reacted to by the owner.

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

GOOD	ACCEPTABLE	POOR
Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.	Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.	Dam does not appear to receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam.

OVERALL CONDITIONS

SATISFACTORY	CONDITIONALLY SATISFACTORY	UNSATISFACTORY
The safety inspection indicates no conditions that appear to threaten the safety of the dam, and the dam is expected to perform satisfactorily under all design loading conditions. Most of the required monitoring is being performed.	The safety inspection indicates symptoms of possible structural distress (seepage, evidence of minor displacements, etc.), which, if conditions worsen, could lead to the failure of the dam. Essential monitoring, inspection, and maintenance must be performed as a requirement for continued full or reduced storage in the reservoir.	The safety inspection indicates definite signs of structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which could lead to the failure of the dam if the reservoir is used to full capacity. The dam is judged unsafe for full storage of water.

SAFE STORAGE LEVEL

FULL STORAGE	CONDITIONAL FULL STORAGE	RESTRICTION
Dam may be used to full capacity with no conditions attached.	Dam may be used to full storage if certain monitoring, maintenance, or operational conditions are met.	Dam may not be used to full capacity, but must be operated at some reduced level in the interest of public safety.

CLASSIFICATION OF DAMS

CLASS I	CLASS II	CLASS III
Class I - Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.	Class II - Significant damage to improved property is expected in the event of failure of the dam while the reservoir is at the high water line, but no loss of human life is expected.	Class III - Loss of human life is not expected, and damage to improved property is expected to be small, in the event of failure of the dam while the reservoir is at high water line.

The State Engineer, by providing this dam safety inspection report, does not assume any liability for the safety of this dam rests with the research owner or operator.

OVERALL CONDITIONS MAINTENANCE AND REPAIR MONITORING

REASON ACTION
Engineer Signature
DC-22

DAM NAME: _____ DAM I.D.: _____ DATE: / /

MONITORING

EXISTING INSTRUMENTATION FOUND (110) NONE (111) GAGE ROD (112) PIEZOMETERS (113) SEEPAGE WEIRS/FLUMES

(114) SURVEY MONUMENTS (115) OTHER _____

MONITORING OF INSTRUMENTATION: (116) NO (117) YES PERIODIC INSPECTIONS BY: (118) OWNER (119) ENGINEER

Comments: _____

GOOD
ACCEPTABLE
POOR

MONITORING

MAINTENANCE AND REPAIR

PROBLEMS NOTED: (60) NONE (61) ACCESS ROAD NEEDS MAINTENANCE (62) CATTLE DAMAGE

(63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE

(65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE (66) DETERIORATED CONCRETE-FACING, OUTLET, SPILLWAY

(67) GATE AND OPERATING MECHANISM NEED MAINTENANCE (68) OTHER _____

Comments: _____

GOOD
ACCEPTABLE
POOR

MAINTENANCE AND REPAIRS

OVERALL CONDITIONS

REMARKS: _____

Based on this Safety Inspection and recent file review, the overall condition is determined to be:

71 SATISFACTORY 72 CONDITIONALLY SATISFACTORY 73 UNSATISFACTORY

OVERALL CONDITIONS

ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE - MINOR REPAIR - MONITORING

(80) PROVIDE ADDITIONAL RIPRAP: _____

(81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE: _____

(82) CLEAR TREES AND/OR BRUSH FROM: _____

(83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES: _____

(84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE: _____

(85) PROVIDE SURFACE DRAINAGE FOR: _____

(86) MONITOR: _____

(87) DEVELOP AND SUBMIT AN EMERGENCY PREPAREDNESS PLAN: _____

(88) OTHER: _____

(89) OTHER: _____

ENGINEERING - EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO: (Plans & Specification must be approved by State Engineer prior to construction.)

(90) PREPARE PLANS AND SPECIFICATIONS FOR THE REHABILITATION OF THE DAM: _____

(91) PREPARE AS-BUILT DRAWINGS OF: _____

(92) PERFORM A GEOTECHNICAL INVESTIGATION TO EVALUATE THE STABILITY OF THE DAM: _____

(93) PERFORM A HYDROLOGIC STUDY TO DETERMINE REQUIRED SPILLWAY SIZE: _____

(94) PREPARE PLANS AND SPECIFICATIONS FOR AN ADEQUATE SPILLWAY: _____

(95) SET UP A MONITORING SYSTEM INCLUDING WORK SHEETS, REDUCED DATA AND GRAPHED RESULTS: _____

(96) PERFORM AN INTERNAL INSPECTION OF THE OUTLET: _____

(97) OTHER: _____

(98) OTHER: _____

(99) OTHER: _____

The State Engineer, by providing this dam safety inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of the dam rests with the dam owner, operator, or whoever should take every step necessary to prevent damage caused by leakage or overflow of waters from the reservoir or floods resulting from a failure of the dam.

SAFE STORAGE LEVEL RECOMMENDED AS A RESULT OF THIS INSPECTION

(101) FULL STORAGE

(102) CONDITIONAL FULL STORAGE

(103) RECOMMENDED RESTRICTION

RESTRICTED LEVEL OFFICIAL ORDER TO FOLLOW

_____ FT. BELOW DAMS CREST

_____ FT. BELOW SPILLWAY CREST

_____ FT. GAGE HEIGHT

NO STORAGE-MAINTAIN OUTLET FULLY OPEN

REASON FOR RESTRICTION: _____

ACTIONS REQUIRED FOR CONDITIONAL FULL STORAGE OR CONTINUED STORAGE AT THE RESTRICTED LEVEL: _____

Engineers Signature _____

Owner's Signature _____

INSPECTED BY _____ OWNER/OWNER'S REPRESENTATIVE _____

DATE: / /

An Act

HOUSE BILL 90-1130.

BY REPRESENTATIVES Masson, Ratterree, and D. Williams;
also SENATOR DeNier.

CONCERNING FEES CHARGED BY THE STATE ENGINEER.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. 35-49-112, Colorado Revised Statutes, 1984 Repl. Vol., is amended to read:

35-49-112. Fees deposited in general fund. Each set of plans, drawings, and specifications for a livestock water tank submitted to the state engineer under the provisions of this article shall be accompanied by a fee of ~~one-dollar~~ FIFTEEN DOLLARS. This fee shall be deposited by the state engineer with the state treasurer who shall credit all such fees to the general fund of the state.

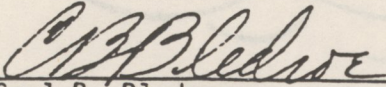
SECTION 2. 37-80-110 (1) (e), Colorado Revised Statutes, is amended to read:

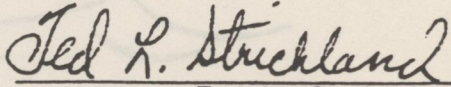
37-80-110. Fees collected by state engineer.
(1) (e) For the examination and filing of each set of plans and specifications required by law to be filed in the office of the state engineer, ~~two-dollars~~ THREE DOLLARS for each one thousand dollars or fraction thereof of the estimated cost thereof; but the total amount of fees for examination and filing of each set of plans and specifications shall not ~~exceed-the-sum-of-two-hundred-dollars~~ BE LESS THAN ONE HUNDRED DOLLARS NOR MORE THAN THREE THOUSAND DOLLARS;

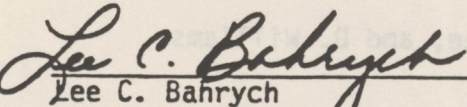
SECTION 3. 37-87-111, Colorado Revised Statutes, as amended, is amended to read:

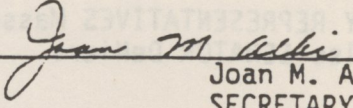
37-87-111. Expense of examination. The person calling upon the state engineer to perform the duty required of him by

finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

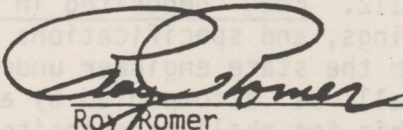

Carl B. Bledsoe
SPEAKER OF THE HOUSE
OF REPRESENTATIVES


Ted L. Strickland
PRESIDENT OF
THE SENATE


Lee C. Bahrych
CHIEF CLERK OF THE HOUSE
OF REPRESENTATIVES


Joan M. Albi
SECRETARY OF
THE SENATE

APPROVED April 12, 1990 at 9:05 a.m.


Roy Romer
GOVERNOR OF THE STATE OF COLORADO

section 37-87-109, if the request is frivolous or made in bad faith, shall pay him any invoiced expenses as provided in section 37-87-106, and mileage at the rate prevailing for state officers and employees under section 24-9-104, C.R.S., for each mile actually and necessarily traveled in going to and from said reservoir, and, should the state engineer find upon examination that such reservoir is in an unsafe condition, the owners thereof shall be liable for all expenses incurred in such examination.

SECTION 4. 37-87-122 (2), Colorado Revised Statutes, is amended, and the said 37-87-122 is further amended BY THE ADDITION OF A NEW SUBSECTION, to read:

37-87-122. Erosion control dams. (2) Erosion control dams for reservoirs may be constructed on watercourses, the channels of which have been determined by the state engineer to be normally dry, having a vertical height not exceeding fifteen feet from the bottom of the channel to the bottom of the spillway, and having a capacity not exceeding ten acre-feet at the emergency spillway level, upon approval of an application for such erosion control dam by the state engineer, WHICH APPLICATION SHALL BE ACCOMPANIED BY A FEE OF FIFTEEN DOLLARS. When such reservoirs are to be constructed with such height exceeding fifteen feet and such capacity exceeding ten acre-feet, they shall be constructed in accordance with section 37-87-105.

(5) The fees collected pursuant to subsection (2) of this section shall be deposited by the state engineer with the state treasurer who shall credit all such fees to the general fund of the state.

SECTION 5. Repeal. 37-87-106, Colorado Revised Statutes, as amended, is repealed.

SECTION 6. Effective date. This act shall take effect July 1, 1990.

SECTION 7. Safety clause. The general assembly hereby

Total Storage Lost - 151,357.30
Restrictions imposed this month
Restrictions removed this month (date)
Revised existing restrictions

APPENDIX F

DAM SAFETY BRANCH CURRENT RESTRICTIONS¹

JUNE 30, 1990

DIVISION ONE

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD CLASS	APPROX. STG. LOST ACRE- FEET
Adams & Bunker #3	01	6' below crest	05/22/75	Inadequate freeboard, high seepage	3	150
Adrian Pond	04	8' below crest	12/03/86	No spillway	3	18
Akers & Tarr	05	7' below crest Oct. 1 to April 1 Full storage April to Oct. 1	03/23/89	Slide on downstream slope and seepage in area of abandoned outlet	2	34
Allis	08	11.5' below crest	05/03/85	Spillway prone to erosion	2	80
Angel Lake	03	5' below crest	09/06/88	Poor condition E. concrete wall		50
Antero	23	G.H. 18'	02/04/86	Stab. berm const. & new instrumen. monitoring	1	5,100
Badding/Croke l2 West	07	11' below embank- ment crest	12/30/83	Lack of maint. & repair: no serv. spwy.: no invest. of seepage situation, no EPP	1	751
Baird #1 Reservoir	08	7' below crest	01/08/90	Severe beaver activity, plugged outlet	3	25
Banning Lewis #1	10	Zero Storage	05/17/90	Generally Poor Condition	3	50
Beaver Brook #2	07	3' below crest	09/02/88	Spillway too small	1	6
Beaver Brook #3	07	4' below spwy.	09/02/88	Inadequate freeboard	2	20
Beaver Brook #3A	07	15' below crest	06/22/87	Seepage high on embankment	1	48
Bergen East	10'	below crest	04/30/84	Cracks in crest: inadequate spillway	1	209
Bijou #2	01	G.H. 16.5'	12/20/89	Erosion on upstream slope	2	230
Bluebird	05	No storage	11/21/74	Poor condition	2	966
Box Elder #2	03	3' below Spillway	08/08/89	Excessive Seepage	3	60
Box Elder #3	03	5' below outlet	10/10/84	No emergency spillway	3	150
Bright View #1	02	7' below crest	09/30/85	Inoperable outlet, inadequate frbd.	3	17
Camp Shoshoni	06	3' below crest	08/08/88	Inadequate freeboard	3	4
Cantrill	08	G.H. 0'	10/22/87	No spillway, inoperable outlet	3	64
Carlin	02	5' below crest	07/29/86	No spillway	3	0
Carmody	09	3' below crest	04/30/84	No spillway	2	0

8,032.0

¹Total Storage Lost - 151,353.50

*Restrictions imposed this month

**Restrictions removed this month (date)

-Revised existing restrictions

Division One (cont.)

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE- FEET</u>
Chambers	03	No storage above G.H. 45' more than 30 days	11/22/78	Excessive seepage over gage 45	1	0
Clennon	05	Zero	06/12/89	Poor condition of embankment, sink-hole above outlet on d/s slope	2	120
Comanche	03	G.H. 25'	07/24/87	Sand boils in outlet discharge channel & inadequate spillway	1	340
Cooke	01	5' below crest	03/20/74	Deteriorated conditions	3	75
Croke #12 East	07	4' below emerg. spwy.	06/01/84	Leakage from outlet pipe, sinkholes & depressions above outlet pipe	2	44
Crystal	05	5' below crest at outlet	04/17/85	Excessive seep. erosion of u/s slope, no spwy., brush, trees, and slough areas on d/s slope	2	50
Curtis	03	G.H. 10'	07/02/85	Irr. narrow crst, eroded unprotected u/s slope, exten. seep. area below d/s toe.	2	173
D. A. Lord #4	01	2' below prin. spwy	02/10/76	Inadequate spillway & seepage	3	400
Derby	02	14.5' below crest	02/05/85	Inadequate Spillway	2	400
Divide	05	5' crest	07/13/88	No spillway, generally poor condition	3	130
Dry Creek	03	6' below crest	03/27/84	Outlet deter., u/s face erosion seep. d/s slope cracking	3	125
Duck	65	4' below spwy.	03/23/87	Narrow crest, steep slopes	3	15
Empire	01	No storage above G.H. 29'	07/09/84	Excess seepage and no spillway	1	6,000
Erie	06	3' below crest	06/02/86	Insufficient freeboard	2	29
Fairport	04	6' below spwy.	06/22/87	Poor condition	3	30
Florissant	23	No storage	05/21/73	Spillway failed: dam breached	3	20
Foothills	05	G.H. 41'	05/20/86	Excessive leakage	1	450
Geist/aka/B-22	03	5' below crest	01/27/84	Erosion, seep., inad. spwy. no acceptable outlet	3	57.5
Gerlits	08	No storage	11/13/84	Dam partially breached due to overtopping	3	10
Gray #3	03	2' below spwy.	03/11/83	Severe erosion u/s slope	2	200
Green Lake #1	06	3.' below crest	10/12/84	Seepage, no spillway	3	30
Green Lake #3	06	3' below crest	10/08/84	Leaks, inadequate spwy. freeboard	3	60
Hanshaw	65	5' below crest	07/07/87	Seepage, slide	3	20
Havana Street	02	No storage	01/02/87	No spillway	3	75
Henry	02	No storage	01/02/87	Piping into outlet, no spillway	3	100

8,953.5

Division One (cont.)

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE-FEET</u>
Hoder	08	4' spillway	04/27/89	Spillway channel erosion	3	20
Hourglass	03	31.0'	08/20/87	Excessive seepage	1	259
Idaho Springs	07	9' below crest	10/06/87	Seepage, settlement, and repairs required on spillway	2	59
Ide & Starbird #1	05	3' below crest	07/03/85	Poor maintenance, eroded u/s face questionable spillway	2	
John Law	03	3' below crest 11' gage height	06/22/87	Inadequate freeboard & spillway	3	45
Johnson/aka Hohnholtz #3	48	5' below crest	07/24/86	Erosion on u/s face, lack of proper freeboard, seepage along d/s toe.	3	88
Julesburg	64	G.H. 23'	06/13/88	Seepge at toe dam #2	1	6000
Kalcevic	07	11' below crest	02/10/83	Sloughing on upstream slope	1	69
Kelly	07	3' below crest	12/05/86	No spwy, inad. outlet construction	3	30
Knoth	05	Zero storage	12/24/85	Never completed dam	3	204
Lake Loveland	04	8' below crest	06/27/85	Deteriorated outlet, no spillway	1	1,000
Lambert	08	8' below crest	07/09/84	Large slide, abandoned outlet	3	50
Leyden	07	8' below crest	05/29/74	Inadequate spillway, unstable embankment	2	207
Lilly Lake	04	3.5' below crest	10/09/85	Spillway too small	2	5
Little Gem	05	10' below crest	10/11/85	Erosion on u/s slope & crest & trees on u/s slope	3	60
Louisville #1	06	5.5' below crest	06/28/85	Excessive seepage This is a seasonal restriction between the months of 10/1 & 4/30	2	
Lower Cochran	09	4.5' below crest	05/22/86	Poor condition of upstream slope	4	2
Lower Long Lake	07	5' below crest	06/22/85	Poor condition of upstream face and crest, no spillway	4	52
McLain	23	3' below crest	07/07/87	Slip on upstream slope	3	6
Magnusun #1	23	8' below crest	12/04/85	Provide adequate freeboard	3	18
Mountain	23	4' below crest	11/06/85	Insufficient freebd., seepage @ toe	3	3
Mountain Supply #8	03	No storage	10/03/78	Poor condition	3	643
North Poudre #1	03	7' below crest	10/17/88	Seepage at higher storage levels, the condition of the upstream slope and the deteriorated condition of the outlet conduit.	2	106
North Poudre #2	03	G.H. 18'	05/15/84	Concentrated seep, questions concerning abandoned outlet	1	985
North Poudre #4	03	G.H. 17'	04/25/84	Poor u/s face, general condition	2	265
North Poudre #5	03	5.5' below spwy.	12/12/78	Seepage instability	1	2,375

12,551.0

Division One (cont.)

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE- FEET</u>
North Poudre #6	03	G.H. 0	05/08/89	Deteriorated outlet, potential piping, no spillway, poor overall condition	1	9,968
North Poudre #17	03	15' below crest after repaired	07/15/83	Poor condition, outlet	2	600
Oberon #1 (Lower) aka/ Hays Lake	07	No storage	06/08/85	Inadequate spwy., inoperable & disintegrating outlets.	2	54
Ohio Lake	02	5' below crest	05/14/84	Erosion on u/s slope, rodent activity, lack of maintenance	2	0
Park Creek #2	03	8' below crest	10/03/84	Generally poor condition, seepage	2	10
Pear	05	No storage	11/21/74	Poor condition	3	420
Pennock Creek/aka/ Twin Lakes	03	Zero storage	01/22/86	Deteriorated outlet, etc.	2	278
Peterson	03	12.6' below principal spwy.	08/16/82	Excessive uplift at toe	1	246
Prospect	01	G.H. 15.5'	04/15/80	Post-failure monitor: cracking on d/s slope	2	720
Quick	08	G.H. Zero	10/22/87	No spillway, inoperable outlet	3	37
Rainbow Falls #5	08	9' below crest	09/11/85	Inadequate spillway	3	25
Richards	02	6' below crest	12/22/83	Erosion, narrow crest, seepage, plugged outlet, etc.	3	140
Rist Benson	04	11.5'	06/15/89	Concentrated seepage	2	62
Rist Canyon	03	3' below crest	04/19/83	Poor condition	3	30
Rist George	04	G.H. 8.0'	07/18/85	Dilapidated condition, no spwy.	2	200
Riverside	01	G.H. 33.55'	05/09/84	Prevent overfilling of reservoir	1	0
Ryan Gulch	04	8' below crest	02/15/78	Inadequate spillway and leakage	2	217
Sandbeach	05	No storage	02/07/83	Poor condition	2	297
Section 19 Res.	06	4' below crest	07/24/84	No spillway	4	10
Signal #1	02	10' below crest	05/25/84	Concentrated seepage areas and questionable condition of outlet	3	100
Southside	04	8' below crest	07/07/78	Inadequate spillway	2	144
Steele Bros. #1	05	4' below spwy.	12/01/87	Sat. embankment: inoperable outlets: unknown cond. of n. outlet & adj. seep.: inad. frbd.: lack of erosion protection in spillway	3	34
Steele Bros. #2	05	3' below spwy.	11/23/87	Total rehabilitation required	3	14
Storm	02	5' below crest	11/07/84	Inadequate cross-section, low areas on crest	3	10
Stocking Pond	23	Zero Storage	06/13/88	Inadequate spillway	3	10
Sun Lake	23	8' below crest	06/20/83	Provide adequate freeboard	3	1

13,627.0

Division One (cont.)

OX. LOST FEET	NAME	DIST.	AMOUNT	DATE	REASON	HAZARD CLASS	APPROX. STG. LOST ACRE- FEET
968	Swede	05	5' below crest	11/14/86	Embankment seepage & inadequate freeboard	3	75
	Swift	05	7' crest	12/09/88	Piping failure at outlet headwall	3	20
600	Thompson	02	5' below crest	10/07/87	Inadequate freeboard, generally poor condition	3	30
54	Tony White	08	10' below crest	05/18/84	Dam breached through spillway	3	112
0	Tucker Lake	07	6' below crest	06/08/87	Inadequate spillway	1	70
10	Twin Lakes Res.	03	Gage-height 0	01/22/86	Deteriorated outlet	3	278
420	Wadley #1	02	8 below crest	06/13/85	Poor condition of dam	3	50
278	Wadley #2	02	7 below crest	06/17/85	Poor condition of dam	3	140
	Waterpoint	02	No storage	06/19/86	Poor condition of spillway	3	10
246	W. Cherry Crk #11	08	G.H. 72.8'	08/01/88	Illegal storage in flood control dam.	3	5
720	Wind	23	5.5' below crest	09/20/85	Saturated downstream slope	3	3
37	Woodland Park	08	20' below crest	05/21/83	Poor condition/inadequate spillway	1	40
25							833.0
140					Division One Total		44,196.5

627.0

Revised existing restrictions
 Restrictions removed this month (date)
 Restrictions imposed this month

DAM SAFETY BRANCH CURRENT RESTRICTIONS

JUNE 30, 1990

DIVISION TWO

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE-FEET</u>
Browning & Reese #1	17	Zero storage	12/28/87	Generally poor condition: inoperable outlet	3	383
Browning & Reese #2	17	Zero storage	12/28/87	Generally poor condition: inoperable outlet	3	100
Calahan	10	8' below crest	12/06/84	Saturated downstream slope	3	180
Clark #1	16	4.0 foot crest	06/07/89	Eroded upstream slope		20
Cottonwood #1	67	7' crest	12/20/88	Poor condition	3	20
Cripple Creek #3	12	3' below crest	06/27/86	Inadequate spillway	3	112
Cucharas #5	16	G.H. 100'	07/21/88	Poor overall condition of the embankment & history of movement	1	35,000
Dotson & Enlargement	14	Zero storage	12/14/89	Failing outlet system	3	2,500
Evans Gulch	11	3' below crest	02/02/85	Insufficient freeboard	3	2
Evans Gulch #2	11	1.5' below spwy.	09/14/84	Insufficient freeboard	2	39
Fountain Valley #3	10	Zero storage	12/05/89	Poor condition	2	700
Gagliardi, Mike	19	Zero storage	10/21/87	Large animal holes in u/s slope	3	75
Garden of the Gods	10	3' crest	05/31/88	No spillway	3	
Holita	16	3' below crest	06/02/77	Inadequate freeboard, slip on d/s slope	3	189
Horse Creek & Black Draw	17	5' below crest	04/24/86	In disrepair, abandoned	3	112
Lake Chipita	10	5' below crest	12/12/84	Provide adequate freeboard	3	5
Lake Dorothy	19	23' below crest	08/12/88	Seepage and stability	3	200
Lake Henry	17	7' below crest	07/15/87	Seepage on east dam	2	2,659
Lolita #3	17	5' below crest	08/12/85	Inoperable outlet, uneven crest	3	700
Martin Lake	16	5' below crest	02/18/83	No spillway, poor condition of outlet	1	412
Mill Lake	16	9' below crest	02/16/83	Inadequate spillway, poor condition	3	40
Modern Woodmen of America #2	10	No storage	08/12/83	Spillway obstructed	3	85
Monument	10	3' below spwy.	04/23/85	Unsat. Spillway condition	2	150
Nee-Noshe	67	5' with	01/17/83	Sandboils	2	7,392
Orlando #2	16	G.H. 22.5', 4' spwy	07/24/84	Cracks on downstream slope	3	750
						51,825.0

*Restrictions imposed this month
 **Restrictions removed this month (date)
 -Revised existing restrictions

Division Two (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD CLASS	APPROX. STG. LOST ACRE-FEET
Park Center L&W#2	12	8.8' dam crest	01/04/89	Slide on downstream slope	3	11
Park Center #10	12	6' below crest	01/05/74	Severe cracking	3	12
Placer Dams near Leadville	11	Zero	05/30/89	Failed dams	4	30
Prospect Lake	10	3 1/2' crest	05/31/88	No spillway, outlet operability questionable	3	0
Queen	67	7' below crest	02/20/87	U/S slope erosion: inadq. riprap	2	500
Seven Lakes	19	7' below crest	05/06/87	Dilapidated cond. of dam	3	1,200
Sharps Orchard	16	7' below crest	05/01/72	Badly eroded upstream slope	3	20
Swink #1	17	5' below crest	04/24/86	In disrepair, abandoned	3	500
Swink #2	17	5' below crest	04/24/86	In disrepair, abandoned	3	600
Swink #5	17	5' below crest	04/24/86	In disrepair, abandoned	3	750
Swink #6 (aka - Powell)	17	5' below crest	04/24/86	In disrepair, abandoned	3	650
Timpas #3	17	10' below crest	04/21/86	In disrepair, abandoned	3	500
Two Buttes	67	35' below crest	01/24/83	Inadequate spillway	1	22,200
Valley #1	10	15' below crest	12/27/84	Poor condition and blocked spillway	3	50
Valley #2	10	40' below crest	12/27/84	Inoperable outlet, poor condition	3	150
Victor #2	12	8' below crest	06/22/84	Extensive cracking along embankment	2	17
Wahatoya	16	5' below crest	05/12/75	Excess seepage, cracks	1	52
Wilson	12	3' below spwy.	08/24/87	Structural cracks, spillway	2	120
Little Giant #1	40	6' crest, 2.3' 10.5'	06/06/88	Poor outlet, inadequate spillway.	3	27,362.0
Low Cabin	40	3' below spwy.	01/07/86	Slide on downstream slope	3	40
Low Star #1	40	10' below crest	04/12/85	Constructed without approved plans	3	10
Meridian Lake Park #1	59	2' below spwy.	06/04/87	Severe erosion of the spillway	3	10
Rock #1	41	9' below crest	04/26/89	60 days storage allowed above restriction	3	20
Shannon	40	10' below spwy.	07/03/87	Cracks in left abutment	2	225
West Lake	60	5' below crest	09/10/85	Insufficient freeboard	3	25
Woods	42	8' below crest	08/14/85	Insufficient freeboard Seepage, trees	3	65
Division Two Total						76,187.0
-----						1,062.0

*Restrictions imposed this month
 **Restrictions removed this month (date)
 -Revised existing restrictions

825.0

DAM SAFETY BRANCH CURRENT RESTRICTIONS

JUNE 30, 1990

DIVISION THREE

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE-FEET</u>
Eastdale #1	24	G.H. 18' (12' below crest) 11/1 - 7/31 G.H. 15' (15' below crest) 8/1 - 10/31	08/21/87	Upstream slope erosion, seepage	3	1,700
Forbes Park	35	2.5' spwy.	07/19/85	Inadequate spillway	3	45
Lost Lake #2	20	3.5' below crest	08/14/87	Cracking, inadequate freeboard, rusted outlet	3	80
Mountain Home	35	G.H. 87.5'	09/16/82	Inadequate spillway	1	15,000
Terrace	21	7' below spwy.	07/18/84	Inadequate spillway	1	2,000
Division Three Total						18,825.0

*Restrictions imposed this month
 **Restrictions removed this month (date)
 -Revised existing restrictions

Splice	1	10'			3	
Horde Creek & Stack Draw	5				3	
Lake Dorothy	19	25'			3	
Lolita #3	22	15'			3	
Martin Lake	18	5'			1	
Hill Lake	16	5'			3	
Robert Woodson of America #2	10	84'			3	
Monument	13	17'			3	
Deerbach	27	5'			2	7,200
Orlando #2	16	6.8'			3	

*Restrictions imposed this month
 **Restrictions removed this month (date)
 -Revised existing restrictions

DAM SAFETY BRANCH CURRENT RESTRICTIONS

JUNE 30, 1990

DIVISION FOUR

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE- FEET</u>
Alta #1	60	5' below crest	08/18/76	Inadequate spillway	4	20
Alta #3	60	5' below crest	09/16/85	Provide sufficient freeboard	4	10
Arch Slough	40	G.H. Zero	12/12/85	Poor condition, reservoir abandoned	3	66
Bates #2	68	Zero storage	12/12/89	Excavation at outlet	3	11
Beaver	40	10' below spwy.	07/07/87	Excessive seepage	1	300
Big Battlement	40	5' gage-height	03/21/89	Sinkholes	3	750
Coffey	41	Zero storage	07/21/88	General poor condition	3	90
Cushman Lake	60	6' below crest	07/29/75	Provide sufficient freeboard	3	6
Cypers #1	40	4' below crest	10/13/88	Inadequate freeboard, outlet inoperable	3	10
Duwall #1	73	16' below crest	05/22/85	Poor condition, no outlet	3	15
Fullmoon	68	3' below crest	11/27/85	Maintain minimum freeboard	3	
Granby #11	40	4' below spwy.	10/15/87	Seepage	2	72
Granby #12	40	G.H. 17'	10/15/87	Seepage	2	98
Grand Mesa No. 1	42	3' below crest	01/27/88	Inadequate freeboard	3	48
Hale	40	5' below crest	09/17/85	Sinkholes	3	15
Knox	40	G.H. 17'	01/08/88	Seepage on embankment revision until 8/15/87	3	135
Little Giant #1	40	6' crest, G.H. 10.5'	06/06/88	Poor outlet, inadequate spillway.	3	
Lone Cabin	40	3' below spwy.	01/07/86	Slide on downstream slope	3	40
Lone Star #1	40	10' below crest	04/12/85	Constructed without approved plans and specifications	3	
Meridian Lake Park #1	59	2' below spwy.	06/04/87	Severe erosion of the spillway	3	10
Mock #1	41	9' below crest	04/26/89	60 days storage allowed above restriction	3	20
Monument	40	10' below spwy.	07/08/87	Cracks in left abutment	2	225
Priest Lake	60	3' below crest	09/16/85	Insufficient freeboard	3	25
Reeder	42	8' below crest	08/14/85	Insufficient freeboard Seepage, trees	3	96

2,062.0

*Restrictions imposed this month
 **Restrictions removed this month (date)
 -Revised existing restrictions

Division Four (cont.)

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE- FEET</u>
Todd	40	10' below crest	10/19/84	6' elevation difference along crest with no spillway	3	112
Trio	40	8' spillway	01/11/89	slide on downstream slope	3	
Waterbug	40	6' below spwy.	11/10/86	Poor condition, slip on u/s slope, d/s outlet valve	3	65
						<hr/> 177.0
Division Four Total						2,239.0

0.000

Restrictions imposed this month
 Restrictions removed this month (date)
 Revised existing restrictions

DAM SAFETY BRANCH CURRENT RESTRICTIONS

JUNE 30, 1990

DIVISION FIVE

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE-FEET</u>
Battlement #2	45	Zero storage	11/05/85	Damaged outlet	3	70
Big Beaver	72	10' below crest outlet fully open during spring runoff	11/17/87	Sinkholes in right embankment	3	96
Bolts Lake	37	1' below spillway	09/29/89	Inadequate spillway & poor maintenance	2	19
Bull Basin #1	72	10' below crest outlet fully open during spring runoff	11/23/87	Spillway flows impinge on embankment toe	3	80
Bull Creek #3	72	Zero Storage Maintain Outlet Fully Open	11/23/87	Sinkhole on u/s slope	3	59
Coon Creek #1	72	8' below spwy.	09/24/87	Inadequate spillway	2	475
Coon Creek #3	72	5' below crest	09/29/87	Outlet deteriorated	3	30
Coon Creek #4	72	No storage	09/16/86	Poor condition	3	9
Currier #2	72	Zero Storage	10/16/87	Land slides into spillway	3	222
Dale	51	15.5' below crest	07/06/87	Outlet distress, sloughing at outlet	3	
Dale #2	51	5' below crest	07/05/85	Insufficient freeboard	3	15
Fruita Settling Basin #2	72	Zero storage	11/23/87	Poor condition	3	38
G. G. Lower	37	No storage	02/14/86	Inadequate freeboard	3	37
G. G. Upper	37	No storage	02/14/86	Inadequate frbd. & questionable stability of d/s slope	3	30
Harris	39	6' below spwy.	11/27/85	Undersized spillway	2	50
Jones	52	5' below p. spwy.	10/23/85	Outlet disrepair, seepage on embmnt.	2	35
Kelly Dam	53	5' below crest	09/20/85	Insufficient freeboard	3	100
Langholen	51	4' below spwy.	06/28/85	Inadequate spillway	3	60
Little King Ranch	51	9.8' below spwy. G.H. 41'	03/07/78	Excessive leakage	2	180

1,605.0

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 -Revised existing restrictions

Division Five (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD CLASS	APPROX. STG. LOST ACRE- FEET
Milk Creek	50	20' below crest except between 5/1/89 & 7/31/89 when filling is allowed.	02/18/89	Excessive seepage on embankment	3	60
Newton Gulch	53	20' below crest	07/03/75	Abutment piping failure	3	400
Noeker	37	5' below crest	10/10/84	Badger holes down into crest	3	65
Parsons	50	10' below spillway	05/14/90	Inadequate spwy. sagging crest, abutment slides at spwy.	3	70
Rapid Creek #1	72	6' below crest	09/27/88	Inoperable outlet, erosion on u/s slope & excessive seepage	2	130
Rapid Creek #2	72	6' below crest	09/21/88	Inadequate freeboard & abandoned old outlet	2	245
Rock Creek	51	15' below crest	08/25/88	Inadequate spillway, poor embankmt.	3	125
Ruby Lee	72	No storage	01/23/87	Inadequate spillway, poor condition	3	367
Scholl	51	22' below crest	11/28/86	Sinkholes in abutment	3	250
Sterner	53	G.H. Zero, maintain outlet fully open	12/18/89	Construction without approval plans & specifications	3	300
Sylvan	51	5' below crest	09/30/85	Erosion on u/s slope & seepage above outlet	2	130
Upper Highline	72	5' below spillway	04/03/90	Increased Leakage	1	63
Y-T Reservoir	72	6' below crest	09/24/87	Extensive historic seepage, inadequate spillway	3	40
						2,245.0
Division Five Total						3,850.0

DAM SAFETY BRANCH CURRENT RESTRICTIONS

JUNE 30, 1990

DIVISION SIX

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE-FEET</u>
Anderson	44	6' below crest	06/06/86	Blocked spillway	3	60
Bar-Bee	58	1' below spwy.	11/17/87	Spillway erosion	3	6
Basin	57	13' below crest	09/17/85	Dam is breached	3	200
Biskup Dam	44	5' below spwy.	08/19/86	Inadequate spillway, slide, poor condition	3	45
Bunker	44	5' below crest	09/24/87	Poor condition, no spillway	3	60
Clayton	47	5' below spwy.	04/16/87	Seepage on d/s face	3	60
D D & E Wise	44	5' below spwy.	09/02/88	Slope appears too steep	2	200
Drescher	44	1' below spwy.	09/22/87	Cracks in crest and spillway backcutting	3	30
Ellgen #2	44	No storage	05/30/86	Poor outlet condition	3	60
Elk Lake	54	5' below crest	09/12/85	Spillway obstructed, poor maint.	2	40
Lake Emrich	57	15' below crest	08/30/88	Slide on d/s face	3	250
Pole Mountain	47	No storage	03/30/83	Slide, upstream slope	2	1,905
Sullivan Dam	44	8' below crest.	09/01/88	Inadequate spillway	3	25
Wilson #3 Dam	43	3' below spillway	09/30/89	Inoperable Outlet, Rodent Activity, Inadequate Spillway, Questionable Stability	3	10
Wilson Dam	43	5' below crest	09/22/89	Inadequate Spillway, Poor Maintenance		15
						2,966.0
Division Six Total						2,966.0

*Restrictions imposed this month
 **Restrictions removed this month (date)
 -Revised existing restrictions

DAM SAFETY BRANCH CURRENT RESTRICTIONS

JUNE 30, 1990

DIVISION SEVEN

<u>NAME</u>	<u>DIST.</u>	<u>AMOUNT</u>	<u>DATE</u>	<u>REASON</u>	<u>HAZARD CLASS</u>	<u>APPROX. STG. LOST ACRE- FEET</u>
Bauer #1	34	3' below spwy. for 45 days or 5' below spwy.	08/27/84	Saturation high on embankment	2	144
Big Pine	71	2' below spwy.	08/12/85	Steepness of d/s slope around outlet and seepage and sloughing from abutment left of outlet	2	70
Caballo Lake	31	2' below spwy.	07/29/86	Leakage along outlet: inadequate spillway	3	8
Charles Lemon	30	G.H. 8.5	03/07/86	Poor condition - restriction is to top of principle spwy. pipe	3	15
Henry's Dam	46	Zero Storage	04/07/89	Constructed without approved plans	3	
J. O. Spencer	34	5' below spwy.		Poor condition	3	13
Short	30	No storage. Outlet full open.	11/13/86	Inadequate spwy.: erosion on u/s face: current rest. results in about 3 AF of dead storage below invert of outlet	3	40
						290.0
Division Seven Total						290.0

*Restrictions imposed this month
 **Restrictions removed this month (date)
 -Revised existing restrictions

DIVISION 1

Pg. 01 8,032.00
Pg. 02 8,953.50
Pg. 03 12,551.00
Pg. 04 13,627.00
Pg. 05 833.00

43,996.50

DIVISION 2

Pg. 06 51,825.00
Pg. 07 27,362.00

79,187.00

DIVISION 3

Pg. 08 18,825.00

18,825.00

DIVISION 4

Pg. 09 2,062.00
Pg. 10 177.00

2,239.00

DIVISION 5

Pg. 11 1,605.00
Pg. 12 2,245.00

3,850.00

DIVISION 6

Pg. 13 2,966.00

2,966.00

DIVISION 7

Pg. 14 290.00

290.00

TOTAL
(ALL DIVISIONS)

151,353.50

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