STATE ENGINEER'S EIGHTH ANNUAL REPORT TO THE COLORADO GENERAL ASSEMBLY ON DAM SAFETY FOR F.Y. 90-91

November 1, 1991

OFFICE OF THE STATE ENGINEER
DIVISION OF WATER RESOURCES

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March 16, 1992

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

The Honorable Ted Strickland
President, Colorado State Senate
State Capitol Building
Denver, CO 80203

The Honorable Chuck Berry
Speaker of the House
Colorado House of Representatives
State Capitol Building
Denver, CO 80203

Gentlemen:

In accordance with Section 37-87-114.4, C.R.S. (1991 Supp.), I am pleased to submit a report covering the activities of the State Engineer on dam safety in Colorado for Fiscal Year 1990-91. Unfortunately, printing delays prohibited distribution of the report in a timely manner.

The Office of the State Auditor completed a performance audit of the Dam Safety Program in March, 1991. They found that the Division of Water Resources has recognized the need for a strong Dam Safety Program, and has established a rigorous safety inspection schedule. They did, however, make recommendations for correcting apparent deficiencies which we are vigorously pursuing.

Colorado's Dam Safety Program is considered to be a leader among states because of the support of the General Assembly. We will continue to maintain this goal for the protection of the safety of the citizens of our state. As we did in our last report, we recommend that our Dam Safety Program's legislation be improved in the area of emergency action. A copy of a proposed statute change is included in the appendix of the report.

Sincerely,

Hal D. Simpson

Hal D. Simpson, P.E.
Acting State Engineer

JAD/AEP:clf/artrans
Enclosure (a/s)

cc: The Honorable Jeffrey Wells, Senate Majority Leader
The Honorable Larry Trujillo, Sr., Senate Minority Leader
The Honorable Scott McInnis, House Majority Leader
The Honorable Ruth Wright, House Minority Leader
The Honorable Tilman Bishop, Chairman, Senate Agriculture Committee
The Honorable Dan Williams, Chairman, House Agriculture Committee
The Honorable Tony Grampsas, Chairman, Joint Budget Committee
Joint Budget Committee Members

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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. (1991 Supp.), and the Livestock Water Tank Act, Title 35, Article 49, of C.R.S. (1991 Supp.), as amended. The "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 in the administration of these statutes.

This report is submitted in compliance with Section 37-87-114.4, C.R.S. (1991 Supp.) concerning the dam safety activities of the State Engineer and the Colorado Division of Water Resources relating to Sections 37-87-105 to 37-87-114, C.R.S. (1991 Supp.)

Organization

Implementation of the Dam Safety Program is made 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 Resources Engineer. (See Appendix A for tables and charts of the personnel and organization of the Branch.)

The Dam Safety Engineering Units' principal duties are to conduct safety inspections of existing dams, design review and construction inspection of repairs and alterations, and investigation of complaints on the safety of dams. They investigate the construction of dams in violation of Section 37-87-105(1) and (4), C.R.S. (1991 Supp.), and conduct training on the inspection of dams for division personnel, dam owners, interested agencies, engineers, and the public. The responsibility to process and approve Livestock Water Tank and Erosion Control Dam applications was transferred to the Division Engineers and the Dam Safety Engineers in February, 1991. 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 Section 37-87-105, C.R.S. (1991 Supp.). 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 dam. The Unit assists the Department of Health in the technical evaluation of tailing impoundments through a Memorandum of Understanding, participates in the state's Joint Review Process with the Department of Natural Resources, and performs 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 as a result of the failure of dams within the resources of this office. The primary goal is the safety inspection of each Class I and Class II hazard, non-federal dam and reservoir on an annual basis, and the safety inspection of each Class III hazard, non-federal 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. (1991 Supp.), which are equal to or greater than ten feet high at the spillway, twenty acres in surface area at the high water line, or 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. Army Corps of Engineers' dams on a cooperative basis with their safety inspections being done 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 U.S. Bureau of Reclamation, the Corps of Engineers, their own people, consulting engineers, or by the State Engineer. When other than State Engineer personnel conduct the safety inspections, the agency submits 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 U.S. 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 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 jeopardizes 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.

A performance audit of the Division was conducted by the Office of the State Auditor and a report was issued in March, 1991. One of the areas evaluated was the Dam Safety Program. Some of the findings and recommendations were:

- The Division does not independently inspect any Class I and Class II dam owned by the U.S. Bureau of Reclamation. The Bureau inspects their dams only every three years, in which the Division participates. The Auditor recommended the Division improve its oversight of Federal dams by inspecting these dams during the years the Bureau doesn't. Although we disagreed with the recommendation, a budget decision item for FY 92-93 was submitted for two additional FTEs for the safety inspection of Federal dams on an annual basis per the recommendation of the legislative audit committee.

- The Division duplicates inspections of some dam owners. The Auditor recommended the Division accept inspection reports from other qualified engineers in lieu of conducting independent inspections when appropriate. We agreed in principle and our regulations provide for this. Although this appeared to be a good idea initially to deal with a manpower shortage, most of the dam owners who have the ability to make inspections prefer us to make them also.

- The Division does not have the authority to take emergency action on dams. The Auditor recommended the Division seek statutory authority to take action on dams in emergency situations. Proposed statute changes have been prepared for submittal to the legislature. See Appendix B.

- The Division has not enforced its requirements related to emergency plans. See section on Emergency Preparedness Plans.

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

JURISDICTIONAL[1] DAM OWNERSHIP STATUS
IN COLORADO

TYPE OF OWNER

HAZARD RATING	FEDERAL	STATE	OTHER GOVT.	PRIVATE	TOTAL
Class I	39	11	84	125	259
Class II	20	22	77	205	324
Class III	61	32	141	956	1190
Class IV	12	2	6	56	76
TOTAL	132	67	308	1342	1849

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 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.

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

TABLE 2

DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/CLASS

HAZARD RATING	DIVISION	NONFEDERAL	FEDERAL	TOTAL
Class I	1	115	13	128
Class II	1	126	8	134
Class III	1	469	12	481
Class IV	1	16	9	25
Class I	2	33	6	39
Class II	2	52	6	55
Class III	2	198	14	212
Class IV	2	27	0	27
Class I	3	9	1	10
Class II	3	16	0	16
Class III	3	31	4	35
Class IV	3	7	1	8
Class I	4	23	8	31
Class II	4	39	0	39
Class III	4	157	8	165
Class IV	4	1	2	3
Class I	5	19	7	26
Class II	5	37	8	45
Class III	5	121	16	137
Class IV	5	7	0	7
Class I	6	11	0	11
Class II	6	16	1	17
Class III	6	110	6	116
Class IV	6	3	0	3
Class I	7	10	4	14
Class II	7	18	0	18
Class III	7	43	1	44
Class IV	7	3	0	3
TOTALS		**1717**	**132**	**1849**

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 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 90-91, the State Engineer received plans for five new dams and eighteen plans for alteration, modification, repair, or enlargement. Six separate hydrology/hazard studies were also approved for determination of the inflow design flood for spillway design or hazard classifications. The estimated cost of construction for the submitted plans is $22,956,101.00. Eleven thousand seven hundred forty one dollars and twenty cents ($11,741.20) was collected for the examination and filing of the submitted plans.

Twenty-three sets of plans and specifications were approved by the State Engineer for construction during FY 90-91. (See Appendix C for lists of dams which were approved.) In order to expedite the approval of repair plans for dams, the Dam Safety Engineers review them and perform the construction inspections. This enables the owners to repair their dams sooner by shortening the review time. Two special studies associated with dams were also performed, including geotechnical reports, and the United States Committee on Large Dams questionnaire.

Upon completion of construction, the owner's engineer submits copies of the "AS-CONSTRUCTED" plans showing any 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 required 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 the construction inspection by the Unit. The supervisor also provides expert guidance to the Branch in the area of design review.

Section 37-87-114.5., C.R.S., (1991 Supp.) 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 Article 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 only store water below the natural surface of the ground.

In order to prevent administrative problems as a result of 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. (1991 Supp.) requires that a Notice of Intent to Construct a Nonjurisdictional Water Impoundment Structure must be submitted to the State Engineer prior to beginning construction.

SAFETY INSPECTIONS AND CONSTRUCTION OBSERVATIONS

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. Water Divisions 2, 3, 4, 5, 6, and 7 are assigned to the Resident Dam Safety Engineers. The engineers each schedule the inspection of approximately 70 to 125 separate dams each "inspection season," which begins around April 1st, and ends approximately November 1st, depending upon the weather. Subsequent follow-up and problem solving results in additional inspections each year. Due to the loss of an FTE in the Branch resulting from budget cuts, the workload for Division 1 engineers has increased to 125 dams each. Even with assistance from the supervisors, this is too large of a workload to accomplish the goals and objectives of the program. A reasonable workload is approximately 85 dams each. 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 hazard dams. Inspection of Federal dams are integrated with these schedules. The Dam Safety Engineering Units, therefore, collectively conduct about 900 to 1000 safety inspections on an inspection year basis.

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. An MOU has also been executed with the Bureau of Reclamation (Upper Colorado Region and the Great Plains Region). This MOU provides for the exchange of information at an annual meeting, or when requested, the observation of construction at Bureau dams, the notification of emergency conditions at mutually affected dams, and the access to technical information when requested. An MOU is being pursued with the Bureau of Land Management. Communications have resumed since the last report.

In order to track potential problems which could develop at Class III dams, the Division's Water Commissioners are assigned these dams to observe by the Resident Dam Safety Engineer, and they fill out a report. The report is reviewed by the Dam Safety Engineer, 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 D.

Scope

A safety inspection involves more than a trip to the dam. The site visit is preceded by a review of the file and history of performance, 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.

The safety inspection also includes an evaluation of the adequacy of the spillway to pass the appropriate sized flood for the dam's size and hazard class, to make an evaluation of the dam's hazard classification and whether it has changed, and to assess the adequacy of the Emergency Preparedness Plan for the dam. During the past year, the internal inspection of the outlet works and evaluation of instrumentation have been added to the workload in accordance with the regulations. The hydrologic evaluation of spillways has been postponed due to the publication of the Third Edition, Design of Small Dams, U.S. Bureau of Reclamation, and the revision of the hydrologic procedures. The State Engineer had been using the Second Edition as the procedure for evaluating spillways. New procedures are being developed in accordance with the Third Edition and the HEC1 program for calculating flood hydrographs and evaluations beginning in 1992.

Mr. James Norfleet, Resident Dam Safety Engineer for Division 4, has designed and built a prototype sled and 35mm camera system for photographing the interiors of small outlet pipes in order to evaluate their condition. Results to date look promising. Although this system has limitations, it is less expensive than using a TV camera system. The TV system, however, is much more versatile by being able to view the entire outlet while being advanced through the conduit. A video tape can also be made to have a permanent record.

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 for the safe storage level by the Dam Safety Engineer. The report also identifies the several repair and maintenance items which the owner should take care of, and any engineering and monitoring requirements necessary to assure the safety of the dam. A copy of the ENGINEERS INSPECTION REPORT is in Appendix D.

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. Re-inspections also occur to assure follow-up of the State Engineer's orders or as requested by the owner. 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 storage level. If the findings are conditionally satisfactory, full storage is recommended contingent upon appropriate monitoring being provided by the owner. Restriction letters are accompanied by orders to rehabilitate the dam to make it safe for full storage or to breach the dam. In the event the owner fails to comply with an order to make the dam safe, a breach order is issued to remove the hazard created by the dam and reservoir.

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 the reports. They also provide guidance and direction on problems and questions that the Dam Safety Engineers have. Because of a shortage of manpower from budget cuts and vacancies, and by legislative mandate, the supervisors also conduct safety inspections.

On January 1, 1991, the State Engineer placed the supervision of the Resident Dam Safety Engineers under the Division Engineers in their respective divisions. The Division Engineers are responsible for implementation of the Dam Safety Program, exclusive of design review, including enforcement of reservoir level restrictions and performance evaluation of the engineers. The Dam Safety Branch is responsible for development of a comprehensive statewide Dam Safety Program to include training of all dam safety personnel, monitoring of the Program in the field, and reporting to the State Engineer any shortfalls or discrepancies observed in the field that cannot be resolved.

Number of Inspections

During FY 90-91, a total of 829 safety inspections and 127 construction inspections were conducted for a total of 956. In addition, 106 follow-up inspections were made. This included 245 safety inspections of Class I hazard dams, 291 safety inspections of Class II hazard dams, 272 safety inspections of Class III hazard dams, and 21 inspections of Class IV dams (including Federal dams). The number of construction inspections significantly increased compared to the past due to reorganization and more emphasis placed on these inspections. Construction inspections are important because we must assure that the approved plans are being followed and to assure changed conditions during construction don't jeopardize the safety of the design. The objective of inspecting all Class I and Class II hazard dams on an annual basis and Class III dams on a five year basis is an inspection year objective versus a fiscal year objective. This objective was attained for 1990 with the assistance of the Dam Safety Branch supervisors, including the Chief of the Branch, and engineers in some of the divisions.

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 engineers having been transferred to Durango, Glenwood Springs, Montrose, Pueblo, and Steamboat Springs in the past several years. Plans are being made to transfer engineers to Division 1 in Greeley. 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 on several occasions assisted dam owners with the repair and engineering of their dams. Following are examples of the assistance provided:

- In Larimer County, the owners of Rist Benson and Donath Dams were provided hydrologic evaluations in order to determine the appropriate spillway size in one case, and to determine the alteration plan for lowering the reservoir in the other.

- Also in Larimer County, the owner of the Loveland Water Storage Dam was provided a dam-break study for preparation of an inundation map for the Emergency Preparedness Plan.

- In Washington County, a hydrologic study was done for the owner of the West Livestock Water Tank in order to design the spillway as an alternate to the standard specifications for their Livestock Water Tank permit.

- In Conejos County, dam-break studies were provided, and assistance was given to the developer in order to prevent a proposed housing development from affecting the hazard classification of Trujillo Meadows Dam.

- In Delta County, the division completed field surveys and cross-sections of drainages and developed rating curves for streams in District 40 which can be used for inundation mapping requirements of Emergency Preparedness Plans. Aerial photos of Surface Creek and Kiser Creek were also taken for identifying critical sections. Owners were assisted with the preparation of their Emergency Preparedness Plans in cooperation with the Delta County Emergency Manager.

- In Division Four, the Resident Dam Safety Engineer assisted dam owners with the compilation and graphing of instrumentation data at their dams.

- Also in Division Four, Jim Norfleet built a device for photographing the interior of outlet pipes that are too small to enter. This device helps evaluate the condition of outlets at a much lower cost than TV camera inspections, but it does have some limitations compared to TV cameras. The prototype is being tested and has some problems, but it should be useful in our program.

USE OF APPROPRIATED FUNDS

For FY 90-91, the legislature budgeted $828,174.00 for dam safety personal services. The Division of Water Resources allocated $33,200.00 for both operating costs and travel to the Dam Safety Branch. Thirteen thousand two hundred dollars ($13,200.00) was reallocated to the Division Engineer's offices for support of the Dam Safety Program.

Dam safety personal service expenditures for the Fiscal Year were $828,174.00. Total operating and travel expenditures were approximately $32,000.00, but this figure is uncertain due to problems with reporting expenditures under the COFRS system.

Whenever possible, the members of the Dam Safety Branch are provided training. Several members of the Branch have attended conferences and meetings of the Association of State Dam Safety Officials, participated in 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 are being used to provide this training.

RECEIPTS GENERATED FOR COSTS OF FILING PLANS

Fees collected by the State Engineer and deposited in the General Fund for dam safety amounted to $11,741.20 for filing plans and specifications during the period. House Bill 90-1130, approved April 12, 1990, amended the fees charged by the State Engineer effective July 1, 1990. The fee for safety inspections was repealed, and the fees for filing plans were increased to three dollars for each one thousand dollars of estimated costs of engineering and construction, with a minimum fee of one hundred dollars, and a maximum fee of three thousand dollars. See Appendix E for a copy of HB 90-1130.

ENFORCEMENT ORDERS AND PROCEEDINGS

There were no enforcement proceedings under Section 37-87-114, C.R.S. (1991 Supp.) during the fiscal year.

EMERGENCY PREPAREDNESS PLANS

During the National Dam Safety Program's (U.S. Army Corp of Engineers) inspection and Phase I findings on the safety of dams in the United States, recommendations were made by the reviewing professional engineers to prepare emergency plans to deal with potential failures at dams. The plans included the means in which to combat the incident from occurring, and to give warning to emergency managers for the affected floodplain. 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 (EPPs) and provided a guideline for them to follow. Emergency Preparedness Plans became a requirement for Class I and Class II dams in the regulations for dam safety adopted in September, 1988. As of October 10, 1991, a total of 152 plans for Class I dams have been filed with the State Engineer out of the 259 Federal and non-federal dams of record. Of the 152, twenty-eight are for federal dams, primarily belonging to the U.S. Bureau of Reclamation. This was an increase of only one from the previous period. In addition, plans have been submitted for 54 Class II dams, three being Federal, which is an increase of five plans. During FY 91-92, the Dam Safety Branch plans to continue requesting the plans during safety inspections and assisting the owners in their preparation. The owners

are also requested to coordinate with the state Division of Disaster Emergency Services and local emergency managers. Owners who refuse to prepare plans will be subject to court proceedings enforcing the State Engineer's orders under Section 37-87-114(2), C.R.S. (1991 Supp.).

It appears that a lot of owner apathy exists regarding the preparation of EPPs. One reason may be a lack of understanding of the value of the plans. The owners probably think their dams cannot fail. An intensive educational program may be needed before resorting to legal means. A performance audit of the Division, dated March, 1991, found that the Dam Safety Branch has not taken sufficient action to enforce the requirement for EPPs based upon the number of plans on file. Several recommendations were made which we agreed with and have implemented. The recommendation which we disagreed with, No. 4.b., was related to restricting storage for dams whose owners have not complied with our request for plans. We would prefer to enforce our order per Section 37-87-114(2), C.R.S. (1991 Supp.) if necessary.

DAM SAFETY DATABASE MANAGEMENT SYSTEM

During FY 90-91, the dams' database (DAMS) was permanently transferred to a personal computer (PC) using dBASE IV as the data management program. While the main database is kept on the PC in Denver, several dam safety engineers maintain the data for their divisions on division PCs. The main database in Denver is updated from the several divisions on a periodic basis.

The State Engineer submitted a workplan for updating the National Inventory of Dams (NID) to the Association of State Dam Safety Officials (ASDSO) in accordance with a Memorandum of Agreement executed in 1989. The project involves updating/correcting the NID through 1992. The Division received computer equipment as compensation for the work. The computer equipment and software will enhance the Branch's ability to maintain the DAMS database.

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, or since the Sage Creek Dam failure, Routt County, in 1985. The enforcement of the State Engineer's orders is also instrumental in assuring the effectiveness of the program. The combination of the State Engineer's safety inspections, restrictions, Emergency Preparedness Plans, and programs to make dam owners more knowledgeable about the safe operation and maintenance of their dams, makes Colorado's Dam Safety Program one of the most effective in the United States.

As a service to dam owners, the Dam Safety Branch has and makes available at no charge, a brochure on the construction and operation of dams in Colorado (June, 1989). It contains general information on requirements for approval of plans, water rights, financing, liability, insurance, Emergency Preparedness Plans, statutes, publications, and Division Engineer and Water Court addresses. A "Dam Safety Manual" is also available at a reasonable cost that instructs dam owners on the safety inspection of their dams.

All of the engineers in the Dam Safety Branch are members of the Association of State Dam Safety Officials (ASDSO) and actively participate in its programs. 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 dam safety programs, provide representation of state interests before Congress and Federal agencies for dam safety, and to improve efficiency and effectiveness of state dam safety programs. The State Engineer is a 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 City of Grand Junction to receive ASDSO's special recognition at their Annual Meeting in New Orleans, Louisiana in October, 1990. The City received an award for their maintenance program for their dams, and for their cooperative spirit with the state's Dam Safety Program. The Chief of the Branch is participating on an ASDSO workgroup for developing a manual on the performance of dams. The manual will be used by states and others to submit data to a library which will be maintained by Stanford University. Mr. Gregory Hammer, a dam safety engineer, serves on the Subcommittee for Geosynthetics. Several of the engineers have made presentations at the conferences.

LEGISLATION

House Bill 90-1130, by Representatives Masson, Ratterree, and D. Williams in association with Senator DeNier was signed into law by Governor Romer on April 12, 1990, and became effective July 1, 1990. The Bill amended several fee statutes related to dams. It eliminated the fees for safety inspections and construction observations, and increased the fees for filing plans to three dollars per one-thousand dollars of the cost of engineering and construction, with a minimum of one hundred dollars and a maximum of three-thousand dollars. The fees for applying for a Livestock Water Tank or Erosion Control Dam were increased to fifteen dollars.

RECOMMENDED LEGISLATION

Program Funding

Increased funding is recommended for several areas of the Dam Safety Program in order to maintain and improve the Program. One area is obtaining a full-time technician. A technician is needed to support the database, the Branch, and to provide more time for the engineers to do more technical work.

Rapid changes occur in the field of dam safety engineering and related disciplines. New designs for dams (and rehabilitation of dams) are utilizing new materials whose behavior and properties are unknown to the staff. Many conferences are held throughout the country with the objective of sharing knowledge and experience in the field of dam safety. It is proposed to establish training plans to send our engineers to these training courses to maintain a knowledge of state-of-the-art dam safety. The estimated first year's cost for the program is about $5,000.

Another funding area is the acquisition of computer programs such as DAMBRK, BREACH, STABL, HEC1,and HEC2 that have been developed by companies to be "user-friendly," enabling the efficiency of the users to apply them to engineering problems. The estimated cost for these programs is about $13,000.

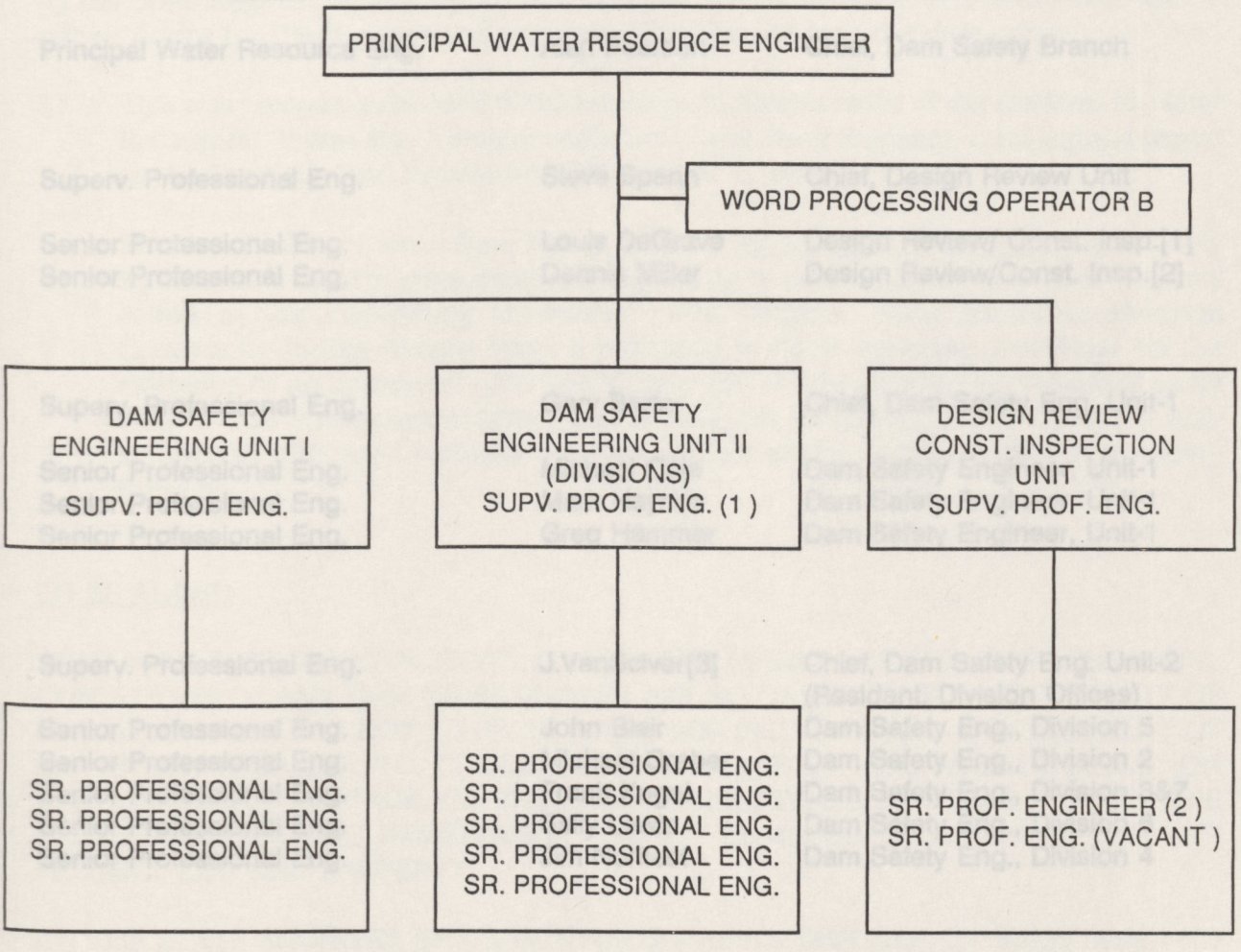
Although the sled and 35mm camera have been useful for evaluating the condition of small outlets, a TV camera and video monitoring system is needed to evaluate the condition of outlets. The estimated cost for these systems ranges from $20,000 for a minimally equipped portable unit, to $50,000 for a mobile color system.

Emergency Actions

The Association of State Dam Safety Officials published their Model State Dam Safety Program in April, 1987. It outlines the key components of an effective dam safety program. Colorado's dam safety law and program meet the model in most aspects, except in the area of enforcement capability during life threatening emergencies. There are no provisions for the State Engineer to take emergency action, or to pay for the costs, in the event the owner of a dam refuses or is unable to take action. A proposed statute change for emergency action at dams has been prepared and a copy is included in Appendix B. It provides for the State Engineer to take control of a dam or reservoir in an emergency if conditions are so dangerous to the safety of life or property that it does not permit time to issue orders to restrict storage, or if the dam is threatened by large floods. The proposed statute also provides for the recovery of expenses from the owner, and establishes a dam emergency repair fund.

APPENDIX A-1

PERSONNEL
DAM SAFETY BRANCH



(1) One supervisor for both units for one-half year. Added supervisor for last half.

(2) Dam Safety Engineer position being used for design review and const. inspection.

APPENDIX A-2

PERSONNEL
DAM SAFETY BRANCH

TITLE	NAME	AREA OF RESPONSIBILITY
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.[2]
Superv. Professional Eng.	Gary Barta	Chief, Dam Safety Eng. Unit-1
Senior Professional Eng.	Michael Cola	Dam Safety Engineer, Unit-1
Senior Professional Eng.	Mark Haynes	Dam Safety Engineer, Unit-1
Senior Professional Eng.	Greg Hammer	Dam Safety Engineer, Unit-1
Superv. Professional Eng.	J.VanSciver[3]	Chief, Dam Safety Eng. Unit-2 (Resident, Division Offices)
Senior Professional Eng.	John Blair	Dam Safety Eng., Division 5
Senior Professional Eng.	Michael Graber	Dam Safety Eng., Division 2
Senior Professional Eng.	Frank Kugel	Dam Safety Eng., Division 3&7
Senior Professional Eng.	Sally Lewis	Dam Safety Eng., Division 6
Senior Professional Eng.	Jim Norfleet	Dam Safety Eng., Division 4
Word Processing Operator B	Gina Antonio[4]	Typing, Word Processing Maintain File System

[1] Dam Safety Engineer position being used for design review/const. insp.

[2] Vacant April 1, 1991

[3] Beginning January 1, 1991. Steve Spann supervised prior.

[4] Vacant October 1990. Transferred duties to Support Services.

APPENDIX B

PROPOSED STATUTE CHANGE
EMERGENCY ACTION ON DAMS

Reason for Requested Change: Our statutes do not presently provide for emergency action by the State Engineer to attempt to remedy a dangerous situation at a dam when time is not sufficient for the issuance and enforcement of an order to the dam owner.

1) This was recommendation 3 of the recent performance audit of the Division of Water Resources. It was also a recommendation of the State Engineer in his annual report to the Governor and legislature of November 1, 1990.

The Association of State Dam Safety Officials Model Dam Safety Program strongly recommends that the state regulatory agency have clear authority to take emergency action in life threatening situations. The National Flood Insurance Program Community Rating System bases a reduction in flood insurance premiums on the existence of an accredited dam safety program, one requirement of which is to be able to take emergency actions. The lack of this emergency authority is the only substantial difference between the Association's model and Colorado's Dam Safety Program.

TO BE ADDED

37-87-108.5 EMERGENCY ACTIONS. (1) IF, IN THE OPINION OF THE STATE ENGINEER, CONDITIONS OF ANY DAM OR RESERVOIR ARE SO DANGEROUS TO THE SAFETY OF LIFE OR PROPERTY AS NOT TO PERMIT TIME FOR ISSUANCE AND ENFORCEMENT OF AN ORDER RELATIVE TO CONSTRUCTION, MODIFICATION, MAINTENANCE, OR RESTRICTION OF STORAGE, OR THE DAM IS THREATENED BY LARGE FLOODS, THE STATE ENGINEER MAY IMMEDIATELY EMPLOY REMEDIAL MEANS NECESSARY TO PROTECT LIFE AND PROPERTY.

(2) THE STATE ENGINEER SHALL CONTINUE IN FULL CONTROL OF SUCH DAM AND RESERVOIR UNTIL THEY ARE CONSIDERED TO BE SAFE, OR THE EMERGENCY CONDITION HAS PASSED, AS DETERMINED BY THE STATE ENGINEER.

(3) THE COST AND EXPENSES INCURRED BY THE STATE ENGINEER FOR THE REMEDIAL ACTIONS, OR ANY EMERGENCY ACTIONS, SHALL BE RECOVERED BY THE STATE ENGINEER FROM THE OWNER. IN THE EVENT THAT OTHER REASONABLE EFFORTS TO COLLECT SUCH COSTS AND EXPENSES FROM THE OWNER FAIL, A LIEN MAY BE PLACED AGAINST THE PROPERTY OF THE OWNER, AND SHALL BE SUPERIOR TO ALL MORTGAGES AND OTHER ENCUMBRANCES OF THE OWNER. ALL MONIES SO COLLECTED BY THE STATE ENGINEER SHALL BE DEPOSITED IN AN EMERGENCY DAM REPAIR FUND AS ESTABLISHED BY THIS ACT.

APPENDIX B-2

REQUESTED ADDITION TO STATUTE, EMERGENCY ACTION AT DAMS, CONTINUED

(4) AN EMERGENCY DAM REPAIR FUND IS HEREBY ESTABLISHED CONSISTING OF MONIES COLLECTED BY THE STATE ENGINEER FOR REVIEW OF PLANS FOR DAMS UP TO A MAXIMUM OF $10,000. THE MONIES SHALL BE DEPOSITED IN AN INTEREST BARING ACCOUNT FOR USE BY THE STATE ENGINEER TO TAKE REMEDIAL OR EMERGENCY ACTIONS IN ACCORDANCE WITH THIS ACT. MONIES RECOVERED FROM OWNERS IN ACCORDANCE WITH THIS ACT WILL BE DEPOSITED INTO THE EMERGENCY DAM REPAIR FUND TO THE EXTENT NECESSARY TO REPLENISH THE FUND. ALL MONIES COLLECTED ABOVE THE $10,000 MAXIMUM SHALL REVERT TO THE GENERAL FUND. ALL MONIES IN THE FUND AT THE END OF EACH FISCAL YEAR SHALL REMAIN IN THE FUND FOR USE IN THE FOLLOWING FISCAL YEAR.

(5) IN ADDITION TO ANY OTHER APPROPRIATION, THERE IS HEREBY APPROPRIATED TO THE STATE ENGINEER, OUT OF MONIES RECEIVED IN FISCAL YEAR 92-93 BY THE STATE ENGINEER FOR EXAMINATION OF PLANS AND SPECIFICATIONS FOR DAMS AUTHORIZED BY SECTION 37-80-110(1)(E), THE SUM OF TEN THOUSAND DOLLARS ($10,000), FOR THE IMPLEMENTATION OF THIS ACT. THE GENERAL ASSEMBLY SHALL ANNUALLY APPROPRIATE TO THE STATE ENGINEER THE FUNDS IN THE EMERGENCY DAM REPAIR FUND FOR HIS USE IN MEETING HIS RESPONSIBILITIES UNDER THIS ACT.

APPENDIX C

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

NAME	DAMID	C-NO.[1]	DATE	USE
MCCALL	050218	C-1717	07/18/90	MUNICIPAL
MIDWAY SP-1	100450	C-1721	05/01/91	INDUSTRIAL
MINEQUA NO. 2	120239	C-1722	06/14/91	MUNICIPAL
MINERICH DAM	620127	C-1719	11/01/90	RECREATION
RAPID CREEK NO. 1	720316	C-1723	06/21/91	IRRIGATION
SNOW MOUNTAIN	510208	C-1718	08/10/90	RECREATION

[1] Filing system for approved plans (C-1718). Assigned to new dams, and existing dams without previously approved plans, that are being altered. enlarged, or repaired.

APPENDIX C-2

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

NAME	DAMID	C-NO.[1]	DATE	USE
BEAVER BROOK 3A	070103	C-178 A	12/10/90	MUNICIPAL
BEAVER PARK	050108	C-1436 B	07/27/90	IRRIGATION
BIG PINE	710105	C-315 A	09/26/90	IRR/STK/REC
CHAMBERS	033105	C-173 C	08/10/90	IRRIGATION
DOUGLAS	030126	C-1034 B	03/18/91	IRRIGATION
FLORENCE 1 & 2	120118	C-904 A	01/29/91	IRRIGATION
FORT LOGAN	090215	C-1593 A	12/18/91	MUNICIPAL
GOOSE PASTURE	030105	C-1144 C	09/26/90	MUN/RECRE
HAHN'S PEAK	580110	C-793 D	06/21/91	RECREATION
HANDY aka WELCH	040126	C-535 B	05/21/91	IRRIGATION
JONES RESERVOIR	520107	C-1164 A	01/23/91	RECREATION
LAKE LOVELAND	040135	C-1686 A	03/18/91	IRRIGATION
NORTH POUDRE NO. 2	030237	C-699 A	10/03/90	IRRIGATION
RALSTON	070224	C-296 B	08/15/90	MUNICIPAL
TAYLOR DRAW	430204	C-1612 B	05/19/91	IRR/HYDREL
UPPER URAD	070234	C-1147 B	11/01/90	INDUSTRIAL
WINDSOR	020404	C-982 D	01/28/91	IRRIGATION

[1] Filing system for approved plans (C-982 D). Letters denote revisions/additions to previously approved plans.

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.

		Conditions Observed			
		GOOD	ACCEPTABLE	POOR	
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 _____				UPSTREAM SLOPE
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 _____				CREST
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 _____				DOWNSTREAM SLOPE
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 _____				SEEPAGE
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 _____				OUTLET
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 _____				SPILLWAY
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 _____				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, does not assume responsibility for any unsafe condition 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 water from the reservoir or floods resulting from a failure of the dam.

3/96 JTS

OBSERVATION BY WATER COMMISSIONER _____ DATE _____

APPENDIX D

APPENDIX D-2

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			
CREST			
DOWNSTREAM SLOPE			
SEEPAGE			
OUTLET			
SPILLWAY			

APPENDIX D-3

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.

APPENDIX D-4

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: _____

MONITORING: ☐ GOOD ☐ ACCEPTABLE ☐ POOR

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: _____

MAINTENANCE: ☐ GOOD ☐ ACCEPTABLE ☐ POOR

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: ☐ ☐ ☐

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 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.

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: _____

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: _____

Engineer's Signature _____ INSPECTED BY
Owner's Signature _____ OWNER/OWNER'S REPRESENTATIVE DATE ___/___/___

DC-22-2649a-86

1990

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

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Capital letters indicate new material added to existing statutes; dashes through words indicate deletions from existing statutes and such material not part of act.

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

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