

**STATE ENGINEER'S
SIXTEENTH ANNUAL REPORT
TO THE COLORADO GENERAL ASSEMBLY
ON DAM SAFETY FOR FY 99-00**

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November 1, 2000

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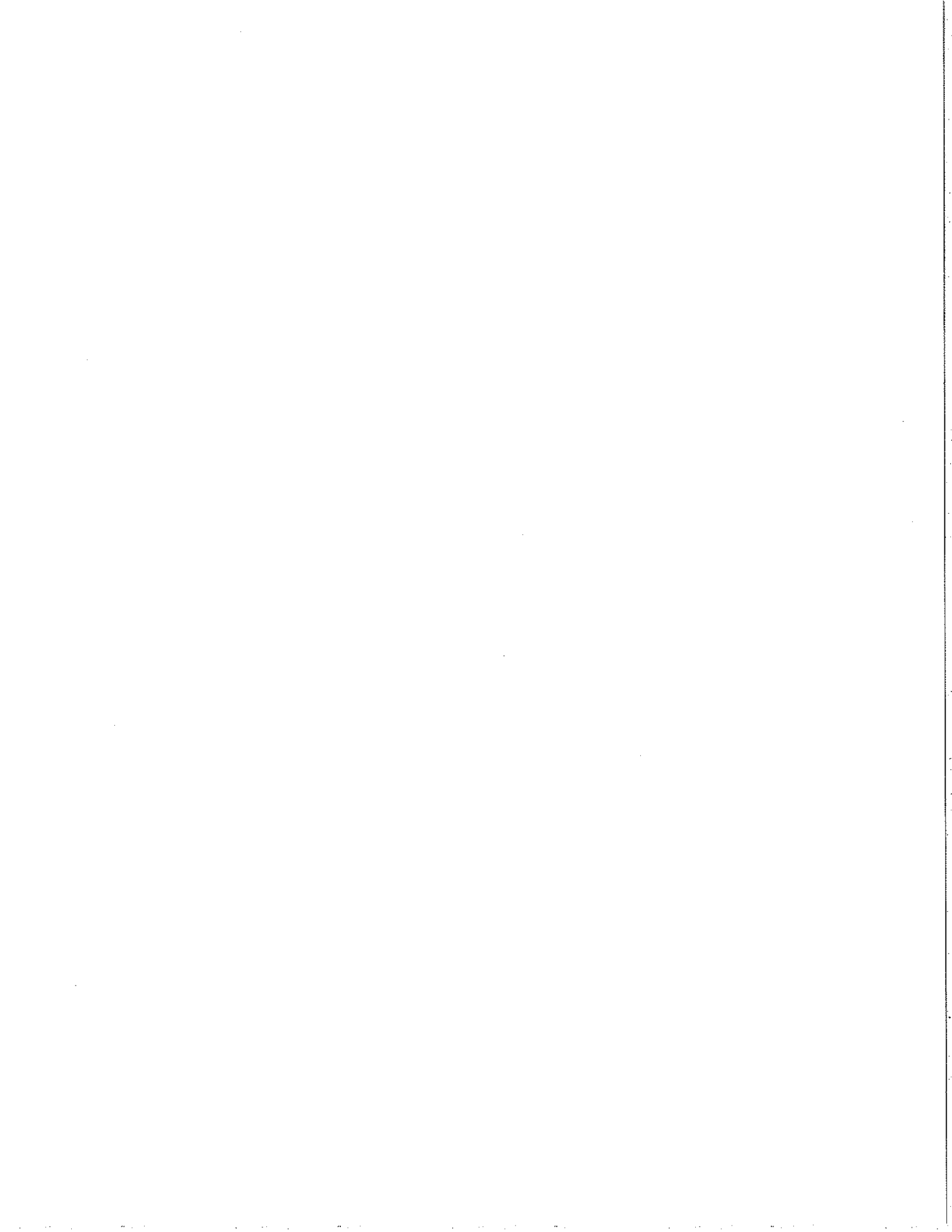


TABLE OF CONTENTS
1999-2000

| | |
|---|----|
| INTRODUCTION/PURPOSE | 1 |
| EFFECTIVENESS OF PROGRAM | 1 |
| DAM SAFETY PROGRAM | 3 |
| APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF DAMS AND RESERVOIRS | 6 |
| SAFETY INSPECTIONS AND CONSTRUCTION OBSERVATIONS | 8 |
| DAM SAFETY PROJECTS | 10 |
| ASSOCIATION OF STATE DAM SAFETY OFFICIALS | 11 |
| USE OF APPROPRIATED FUNDS | 12 |
| RECEIPTS GENERATED FOR COSTS OF FILING PLANS | 12 |
| ENFORCEMENT ORDERS AND PROCEEDINGS | 12 |
| LEGISLATION | 12 |

TABLES

| | |
|---|----|
| TABLE 1 - DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/CLASS | 13 |
|---|----|

APPENDIXES

| | | |
|--------------|---|---|
| APPENDIX A | - | DAM SAFETY BRANCH CHART AND PERSONNEL |
| APPENDIX B | - | APPROVED PLANS AND SPECIFICATIONS FOR ALTERATIONS, ENLARGEMENTS, OR REPAIRS OF EXISTING DAMS |
| APPENDIX C | - | WATER COMMISSIONER DAM OBSERVATION REPORT |
| APPENDIX D | - | ENGINEERS INSPECTION REPORT, PAGE 1 |
| APPENDIX D-2 | - | ENGINEERS INSPECTION REPORT, PAGE 2 |
| APPENDIX D-3 | - | ENGINEERS INSPECTION REPORT, PAGE 3 |
| APPENDIX E | - | EXTREME PRECIPITATION PROPOSAL |
| APPENDIX F | - | RESTRICTION LIST |



**COLORADO STATE ENGINEER'S SIXTEENTH ANNUAL REPORT
TO THE
GENERAL ASSEMBLY
ON
DAM SAFETY
FOR
FISCAL YEAR 1999-2000**

INTRODUCTION

The mission of Colorado's Dam Safety Program is to prevent loss of life and property damage and protect the state's water supplies from the failure of dams within the resources available to this office. The program assures a safe environment related to the design, construction, and operation of dams and reservoirs through working with dam owners and designers to achieve compliance with state statutes. The program includes the enforcement of a comprehensive set of regulations, policies, and procedures for the construction and maintenance of dams, the safe operation of reservoirs, and emergency preparedness. The public safety is provided by restricting the storage in the reservoir to a safe level. The safe storage level is determined by the review and approval of engineered plans for the construction and repair of dams, and regular safety evaluations of existing dams and reservoirs by professional engineers.

The program is managed by the State Engineer in accordance with Title 37, Article 87, of C.R.S. (1999 Supp.), and the Livestock Water Tank Act, Title 35, Article 49, of C.R.S. (1999 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 implementation of these statutes.

PURPOSE

This report is submitted in compliance with Section 37-87-114.4, C.R.S. (1999 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. (1999 Supp.).

EFFECTIVENESS OF PROGRAM

The effectiveness of a program can be demonstrated by producing a result or accomplishment. For fiscal year 1999-2000, the dam safety program again achieved the majority of its goals and objectives in the design review and inspection of dams. We continue, however, to experience incidents at dams. Because of our dam safety program however, the incidents resulted in reduced consequences. This is attributed to the increased awareness of the dam owners to be responsible for their dams, including emergency preparedness; and to the enforcement of the regulations, policies, and procedures by our office.

At the end of the reporting period, there were 190 dams restricted from full storage due to various structural problems such as serious leakage, cracking and sliding of embankments, and

inadequate spillways. The restrictions provide increased safety for the public and environment until the problems are corrected. The owners are responsible for following the restricted operating levels, and the restrictions are enforced by the Division Engineers. See Appendix G for a list of restricted dams. In the event conditions of any dam or reservoir are so unsafe as to not permit the time to issue or enforce a restriction, or a dam is threatened by a large flood, the State Engineer may immediately employ remedial measures to protect the public safety. An emergency dam repair cash fund is provided under the Colorado Water Conservation Board's construction fund per Section 37-87-122.5 (1999 Supp.)

Six dams experienced serious problems during the period. Following is a short description of the incidents:

- ◆ Rist-Benson, a High Hazard dam near Loveland in Larimer County, experienced a point source leak from a rodent hole on the downstream slope of the dam. The reservoir is restricted to a level where the leakage ceased.
- ◆ Occhiato No.1, a Low Hazard dam near Beulah in Pueblo County, suffered a massive slide on the downstream slope. The reservoir is restricted to a level ten feet below the crest of the dam pending repairs.
- ◆ Woodland Park, a Significant Hazard dam owned by the Town of Woodland Park in Teller County, experienced uncontrolled leakage during the first filling after construction of a stability berm and seepage control drains. The reservoir has been lowered and is being monitored. Additional piezometers are being installed.
- ◆ Teller Dam, a significant Hazard structure owned by the US Army on Fort Carson experienced longitudinal cracking on the crest of the dam near the right abutment. The cracks were closely monitored and subsequently repaired. Any movement is monitored with a new inclinometer.
- ◆ North Lake, a High hazard dam near Stonewall in Las Animas County, experienced a sudden increase in outflow from a 24-inch Corrugated Metal Pipe(CMP) outlet, "possibly due to a hole in the pipe near the upstream gate which is closed". Investigations are under way to determine the problem while the situation is closely monitored.
- ◆ Grandby No.11 dam, a Significant Hazard structure on the Grand Mesa near Cedaredge experienced leakage and sinkholes on the upstream side of the dam. The reservoir was restricted and drawn down to investigate the problem. A repair plan has been submitted and approved.

With the passage of the National Dam Safety Program Act (NDSP), PL 104-303, and its subsequent funding, Colorado has applied for and received a \$25,162 assistance grant for 1998 to improve the effectiveness of its program. Additional grants were approved for \$49,230 for year 1999, and \$85,405 for 2000. These funds are being used to provide advanced training to the staff in the field of dam safety. Additional training will also be provided under the Technical Seminar training provisions of the Act. The grant funds will also be used to acquire emergency communication equipment; upgraded computers; engineering computer programs; and digital cameras. Future grants may be available each year under the Act, until the year 2002, subject to appropriations.

The following sections of this report cover the activities of the program during the period.

DAM SAFETY PROGRAM

Organization

The Dam Safety Program is implemented by the State Engineer through the Dam Safety Branch and the Division Engineer's Offices. The branch is partially decentralized, with Dam Safety Engineers working under the general supervision of the Division Engineers in the several divisions throughout the state. The Dam Safety Engineers and the divisions are responsible for the Program for their geographic area, including enforcement of reservoir level restrictions. The Principal Engineer of the Branch, who is located in Denver, has program-wide responsibilities such as: communication, training, coordination, formulating the goals of the program, recommending policies for implementation of the regulations, preparing procedures for carrying out the policies, and providing technical guidelines for conduct of the work. The Principal Engineer also supervises the Design Review and Construction Inspection activities. (See Appendix A for tables and charts of the personnel and organization of the Branch.)

The Dam Safety Engineers' principal duties are to respond to emergency situations, conduct safety inspections of existing dams, review the adequacy of spillways under the rules, enforce the requirement for emergency planning, assist dam owners in developing their Emergency Preparedness Plans (EPP), provide design review and construction inspection of repairs and alterations when necessary, and investigate complaints on the safety of dams. They also investigate the construction of dams in violation of Section 37-87-105(1) and (4), C.R.S. (1999 Supp.), and conduct training on the inspection of dams for division personnel, dam owners, interested agencies, engineers, and the public. In addition, they review and approve Livestock Watertank and Erosion Control Dam applications, and do other related work as assigned.

Interagency coordination occurs as necessary. For example, we provide the U.S. Forest Service copies of our inspection reports and orders for repair for privately owned dams, so they can administer their use permits on national forest lands. We also coordinate the reviews of plans with the forest service for permitted dams. See page 5 for more information on the safety of federal dams.

A Memorandum of Understanding has been executed with the Division of Wildlife (DOW) regarding the responsibilities of each agency in carrying out the safety inspection of their dams. DOW is making safety inspections of their Low hazard (Class 3) dams.

The Design Review Engineers' 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. (1998 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 engineers assist 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, provides technical assistance to the Division Engineers' offices on dam safety, and performs other related work as assigned.

The Colorado Water Conservation Board uses its construction fund to assist owners with the repair of their dams. We coordinate the review and approval and the final acceptance of these dams with them.

Goals and Objectives of the Program

The program concentrates on "jurisdictional" dams and reservoirs as defined in Section 37-87-105, C.R.S. (1999 Supp.), which are greater than ten feet high at the spillway; or twenty acres in surface area, or 100 acre-feet in capacity at the high water line. Particular attention is placed on inspecting Class 1 (High Hazard) dams annually, Class 2 (Significant Hazard) dams every two years, and Class 3 (Low Hazard) dams are inspected at least every six years. Because of their non-hazardous location, Class 4 (No Hazard) dams are not inspected regularly, but observed for changes in hazard class periodically. See SAFETY INSPECTIONS AND CONSTRUCTION OBSERVATIONS, page 8 for more information.

The Dam Safety Branch developed the following goals and objectives for the Dam Safety Program.

1. **In order to protect the public safety, the Dam Safety Branch shall determine the amount of water, which is safe to impound in the several reservoirs in the state.** All of the objectives were accomplished for the period. See page 9 for more details on the number of inspections conducted.
2. **In order to protect the public from the failure of dams, the Dam Safety Branch shall review and recommend approval of plans and specifications for the construction, modification, and repairs of dams, in accordance with the Regulations for Dam Safety and Dam Construction, September 30, 1988.** All of the objectives for this goal were also accomplished, including the Design Review Unit completing the review of plans and specifications within the 180-day limit. See page 6 for more details on the number of plans reviewed and approved.
3. **In order to improve the public safety from the failures of dams, the Dam Safety Branch shall implement the Rules and Regulations for Dam Safety and Dam Construction in a reasonable time.**

Emphasis has been placed during the period on improving the number and quality of Emergency Preparedness Plans for High and Significant hazard dams, especially getting existing plans updated. Moderate success is being realized due to the efforts of our Dam Safety Engineers, in some cases assisting the owners by providing the forms and data they need.

4. **To improve the communications of the Dam Safety Branch, the Principal Engineer of the branch and the Division Engineers shall coordinate their activities closely.** Communications are maintained through the use of e-mail and sending monthly activity reports to the Divisions by the Principal Engineer of the branch.

The Assistant State Engineer, Jack Byers, schedules frequent meetings with the Division Engineer's offices and annual meetings with the branch.

5. **In order to improve the functions of the Branch, and to meet the public information needs, the Dam Safety Branch shall maintain a data information system.** The maintenance of the DAMS database has been very successful. See page 11 for more information about this and the NATDAM program.
6. **In order to improve the technical proficiency of the Branch, the Division of Water Resources shall provide training and professional development of the personnel.** The Dam Safety Branch submitted a training plan as part of an application to the Federal Emergency Management Agency (FEMA) under the National Dam Safety Program Act (NDSP) to provide the staff with advanced training in technical subjects. During the period the staff have taken part in Technical Seminars offered by the Association of State Dam Safety Officials (ASDSO) as follows:

Association of State Dam Safety Officials Annual Conference and Technical Seminar on Risk Analysis. Two members of the branch attended. Out-of-state travel limitations prevented additional dam safety engineers attending.

The Branch engaged URS Griener Woodward-Clyde, Denver, to present a technical seminar on advanced slope stability analysis and seepage analysis. Eleven of the members of the branch participated.

ASDSO Western Region conference and Technical Seminar on construction Inspection. Two members of the branch attended.

Administrative leave is also provided for continuing education and participation on task groups and committees.

7. **In order to improve our dam safety program, and to participate in the development of national policies on dam safety, and to take advantage of the continuing education and information available, the State shall be a full voting member of the Association of State Dam Safety Officials (ASDSO).** Under Goal 7, the Principal Engineer of the Branch is the designated state representative to ASDSO. He has served on task groups, committees, and the Board of Directors, and was an officer. All of the personnel in the Branch have had an opportunity to attend ASDSO conferences and technical seminars over the years. Their Associate Member dues are paid for from operating funds.

Safety of Federal Dams

A Memorandum of Understanding (MOU) has been executed with the U.S. Bureau of Reclamation (BOR), the Bureau of Land Management (BLM), and the Air Force Academy (AFA) relating to dam safety activities in Colorado. They provide for the exchange of safety related information of dams under each agency's jurisdiction. An MOU is also being revised with the U.S.

Forest Service, Rocky Mountain Region, to provide coordination of our mutual responsibilities for dam safety. MOUs are being pursued with the other federal agencies such as the Army Corp of Engineers and the Federal Energy Regulatory Commission to assure that the dams under their jurisdiction are being maintained in safe condition and to coordinate our activities and exchange of information and data.

Safety evaluations are done in accordance with the "Federal Guidelines for Dam Safety". We monitor the activities of these federal agencies to assure they are following their guidelines.

We have curtailed participating in routine inspections of federal dams in accordance with the audit. The Branch, however, has participated in the evaluation of the safety of several federal dams for special issues and performance problem evaluations during the period, in accordance with the procedure for obtaining approval to participate in these inspections. One hundred seventy four (174) hours were spent participating in these safety inspections at a cost of \$7,308.

Federal Energy Regulatory Commission Licensed Dams

The Branch makes safety inspections of dams, which are also regulated by the Federal Energy Regulatory Commission (FERC). In accordance with an agreement with them, they notify us of their schedules, and invite us to participate in their inspections. They also furnish us copies of their reports for our records. We notify the FERC of any safety problems that we have identified based on our safety inspections, when requested by them. We have also curtailed our participation in FERC regulated dams in accordance with the audit, but in accordance with the procedures for approval spent 37 hours on inspections to evaluate specific performance or maintenance issues, at a cost of \$1,554.

Tables of Jurisdictional Dams

See page 13 for a table showing the distribution of dams by ownership. Table 1 shows the ownership of jurisdictional dams in divisions by hazard class and type of owner.

APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF DAMS AND RESERVOIRS

During FY 99 - 00, the State Engineer's Office received plans for four new dams, and thirty-two plans for alteration, modification, repair, or enlargement. Nine separate hydrology studies were also submitted for determination of the inflow design flood for spillway design. The estimated cost of construction for the submitted plans was \$6,495,971. Eighteen thousand five hundred and sixty eight dollars (\$18,568) was collected for the examination and filing of the submitted plans.

Thirty-seven sets of plans and specifications for construction, and four hydrology studies were approved by the State Engineer during FY 99-00. (See Appendix B for lists of dams which were approved.) In order to expedite the approval of repair plans for dams, the Dam Safety Engineers may review them and perform the construction inspections. This enables the owners to repair their dams sooner by shortening the review time.

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.

Section 37-87-114.5., C.R.S. (1999 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. (1998 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

Scope

The statutes specify 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. Construction inspections also need to be maintained at a high level. Construction inspections are important to assure that the approved plans are being followed and to assure changed conditions during construction does not jeopardize the safety of the design. 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 safety inspection must also include 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. The internal inspection of the outlet works and evaluation of instrumentation has also been added to the workload as required by the regulations. The hydrologic evaluation of spillways has been postponed on dams located above 7500 feet in elevation, pending the completion of a study of extreme precipitation by the State Engineer and the Water Conservation Board, (See page 10 for more information.).

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. An order is prepared for the State Engineer's signature, restricting storage in the reservoir until the problem is corrected. 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.

Procedures have been implemented to begin reporting incidents, and the findings of safety inspections where orders have been issued to make modifications for safety reasons, to the Center for the Performance of Dams at Stanford University, Palo Alto, California. This is a new national program that has been developed by the Association of State Dam Safety Officials and the Federal Emergency Management Agency for accumulating data for the improvement of design and safety evaluations of dams nationwide. Dam incident reports were submitted for six dams during the period.

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 an acceptable 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.

Scheduling

The Dam Safety Engineers collectively conduct about 800 to 1000 safety and construction inspections each year. Jurisdictional dams identified for inspection in accordance with the policies of the State Engineer are assigned to the Dam Safety Engineers in each Division. The number of inspections required to be scheduled is related to the number of dams in each division and their hazard class. Included in these numbers has been the annual inspection of all Class 1 dams, one-half of the Class 2 hazard dams, and about one-sixth of the Class 3 hazard dams. Inspection of federal dams for nonroutine inspections are integrated with these schedules. Subsequent follow-up and problem solving meetings with dam owners results in additional inspections each year.

In order to track potential problems which could develop at Class 3 dams, the Dam Safety Engineers assign dams to be observed to the Division's Water Commissioners, and they file an observation report. The report is reviewed, and then furnished to the owner for their information, and to implement any recommendations for repair and maintenance. A copy of the WATER COMMISSIONER DAM OBSERVATION REPORT form is in Appendix C.

Number of Inspections

During FY 99-00, a total of 562 safety inspections and 134 construction inspections were conducted for a total of 696. In addition, 164 follow-up inspections were made. The safety inspections included 236 Class 1 (High) hazard dams, 178 Class 2 (Significant) hazard dams, 146 Class 3 (Low) hazard dams, and two inspections of Class 4 (No Hazard) dams (includes Federal dams which are inspected at 3 year intervals and which we participated.) Fewer low hazard inspections were done due to a vacancy in Divisions 3 and 7. For inspections of federally owned dams in which we don't participate, we receive and review their reports and findings.

DAM SAFETY PROJECTS

Extreme Precipitation Study

The State Engineer and the Colorado Water Conservation Board (CWCB) continued the process during the period to study extreme precipitation in the mountainous areas of Colorado. See Proposal for Evaluating Extreme Precipitation for the Mountainous Areas of Colorado in Appendix E. A volunteer committee of meteorologists, hydrologists, engineers, federal and state agencies, and private entities prepared the proposal. The Department of Atmospheric Science, CSU (State Climatologist) was engaged for doing Phase I of the study, which is the collection and verification of data. A workshop was held to provide a forum for professionals in the field to determine which modeling technology should be used during Phase II of the plan. The Phase I report was completed in May 1997. It contains a list of recommended extreme storms that will be used for modeling research, and can be used for site specific analysis of extreme events for project studies. The CWCB approved \$300,000 for doing the Phase II study. They also approved the use of \$100,000 for updating the 100-year frequency atlas for Colorado. The National Weather Service, NOAA, will be requested to update the atlas, however they are behind schedule and no work is expected to get done until 2002.

A Memorandum of Understanding was approved on March 5, 1999 with Colorado State University (CSU) Department of Atmospheric Science, Ft. Collins, Colorado to develop new methodologies for determining extreme precipitation. This will be about a two plus year (February 1999 – June 2001) research project using the RAMS model at CSU to simulate extreme precipitation of historic events, and to create a graphical user interface (GUI) with the RAMS model to develop extreme precipitation estimates in Colorado. A Technical Review Group is assisting us in reviewing the progress of the research. The members of the group are Mr. Jimmy Dudhia, National Center for Atmospheric Research; Mr. Louis Schreiner and Mr. David Mathews, US Bureau of Reclamation; and Mr Stephen Spann, Consultant. These new criteria should save millions of dollars in the construction of spillways for dams. They are presently on schedule testing the model.

Emergency Preparedness Plans

Emergency preparedness for incidents at dams that jeopardize the public safety, including the failure of dams, has become an integral part of dam safety programs. All the federal dam owning/regulating agencies, and most states require that plans be formulated in order to detect incidents at dams, give adequate warning, and maintain preparedness, for the eventual failure or misoperation of dams. Colorado has been actively involved in this area since 1981, ultimately requiring that Emergency Preparedness Plans (EPP) be prepared for High and Significant Hazard dams as part of the regulations for dam safety adopted in September 1988. As a result of increased effort, at the end of the period of this report, June 30, 2000, emergency plans have been prepared for 100 percent of the High Hazard dams of record statewide. Much work is still needed, however, to update, maintain, and exercise the plans annually.

The Dam Safety Engineers in the Divisions continue to assist dam owners in the preparation of their EPPs. Approximately 98 percent of the Significant Hazard dams have plans on file. The others who do not have a plan, have been notified of the requirement to prepare them. In some

cases, we have prepared the plans for the owners. This will continue to be enforced during the following year of inspections. We also participate in a variety of emergency exercises in coordination with federal, state, and local emergency managers.

Dam Safety Database Management System

The dams database (DAMS) is maintained on a personal computer system (PC) using dBASE IV as the data management program. While the main database is kept on a PC in Denver, the several dam safety engineers maintain the data for their Divisions on their PCs. The main database in Denver is updated from the several Divisions on a periodic basis. The Dam Safety Branch's capability to maintain the database and analyze dams was enhanced by the receipt of computer hardware and software for the Denver office and the Division offices under the auspices of the National Dam Safety Program Assistance Grants. The addition of e-mail and Internet Services has improved our ability to maintain and share our databases materially.

Publications/Internet

As a service to dam owners, the Dam Safety Branch makes available, at no charge, a brochure on the construction and operation of dams in Colorado (January 1999). 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. Guidelines for preparing EPPs and a Project Review Guide for submitting plans for approval also are provided at no cost.

In addition, the Regulations, Project Review Guide, application forms, sample plans, Livestock and Erosion Control Dam Permits, and Notice to Construct a Nonjurisdictional Impoundment Structure are available on the Dam Safety Web Page.

ASSOCIATION OF STATE DAM SAFETY OFFICIALS

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, presenting papers and serving on task groups and committees. 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. Alan Pearson, Principal Engineer of the Dam Safety Branch, is the state's representative for the Association. Mr. Pearson also is a member of the Peer Review Committee and the Executive Committee for the National Center for Performance of Dams (NPDP). The Peer Review Program provides member states with an opportunity to have their dam safety programs reviewed to ensure that they are accomplishing their objectives, and to receive recommendations for improving their programs. Colorado has taken advantage of this opportunity for a review in 1991. Several of the recommendations have been implemented to date. The NPDP's mission is to be the leading source of information on the operational and structural performance of dams.

The Center and the data will provide an important research tool in the improvement of dam safety in the United States.

The Branch executed an MOA with the Association for submitting incidents to the National Center for Performance of Dams for 1999. We received \$2000 for fiscal year 1999-00 upon agreeing to include the submittal of incident data to the Center. The funds were used for training.

USE OF APPROPRIATED FUNDS

Dam safety personal service expenditures for the fiscal year 1999-00 were \$936,550. Total operating and travel expenditures were approximately \$25,000.

\$49,230 of the National Dam Safety Program Act assistance grant for 1999 has been expended to date, for training and purchase of equipment and software. These expenditures were made in accordance with the plan that was submitted to FEMA for improving Colorado's Dam Safety Program.

RECEIPTS GENERATED FOR COSTS OF FILING PLANS

Fees collected by the State Engineer and deposited in the General Fund for dam safety amounted to \$18,568 for filing plans and specifications during the period.

ENFORCEMENT ORDERS AND PROCEEDINGS

No enforcement orders on dam safety were issued during the period.

LEGISLATION

No legislation affecting dam safety was enacted during the period.

TABLE 1

DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/CLASS

| <u>HAZARD RATING</u> | <u>DIVISION</u> | <u>NONFEDERAL</u> | <u>FEDERAL</u> | <u>TOTAL</u> |
|----------------------|-----------------|-------------------|----------------|--------------|
| Class 1 | 1 | 129 | 14 | 143 |
| Class 2 | 1 | 121 | 8 | 129 |
| Class 3 | 1 | 420 | 11 | 431 |
| Class 4 | 1 | 34 | 9 | 43 |
| <hr/> | | | | |
| Class 1 | 2 | 37 | 6 | 43 |
| Class 2 | 2 | 50 | 3 | 53 |
| Class 3 | 2 | 104 | 11 | 115 |
| Class 4 | 2 | 98 | 4 | 102 |
| <hr/> | | | | |
| Class 1 | 3 | 9 | 1 | 10 |
| Class 2 | 3 | 14 | 0 | 14 |
| Class 3 | 3 | 29 | 4 | 33 |
| Class 4 | 3 | 15 | 0 | 15 |
| <hr/> | | | | |
| Class 1 | 4 | 30 | 10 | 40 |
| Class 2 | 4 | 37 | 0 | 37 |
| Class 3 | 4 | 148 | 6 | 154 |
| Class 4 | 4 | 4 | 3 | 7 |
| <hr/> | | | | |
| Class 1 | 5 | 24 | 16 | 40 |
| Class 2 | 5 | 36 | 1 | 37 |
| Class 3 | 5 | 117 | 15 | 132 |
| Class 4 | 5 | 16 | 0 | 16 |
| <hr/> | | | | |
| Class 1 | 6 | 12 | 0 | 12 |
| Class 2 | 6 | 14 | 1 | 15 |
| Class 3 | 6 | 107 | 9 | 116 |
| Class 4 | 6 | 11 | 0 | 11 |
| <hr/> | | | | |
| Class 1 | 7 | 12 | 4 | 16 |
| Class 2 | 7 | 19 | 1 | 20 |
| Class 3 | 7 | 42 | 1 | 43 |
| Class 4 | 7 | 6 | 0 | 6 |
| <hr/> | | | | |
| TOTALS | | 1695 | 138 | 1833 |

Class 1 - Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.

Class 2 - 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 3 - 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.

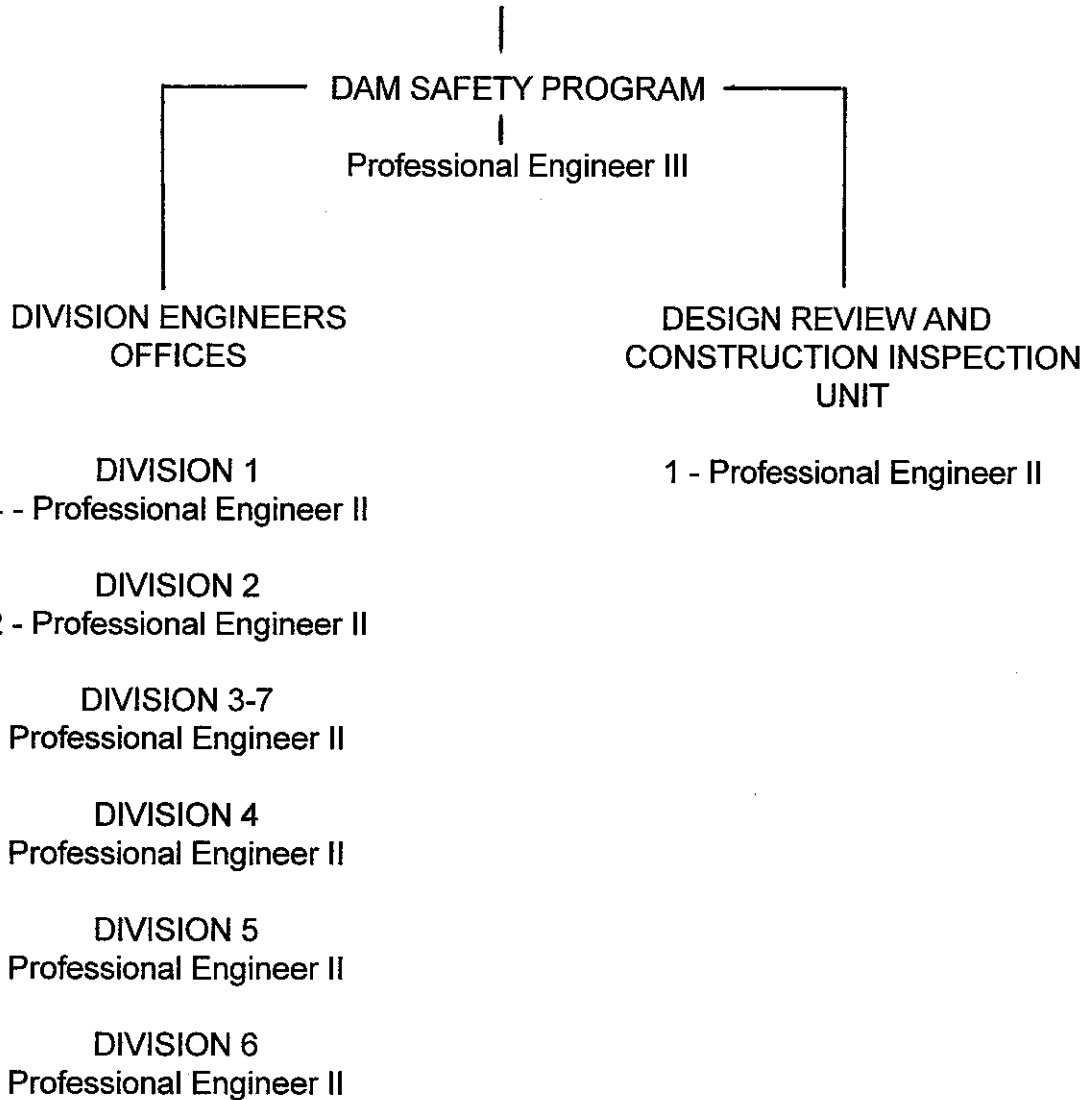
Class 4 - Loss of human life is not expected, and damage will occur only to the dam owner's property in the event of failure of the dam while the reservoir is at the high water line.

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APPENDIX A

DAM SAFETY BRANCH

ASSISTANT STATE ENGINEER
ENGINEERING, TECHNOLOGY, AND INVESTIGATIONS



APPENDIX A
PERSONNEL
DAM SAFETY BRANCH

| <u>TITLE</u> | <u>NAME</u> | <u>AREA OF RESPONSIBILITY</u> |
|-----------------------------------|-----------------|--|
| <u>Denver Office</u> | | |
| Professional Engineer III | Alan Pearson | Principal Engineer, Dam Safety Program |
| Professional Engineer II | Mark Haynes | Design Review/Const. Inspection |
| <u>Resident, Division Offices</u> | | |
| Professional Engineer II | Dennis Miller | Dam Safety Engineer, Division 1 |
| Professional Engineer II | Michael Cola | Dam Safety Engineer, Division 1 |
| Professional Engineer II | James Dubler | Dam Safety Engineer, Division 1 |
| Professional Engineer II | Gregory Hammer | Dam Safety Engineer, Division 1 |
| Professional Engineer II | Michael Graber | Dam Safety Engineer, Division 2 |
| Professional Engineer II | Garrett Jackson | Dam Safety Engineer, Division 2 ¹ |
| Professional Engineer II | Brett Nordby | Dam Safety Engineer, Divs. 3&7 |
| Professional Engineer II | James Norfleet | Dam Safety Engineer, Division 4 |
| Professional Engineer II | John Blair | Dam Safety Engineer, Division 5 |
| Professional Engineer II | Sally Lewis | Dam Safety Engineer, Division 6 ² |

¹ One-half time Field Engineer, one-half time Design Review Engineer

² One-half time Field Engineer, one-half time Asst. Division Engineer



APPENDIX B

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

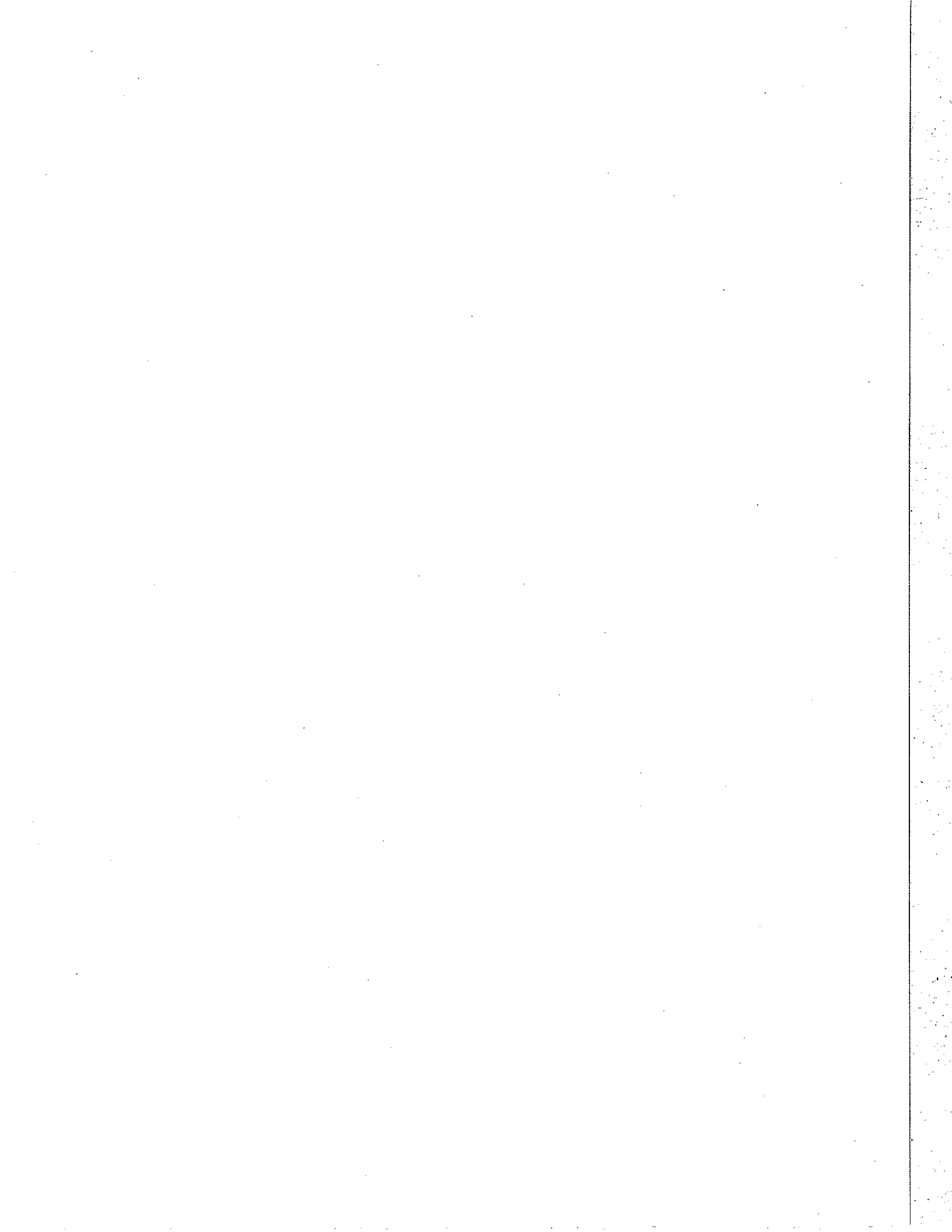
| <u>NAME</u> | <u>DAMID</u> | <u>C-NO(1)</u> | <u>DATE</u> | <u>USE</u> |
|-------------------------|--------------|----------------|-------------|------------|
| CARL SMITH | 400517 | C-473A | 07/09/1999 | IRRIGATION |
| MEADOW CREEK | 510118 | C-1363B | 07/15/1999 | DOMESTIC |
| HALLENBECK NO.1 | 420125 | C-356D | 07/26/1999 | IRRIGATION |
| HUGHES | 380114 | C-335B | 08/20/1999 | RECREATION |
| MCPMAHON NO.2 | 500115 | C-413A | 08/31/1999 | RECREATION |
| GOOSE LAKE | 060121 | C-1639B | 09/07/1999 | DOMESTIC |
| WATSON LAKE | 030334 | C-1090A | 09/20/1999 | RECREATION |
| LONE TREE | 040138 | C-1482B | 09/27/1999 | IRRIGATION |
| HORSE CREEK | 170228 | C-1329B | 10/07/1999 | IRRIGATION |
| CROWN HILL CEMETERY | 070123 | C-1647A | 12/01/1999 | IRRIGATION |
| OURAY DAM | 680113 | C-1361A | 12/16/1999 | POWER |
| TALBOTT IRRIGATION | 020330 | C-696A | 01/06/2000 | IRRIGATION |
| LAKE MEREDITH | 170204 | C-0192B | 01/21/2000 | IRRIGATION |
| MODEL | 190114 | C-0154B | 02/03/2000 | IRRIGATION |
| PANAMA NO. 1 - EAST DAM | 060206 | C-1469B | 02/28/2000 | IRRIGATION |
| FRUITA NO.3 | 730104 | C-0258A | 03/06/2000 | DOMESTIC |
| GLEN EYRIE #3 | 100132 | C-0217A | 03/28/2000 | RECREATION |
| GARDEN OF THE GODS GC | 100131 | C-0950A | 03/28/2000 | RECREATION |
| REYNOLDS | 360107 | C-0329A | 05/03/2000 | RECREATION |
| LAKE MANCHESTER | 060307 | Letter | 06/07/2000 | RECREATION |
| ANDERSON NO.6 | 420104 | C-226A | 06/21/2000 | DOMESTIC |

[1] Filing system for approved plans (C-473A). Letter at end of number denotes revisions/additions.

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

| <u>NAME</u> | <u>DAMID</u> | <u>C-NO(2)</u> | <u>DATE</u> | <u>USE</u> |
|------------------------|--------------|----------------|-------------|---------------|
| FORTUNE RESERVOIR | 02_____ | C-1784 | 11/16/1999 | DOMESTIC |
| STILLWATER | 080444 | C-1785 | 09/07/1999 | RECREATION |
| CLIFTON RAW WATER POND | 72_____ | C-1786 | 06/09/2000 | DOMESTIC |
| SILVER CREEK RES B | 51_____ | C-1787 | 08/04/1999 | RECREATION |
| WADDLE CREEK NO.2 | 440307 | C-1788 | 08/04/1999 | IRRIGATION |
| EXPOSITION PARK | 02_____ | C-1789 | 10/18/1999 | FLOOD CONTROL |
| DROZ CREEK | 110233 | C-1790 | 10/07/1999 | RECREATION |
| BUMGARNER | 360116 | C-1791 | 09/27/1999 | IRRIGATION |
| RUSSELL LAKES SWA | 26_____ | C-1793 | 12/16/1999 | RECREATION |
| PRINCE NO.1 | 060208 | C-1794 | 02/07/2000 | DOMESTIC |
| TROUT CREEK | 11_____ | C-1795 | 04/20/2000 | RECREATION |
| GEIST | 030509 | C-1797 | 06/09/2000 | IRRIGATION |
| TAMARACK SWA B | 640216 | C-1798 | 05/12/2000 | RECREATION |
| ELK POND | 600133 | C-1799 | 05/15/2000 | IRRIGATION |
| SYLVAN | 510125 | C-1801 | 06/14/2000 | IRRIGATION |
| CHAMBERS | 420110 | C-1802 | 06/21/2000 | IRRIGATION |

[2] Filing system for approved plans (C-1784). Assigned to plans for new dams, and alterations and repairs to existing dams that weren't previously approved.



**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.

| | PROBLEMS NOTED: | Conditions Observed | | |
|-------------------------|---|---------------------|------------|------|
| | | GOOD | ACCEPTABLE | POOR |
| UPSTREAM SLOPE | <input type="checkbox"/> (0) NONE <input type="checkbox"/> (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED <input type="checkbox"/> (2) WAVE EROSION-WITH SCARPS <input type="checkbox"/> (3) CRACKS-WITH DISPLACEMENT <input type="checkbox"/> (4) SINKHOLE <input type="checkbox"/> (5) APPEARS TOO STEEP <input type="checkbox"/> (6) DEPRESSIONS OR BULGES <input type="checkbox"/> (7) SLIDES <input type="checkbox"/> (8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED <input type="checkbox"/> (9) OTHER _____ | | | |
| CREST | <input type="checkbox"/> (10) NONE <input type="checkbox"/> (11) RUTS OR PUDDLES <input type="checkbox"/> (12) EROSION <input type="checkbox"/> (13) CRACKS - WITH DISPLACEMENT <input type="checkbox"/> (14) SINKHOLES <input type="checkbox"/> (15) NOT WIDE ENOUGH <input type="checkbox"/> (16) LOW AREA <input type="checkbox"/> (17) MISALIGNMENT <input type="checkbox"/> (18) IMPROPER SURFACE DRAINAGE <input type="checkbox"/> (19) OTHER _____ | | | |
| DOWNSTREAM SLOPE | <input type="checkbox"/> (20) NONE <input type="checkbox"/> (21) LIVESTOCK DAMAGE <input type="checkbox"/> (22) EROSION OR GULLIES <input type="checkbox"/> (23) CRACKS - WITH DISPLACEMENT <input type="checkbox"/> (24) SINKHOLE <input type="checkbox"/> (25) APPEARS TOO STEEP <input type="checkbox"/> (26) DEPRESSION OR BULGES <input type="checkbox"/> (27) SLIDE <input type="checkbox"/> (28) SOFT AREAS <input type="checkbox"/> (29) OTHER _____ | | | |
| SEEPAGE | <input type="checkbox"/> (30) NONE <input type="checkbox"/> (31) SATURATED EMBANKMENT AREA <input type="checkbox"/> (32) SEEPAGE EXITS ON EMBANKMENT <input type="checkbox"/> (33) SEEPAGE EXITS AT POINT SOURCE <input type="checkbox"/> (34) SEEPAGE AREA AT TOE <input type="checkbox"/> (35) FLOW ADJACENT TO OUTLET <input type="checkbox"/> (36) SEEPAGE INCREASED/MUDDY DRAIN OUTFALLS SEEN ___ No ___ Yes <input type="checkbox"/> (37) FLOW INCREASED/MUDDY <input type="checkbox"/> (38) DRAIN DRY/OBSTRUCTED <input type="checkbox"/> (39) OTHER _____ | | | |
| OUTLET | <input type="checkbox"/> (40) NONE <input type="checkbox"/> (41) NO OUTLET FOUND <input type="checkbox"/> (42) POOR OPERATING ACCESS <input type="checkbox"/> (43) INOPERABLE <input type="checkbox"/> (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED <input type="checkbox"/> (45) OUTLET NOT OPERATED DURING INSPECTION INTERIOR INSPECTED <input type="checkbox"/> (120) NO <input type="checkbox"/> (121) YES <input type="checkbox"/> (46) CONDUIT DETERIORATED OR COLLAPSED <input type="checkbox"/> (47) JOINTS DISPLACED <input type="checkbox"/> (48) VALVE LEAKAGE <input type="checkbox"/> (49) OTHER _____ | | | |
| SPILLWAY | <input type="checkbox"/> (50) NONE <input type="checkbox"/> (51) NO EMERGENCY SPILLWAY FOUND <input type="checkbox"/> (52) EROSION-WITH BACKCUTTING <input type="checkbox"/> (53) CRACK - WITH DISPLACEMENT <input type="checkbox"/> (54) APPEARS TO BE STRUCTURALLY INADEQUATE <input type="checkbox"/> (55) APPEARS TOO SMALL <input type="checkbox"/> (56) INADEQUATE FREEBOARD <input type="checkbox"/> (57) FLOW OBSTRUCTED <input type="checkbox"/> (58) CONCRETE DETERIORATED/UNDERMINED <input type="checkbox"/> (59) OTHER _____ | | | |
| MAINTENANCE | <input type="checkbox"/> (60) NONE <input type="checkbox"/> (61) ACCESS ROAD NEEDS MAINTENANCE <input type="checkbox"/> (62) CATTLE DAMAGE <input type="checkbox"/> (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (66) DETERIORATED CONCRETE-FACING, OUTLET, SPILLWAY <input type="checkbox"/> (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE <input type="checkbox"/> (68) OTHER _____ | | | |

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 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 LD. _____ 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 | | |

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

| | | | | | |
|---|---|--|--|--|--|
| MONITORING | EXISTING INSTRUMENTATION FOUND <input type="checkbox"/> (110) NONE <input type="checkbox"/> (111) GAGE ROD <input type="checkbox"/> (112) PIEZOMETERS <input type="checkbox"/> (113) SEEPAGE WEIRS/FLUMES | | | | |
| | <input type="checkbox"/> (114) SURVEY MONUMENTS <input type="checkbox"/> (115) OTHER _____ | | | | |
| MONITORING OF INSTRUMENTATION: <input type="checkbox"/> (116) NO <input type="checkbox"/> (117) YES PERIODIC INSPECTIONS BY: <input type="checkbox"/> (118) OWNER <input type="checkbox"/> (119) ENGINEER | | | | | |
| Comments: _____ | | | | | |

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

| | | | | | |
|--|--|--|--|--|--|
| OVERALL CONDITIONS | REMARKS: _____ | | | | |
| | Based on this Safety Inspection and recent file review, the overall condition is determined to be: | | | | |
| <input type="checkbox"/> 71 SATISFACTORY <input type="checkbox"/> 72 CONDITIONALLY SATISFACTORY <input type="checkbox"/> 73 UNSATISFACTORY | | | | | |

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

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.

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

- | | | |
|---|--------------------------|---------------------------------------|
| <input type="checkbox"/> (101) FULL STORAGE | | |
| <input type="checkbox"/> (102) CONDITIONAL FULL STORAGE | RESTRICTED LEVEL | _____ FT. BELOW DAMS CREST |
| <input type="checkbox"/> (103) RECOMMENDED RESTRICTION | OFFICIAL ORDER TO FOLLOW | _____ 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 _____ Owner's Signature _____ DATE: ____/____/____

INSPECTED BY _____ OWNER/OWNER'S REPRESENTATIVE _____

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 E

PROPOSAL FOR EVALUATING EXTREME PRECIPITATION FOR THE MOUNTAINOUS AREAS OF COLORADO

INTRODUCTION

The state engineer's Regulations for Dam Safety and Dam Construction require that spillways for dams be adequate to handle floods based upon Probable Maximum Precipitation (PMP). PMP is the theoretically greatest depth of precipitation for a given duration, that is physically possible over a drainage basin at any specific time of year. This is essentially a no risk standard that is in accord with the national standards for dam safety, and Colorado case law, where failure of a dam could be catastrophic to the public health and welfare.

PROBLEM

The sources of extreme rainfall (PMP)¹ data for the mountainous areas of Colorado are presently the National Weather Service.² Recent studies by the US Geological Survey (Jarrett-Costa), reveal a difference in quantity between the level of flooding predicted by the weather service publications, and runoff observations for areas above 7500 feet in Colorado. Also, studies presently being done (December 1993) by the Denver Water Board for their Williams Fork Dam appear to support that the extreme rainfall for this basin is significantly less than predicted by the weather service. Another study, of the Grizzly Creek watershed near Aspen (1992), provided a conservative reduction of about 20 % in the PMP in relation to the weather service.

PROPOSAL

Because of these apparent differences, and the significant cost associated with designing/constructing spillways to handle floods caused by extreme precipitation (EP), the state engineer is proposing that the Colorado Water Conservation Board fund a study of the extreme precipitation problem in the mountainous areas of Colorado.

| | | |
|------------------------------------|--------------------------------|--------------------|
| # of dams affected. | 81 Class I, 69 Class II | Total = 150 |
| # of owners affected. | 81 | |
| Volume of storage affected. | 3,379,000 Acre Feet | |

According to a thesis by David Chagnon, Colorado State University, Department of Atmospheric Science (1986), the total economic effect of estimating EP magnitude ranges from \$10 - \$16 Million per inch of change in rainfall, for about 150 dams in the area affected by HMR 55A. (1996 costs at 3% inflation for 10 years are \$13.5 - \$22 Million per inch of change in rainfall.) A 20% reduction in estimates of about 3 inches (conservative analysis) could result in a total savings of \$40 - \$60 million dollars (1996 dollars).

¹Hydrometeorological Reports No. 55A (June 1988) for areas east of the continental divide; and No. 49 (1984) for areas west of the divide.

²US Department of Commerce, National Oceanic and Atmosphere Administration (NOAA)

PLAN

This proposal was developed by a volunteer committee of meteorologists, hydrologists, and engineers from universities, consulting firms, dam owners, and state and federal agencies. The proposal contains the following components, which will be executed in three phases:

| | | |
|-----------|----|--|
| Phase I | 1. | Data collection (Extreme precipitation data/studies). |
| | 2. | Development of EP Database (Verification) |
| | 3. | Modeling Workshops (Forum for professionals in field to reach consensus on which technology would be applicable for predicting an EP atmosphere in the mountains of Colorado.) |
| Phase II | 4. | Research/Development of "Model/s" for use. |
| Phase III | 5. | Creation of data for isohyetal maps and depth-duration data of EP. Correlation of data with hydrologic records (including paleo-hydrologic.). |
| | 6. | Peer review and endorsement by other agencies. |
| | 7. | Documentation, development of the procedures for use by practitioners. |

Phase I is expected to be accomplished in about one-years time. The State Climatologist's Office (SCO) will do the inventory, and develop the EP database. The SCO will also organize and conduct a workshop on modeling of EP at Colorado State University. Additional workshops may be organized for other components. The estimated cost of these Phase I components are \$50,000 - \$75,000 for the inventory, and \$20,000 - \$25,000 for the workshops (primarily for reimbursement of travel expenses of participants). Total cost estimate is \$70,000 - \$100,000.

The research/development component of Phase II is necessary to understand the physical mechanisms of extreme precipitation with elevation, and to develop a modeling program for analyzing/defining extreme precipitation. (The scope of this component is expected to be defined by the workshops.) The time period could be from 3 to 5 years as presently estimated. The cost shall also be defined by the workshops. After the EP analyses and modeling program are developed, the EP data will be produced and correlated with historic records for verification during Phase III. The generated EP data can then be used to develop (after peer review) procedures for use by practitioners. Geographical Information Systems (GIS) technology is available to do this. The time period for this is estimated to be 1 - 2 years. The cost will be defined by the scope of the project and requests for proposals from the industry.

Total estimated time for completion of all phases is 5 to 8 years. The benefits expected from this proposal are:

Significant reduced costs for the design of new dams, and for upgrading spillways at existing dams, to the standards contained in the regulations.

Increased conservation pools in reservoirs.

Increased head available for power generation.

APPENDIX F

Restriction List

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 1

| DAMID | A | DAM NAME | RESTRICTED RESERVOIR LEVEL | REASON FOR RESTRICTION | GAGE HGT | ACT DATE | ACT TYPE | VOLUME LOST |
|--------|---|-------------------------------|----------------------------|--|----------|------------|----------|-------------|
| 010104 | 3 | ADAMS & BUNKER #3 | 6.0 CREST | INADEQUATE FREEBOARD, SEEPAGE | 0.0 | 05/22/1975 | C | 150 |
| 010115 | 2 | BIJOU #2 (DIKE #1) (WEST DAM) | GH 16 FT. | SCARPING OF U/S FACE, NO EMER SPWY, SEEPAGE | 16.0 | 06/01/1993 | C | 1700 |
| 010132 | 3 | J. B. COOKE | 3.0 CREST | FREEBOARD | 0.0 | 05/06/1998 | R | 0 |
| 010138 | 3 | DOVER | 10.0 FT. CREST | POOR CONDITION | 0.0 | 06/27/1996 | I | 60 |
| 010210 | 1 | EMPIRE (EAST EMBANKMENT) | GH 29 FT. | ABSENCE OF SPILLWAY | 29.0 | 03/07/1985 | R | 2779 |
| 010419 | 3 | D.A. LORD NO 4 | 2.0 SPILLWAY | INADEQUATE SPILLWAY | 0.0 | 09/19/1980 | C | 400 |
| 010505 | 2 | PROSPECT | GH 35.5. | QUESTIONABLE SLOPE STABILITY | 35.5 | 08/31/1988 | C | 600 |
| 010506 | 1 | RIVERSIDE | GH 33.55 FT. | PREVENT OVERFILLING OF RESERVOIR | 33.5 | 05/09/1984 | I | 2500 |
| 010611 | 3 | BRAMKAMP | 9.0 CREST | SCARPING/EROSION OF U/S SLOPE | 0.0 | 12/05/1990 | I | 320 |
| 010716 | 3 | HOWARDS LAKE | 3.0 FT. SPILLWAY | EROSION OF DAM AND CREST | 0.0 | 06/03/1998 | I | 50 |
| 020109 | 3 | BRIGHT VIEW #1 | 7.0 CREST | INOP. OUTLET, INADEQUATE FREEBOARD | 0.0 | 09/30/1985 | I | 17 |
| 020113 | 3 | CARLIN | 5.0 CREST | NO SPILLWAY | 0.0 | 07/29/1986 | C | 0 |
| 020115 | 3 | LOWER CHURCH LAKE | 3.0 FT CREST | INADEQUATE SPILLWAY | 0.0 | 06/22/1999 | I | 0 |
| 020119 | 3 | COLE | NO STORAGE | POOR CONDITION | 0.0 | 06/30/1994 | I | 95 |
| 020123 | 2 | EASTLAKE #1 | NO STORAGE | INADEQUATE SPILLWAY, POOR CONDITION | 0.0 | 03/19/1992 | I | 125 |
| 020125 | 2 | EASTLAKE #2 | NO STORAGE | POOR CONDITION | 0.0 | 03/19/1992 | I | 198 |
| 020314 | 3 | NORTH STAR | 3.0 CREST | | 0.0 | 10/17/1991 | I | 30 |
| 020315 | 2 | OHIO LAKE | 5.0 CREST | EROSION ON U/S SLPE, RDNT ACTIVITY, LCK MAINTNWNCE | 0.0 | 05/14/1984 | I | 0 |
| 020322 | 2 | SIGNAL #1 | 5.0 CREST | CONCENTRATD SFG AREAS&QUESTIONBLE COND OF OUTLET | 0.0 | 06/21/1993 | R | 60 |
| 020327 | 2 | RANKIN RESERVOIR | NO STORAGE | POOR CONDITION | 0.0 | 07/12/1995 | I | 44 |
| 020330 | 3 | TALBOT | 5.0 FT. CREST | NO SPILLWAY | 0.0 | 06/05/1997 | I | 0 |
| 020333 | 3 | THOMPSON | 5.0 CREST | INADEQUATE FREEBOARD, GENERALLY POOR CONDITION | 0.0 | 10/07/1987 | R | 30 |
| 020411 | 2 | NISSEN NO.2 | 1.75 SPILLWAY | LACK OF FREEBOARD | 0.0 | 09/11/1995 | I | 50 |
| 020615 | 3 | HAVANA STREET DAM | NO STORAGE | NO SPILLWAY | 0.0 | 06/17/1987 | C | 0 |
| 020634 | 3 | VOGEL POND | 3.0 FT. CREST | NO SPILLWAY | 0.0 | 11/04/1996 | I | 0 |
| 030107 | 1 | BLACK HOLLOW DAM | 4.2 FT. SPILLWAY | INADEQUATE SPILLWAY | 31.0 | 10/22/1997 | I | 999 |
| 030108 | 3 | BOX ELDER #2 | 3.0 FT. SPILLWAY | EXCESSIVE SEEPAGE | 6.5 | 08/08/1989 | I | 49 |
| 030122 | 2 | CURTIS LAKE | GH 10 FT. | CREST, SLOPE, EXT. SEEP. AREA BELOW D/S TOE | 10.0 | 07/02/1985 | I | 397 |
| 030128 | 3 | DRY CREEK | GH 11.5 FT. | OUTLET DETERIORATION, SEEPAGE, INAD SW | 11.5 | 01/17/1996 | R | 150 |
| 030131 | 1 | ELDER | 2.0 FT. SPILLWAY | SINKHOLES | 0.0 | 04/26/1999 | I | 500 |
| 030138 | 2 | GRAY NO.3 | NO STORAGE | SINKHOLE OVER OUTLET | 0.0 | 05/27/1997 | I | 100 |
| 030214 | 3 | LAW, JOHN | 3.0 CREST | INADEQUATE SPILLWAY AND FREEBOARD | 11.0 | 06/22/1987 | C | 45 |
| 030220 | 3 | MATTINGLY DAM | 2.0 FT. SPILLWAY | EROSION/3-5 FT. SCARP ON U/S FACE | 0.0 | 10/23/1997 | I | 99 |
| 030225 | 3 | MOUNTAIN SUPPLY NO.1 | 10 FT. CREST | POOR CONDITION | 5.0 | 11/05/1997 | I | 500 |
| 030226 | 3 | MOUNTAIN SUPPLY NO.2 | 10 FT. CREST | POOR CONDITION | 5.0 | 11/05/1997 | I | 300 |
| 030227 | 3 | MOUNTAIN SUPPLY #6 | 3.0 CREST | NO SPILLWAY | 0.0 | 08/22/1994 | I | 120 |
| 030229 | 3 | MOUNTAIN SUPPLY #8 | NO STORAGE | POOR CONDITION | 0.0 | 10/03/1978 | I | 643 |

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 1

| ID | Location | Height | Condition | Date | Count |
|--------|-----------------------|--|--|--------------------|-------|
| 030236 | 2 NORTH Poudre # 1 | 7.0 CREST | SEEP. @ HIGHER STGE. LEVELS/COND. OF UP SLOPE | 9.0 10/17/1988 R | 365 |
| 030301 | 2 NORTH Poudre # 4 | GH 17 FT. | POOR U/S FACE, GENERAL CONDITION | 17.0 04/17/1984 R | 562 |
| 030509 | 3 GELST | 5.0 CREST | INADEQUATE SPILLWAY | 6.7 06/18/1998 C | 58 |
| 030512 | 3 RIST CANYON | 3.0 CREST | SEEPAGE, INADEQUATE SPILLWAY | 0.0 04/19/1983 I | 33 |
| 040123 | 2 FAIRPORT | 6.0 SPILLWAY | POOR CONDITION | 8.0 06/22/1987 R | 30 |
| 040208 | 1 RIST-BENSON | | LEAKAGE/RODENT HOLE | 9.7 08/02/1999 I | 300 |
| 040209 | 2 GEORGE RIST | | DILAPIDATED CONDITION, NO SPILLWAY | 6.5 06/07/1995 R | 300 |
| 040211 | 2 RYAN GULCH | | INADEQUATE SPILLWAY, LEAKAGE | 27.6 02/12/1997 R | 40 |
| 040213 | 2 SOUTH SIDE | | DAM UNSAFE FOR ORIG. STOR. AMT. | 8.0 07/07/1978 I | 105 |
| 040237 | 3 WESTERDOLL | 8.0 CREST | POOR CONDITION | 0.0 03/30/1992 I | 9 |
| 045234 | 3 IDE AND STARBIRD #1 | 8.5 CREST | POOR MN, ERODED U/S FACE, QUES. SPILLWAY | 0.0 07/03/1985 I | 0 |
| 050101 | 2 AKERS & TARR | 3.0 CREST | SLIDE ON D/S SLOPE, SPGE. IN AREA OF ABAND OTIL | 0.0 03/23/1989 R | 34 |
| 050124 | 1 FOOTHILLS | 7.0 CREST OCT. 1 - APRIL 1 | SEEPAGE | 41.0 05/20/1986 I | 450 |
| 050132 | 3 HIGHLAND | GH 41 FT. | NO SPILLWAY | 0.0 11/26/1990 R | 0 |
| | | 3.0 BELOW TOP OF CONCRETE WALL AT OUTLET | | | |
| 050206 | 3 KNOTH | NO STORAGE | NEVER COMPLETED DAM | 0.0 12/24/1985 I | 204 |
| 050212 | 3 LITTLE GEM | 10.0 CREST | EROSION ON U/S SLOPE & CRST.TREES ON U/S SLOPE | 0.0 10/11/1985 I | 60 |
| 050230 | 2 OLIGARCHY NO.1 | | RODENT HOLES | 26.0 05/20/1999 I | 500 |
| 050301 | 3 STEELE BROTHERS #1 | 4.0 SPILLWAY | SAT. EMBKMT.; INOP. O'S.; INAD. FED.; SPWY. REPAIR | 0.0 12/01/1987 I | 34 |
| 050302 | 3 STEELE BROTHERS #2 | 3.0 SPILLWAY | TOTAL REHABILITATION REQUIRED | 0.0 11/23/1987 I | 14 |
| 050304 | 3 SWEDE | 5.0 CREST | EMBANKMENT SEEPAGE & INADEQUATE FREEBOARD | 0.0 11/14/1986 I | 75 |
| 050308 | 2 UNION | GH 28 FT. | EMERG. SPWY NOT BUILT TO PLAN | 28.0 12/06/1977 I | 0 |
| 060115 | 2 ERIE | 3.0 CREST | INSUFFICIENT FREEBOARD | 12.0 06/02/1986 I | 29 |
| 060121 | 2 GOOSE LAKE | 4.0 SPILLWAY | EXCESS SEEPAGE | 22.0 09/18/1995 I | 200 |
| 060122 | 4 GREEN LAKE #1 | 3.0 CREST | SEEPAGE, NO SPILLWAY | 0.0 10/12/1984 I | 30 |
| 060124 | 4 GREEN LAKE #3 | 3.0 CREST | LEAKS, INADEQUATE SPILLWAY FREEBOARD | 0.0 10/08/1984 I | 60 |
| 060134 | 2 LOUISVILLE #1 | GH 92 FT. (10/1 - 4/30), GH 94 FT. | EXCESSIVE SEEPAGE | 92.0 06/28/1985 I | 32 |
| 060202 | 3 MCKAY LAKE | GH 11 FT. | INAD. FREEBOARD, SEEPAGE | 11.0 09/11/1995 I | 90 |
| 060204 | 3 MESA | NO STORAGE | POOR COND | 0.0 06/28/2000 I | 100 |
| 060208 | 3 PRINCE NO.1 | 7.25 CREST | LEAKAGE | 4.0 07/07/1994 I | 32 |
| 060212 | 3 SECTION 19 | 4.0 CREST | NO SPILLWAY | 0.0 07/24/1984 I | 10 |
| 060306 | 3 VARSITY POND | 1 FT. SPILLWAY | SEEPAGE/SPILLWAY | 0.0 08/31/1999 I | 1 |
| 060314 | 3 HODGSON-HARRIS | 6.0 CREST | POOR CONDITION | 0.0 11/14/1995 I | 60 |
| 070111 | 1 IDAHO SPRINGS | 9.0 CREST | SEEPAGE, SETTLEMENT & REPAIRS REQD. ON SPWY. | 0.0 07/23/1996 R | 69 |
| 070113 | 3 LOWER CHINNS | | SINKHOLES | 110.0 11/24/1999 I | 60 |
| 070126 | 2 DEWEY #1 | 3.0 CREST (NW) | POOR CONDITION | 0.0 11/19/1990 I | 15 |
| 070201 | 1 KALCEVIC | 11.0 CREST | ERODED UPSTREAM SLOPE | 0.0 02/10/1983 I | 43 |
| 070202 | 3 KELLY | 3.0 CREST | NO SPILLWAY, | 0.0 12/05/1986 I | 30 |
| 070209 | 1 LEVDEN | GH 24 FT./NO REFILL AFTER RELEASE FOR IRR. | INADEQUATE SPILLWAY, LOW AREAS IN CREST | 24.0 05/04/1998 R | 750 |

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

| FOR DIVISION 1 | DAM NAME | RESTRICTION | DATE | TYPE | COUNT |
|----------------|---------------------|---------------------------------------|------------|------|-------|
| 075309 | EAST | 1.0 FT. SPILLWAY | 06/08/1999 | I | 26 |
| 075311 | SMITH | 1.0 SPILLWAY | 01/26/2000 | R | 100 |
| 080101 | ALLIS | 15.0 CREST | 08/25/1992 | R | 50 |
| 080105 | BAIRD #1 | 7.0 CREST | 01/08/1990 | I | 25 |
| 080218 | LAMBERT | 8.0 CREST | 07/09/1984 | I | 50 |
| 080306 | WAKEMAN | NO STORAGE | 10/17/1994 | I | 110 |
| 080321 | QUICK | NO STORAGE | 10/22/1987 | I | 64 |
| 080327 | SKBEL DAM | 2.0 FT. SPILLWAY | 04/02/1997 | R | 10 |
| 080422 | RAINBOW FALLS #5 | 9.0 CREST | 09/11/1985 | I | 25 |
| 080424 | GERLITS | NO STORAGE | 09/11/1985 | I | 25 |
| 090104 | BERGEN EAST | 10.0 CREST | 11/13/1984 | I | 10 |
| 090115 | HARRIMAN | GH 19 FT. | 11/23/1987 | C | 400 |
| 090138 | HAYSTACK #1 | NO STORAGE | 11/12/1992 | R | 300 |
| 090204 | WILLOW SPRINGS NO.1 | 2.0 SPILLWAY | 05/08/1987 | I | 3 |
| 095223 | BEERS SISTERS | 5.0 CREST | 05/06/1996 | I | 16 |
| 230102 | ANTERO | GH 18 FT. | 01/08/1999 | I | 0 |
| 230308 | MOUNTAIN | 4.0 CREST | 02/04/1986 | R | 5100 |
| 230310 | STOCKING POND | NO STORAGE | 11/06/1985 | I | 3 |
| 230311 | SUN | 5.0 CREST | 06/13/1988 | I | 10 |
| 230312 | WIND | 5.5 CREST | 12/31/1984 | R | 6 |
| 480101 | JOHNSON | 4.0 CREST(3.0 CREST IRR. SEASON) | 09/20/1985 | C | 3 |
| 640104 | JULESBURG | GH 24 FT. FOR 90 DAYS, THEN GH 23 FT. | 07/18/1994 | C | 68 |
| 640108 | PREWITT | GH 26.5 FT. | 05/02/1995 | R | 6964 |
| 650121 | DUCK | 4.0 SPILLWAY | 08/23/1990 | I | 2531 |
| 650123 | HANSHAW | 5.0 CREST | 03/23/1987 | I | 15 |
| | | | 07/07/1987 | I | 20 |

VOLUME OF STORAGE LOST DUE TO RESTRICTION FOR DIVISION 1 = 33803 AF TOTAL NUMBER OF DAMS AFFECTED = 100 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
 LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 2

| DAVID | A | DAM NAME | RESTRICTED | REASON FOR RESTRICTION | GAGE | ACT | VOLUME |
|--------|---|--------------------------------|-------------------------|--|-------|--------------|--------|
| Z | | | RESERVOIR LEVEL | | HGT | TYPE | LOST |
| 100123 | 3 | A. MCCRAY DAM | 5.0 FT SPILLWAY | INSTABILITY | 0.0 | 04/13/1998 I | 10 |
| 100131 | 3 | GARDEN OF THE GODS GOLF COURSE | 3.0 CREST | NO SPILLWAY | 0.0 | 05/31/1988 I | 0 |
| 100205 | 3 | KEETON | 10.0 FT. SPILLWAY | EROSION OF SPILLWAY, LEAKAGE, PIPING | 0.0 | 08/08/1997 I | 10 |
| 100214 | 2 | MONUMENT LAKE | 3.0 SPILLWAY | UNSAT. SPILLWAY CONDITION | 0.0 | 04/23/1985 I | 150 |
| 100215 | N | MODERN WOODMEN OF AMER. | NO STORAGE | INADEQUATE SPILLWAY, POOR REPAIR | 0.0 | 08/12/1983 R | 85 |
| 100235 | 2 | PROSPECT LAKE | 3.5 CREST | NO SPWY., OILT OPERABILITY QUESTIONABLE | 0.0 | 05/31/1988 I | 0 |
| 100309 | 3 | VALLEY NO. 1 | 15.0 CREST | INOPERABLE OUTLET & BLOCKED SPILLWAY | 0.0 | 12/27/1984 I | 50 |
| 100311 | 1 | WOODMOOR LAKE | 5 FT. SPILLWAY | HYDROLOGIC INADEQUACY | ***.* | 05/28/1998 I | 200 |
| 100402 | 2 | VALLEY RESERVOIR NO. 2 | NO STORAGE | INOPERABLE OUTLET, POOR CONDITION | 0.0 | 07/14/1999 C | 185 |
| 100440 | 2 | TELLER | 10 FT. SPILLWAY | LONGITUDINAL CRACKS ON CREST | 0.0 | 11/22/1999 I | 1300 |
| 110106 | 3 | EVANS GULCH | 3.0 CREST | INSUFFICIENT FREEBOARD | 0.0 | 02/02/1985 R | 2 |
| 120136 | 3 | PARK CENTER L & W #2 | 8.8 CREST | SLIDE ON DOWNSTREAM SLOPE | 0.0 | 01/04/1989 R | 11 |
| 120202 | 3 | PARK CENTER L & W #10 | GH 7 FT. | EXTENSIVE CRACKING ON THE CREST | 7.0 | 10/02/1974 I | 48 |
| 120218 | 2 | VICTOR #2 | 8.0 CREST | EXTENSIVE CRACKING ALONG EMBANKMENT | 23.0 | 06/11/1984 I | 17 |
| 150116 | 3 | OCCHIATO NO.1 | 10 FEET CREST | SLIDE | 0.0 | 09/16/1999 I | 3 |
| 160108 | 1 | CUCHARAS #5 | GH 100 FT. | POOR OVERALL CON. EMBKMT. HISTY. MVMNT. | 100.0 | 07/21/1988 R | 33000 |
| 160112 | 1 | HORSESHOE LAKE | 5.0 FT. SPILLWAY | EXTENSIVE LEAKAGE, PIPING AT OUTLET | 0.0 | 02/17/1998 R | 1000 |
| 160135 | 3 | CLARK #1 | 8.0 CREST | ERODED UPSTREAM SLOPE | 0.0 | 02/16/1994 R | 80 |
| 160218 | 1 | MARTIN LAKE | 5.0 CREST | NO SPILLWAY | 0.0 | 02/18/1983 I | 1200 |
| 170118 | 3 | CUDAHY #1 | 5.0 FT. BELOW DAM CREST | INADEQUATE FREEBOARD AND INOPERABLE OUTLET | 0.0 | 07/15/1985 I | 900 |
| 170217 | 3 | SWINK #1 | 5.0 CREST | IN DISREPAIR, ABANDONED | 0.0 | 04/24/1986 I | 500 |
| 170218 | 3 | SWINK #2 | 5.0 CREST | IN DISREPAIR, ABANDONED | 0.0 | 04/24/1986 I | 600 |
| 170219 | 3 | SWINK #5 | 5.0 CREST | IN DISREPAIR, ABANDONED | 0.0 | 04/24/1986 I | 750 |
| 170220 | 3 | SWINK #6 | 5.0 CREST | IN DISREPAIR, ABANDONED | 0.0 | 04/24/1986 I | 650 |
| 170222 | 3 | TIMPAS #3 | 10.0 CREST | IN DISREPAIR, ABANDONED | 0.0 | 04/21/1986 I | 500 |
| 180206 | 2 | APISHIPA DAM | 22.0 CREST | SPILLWAY, OUTLET SILTED IN | 0.0 | 02/18/1994 I | 260 |
| 180207 | 3 | SEVEN LAKES | 7.0 CREST | DILAPIDATED CONDITION OF DAM | 0.0 | 05/06/1987 I | 1200 |
| 190114 | 3 | MODEL | 3.0 FT SPILLWAY | POOR COND | 0.0 | 06/28/2000 I | 1000 |
| 670218 | 2 | NEE-NOSHE | | SAND BOILS IN OUTLET CHANNEL | 23.5 | 06/22/1999 R | 6392 |
| 670236 | 1 | TWO BUTTES | GH 20 FT. | HYDRAULICALLY INADEQUATE SPILLWAY | 20.0 | 01/24/1983 I | 31465 |

VOLUME OF STORAGE LOST DUE TO RESTRICTION FOR DIVISION 2 = 81568 AF TOTAL NUMBER OF DAMS AFFECTED = 30 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 3

| DAMID | A | DAM NAME | RESTRICTED RESERVOIR LEVEL | REASON FOR RESTRICTION | GAGE HGT | ACTDATE | ACT TYPE | VOLUME LOST |
|--------|---|-----------------|-------------------------------|---------------------------------------|-------------|------------|-------------|----------------|
| 200110 | 1 | CONTINENTAL DAM | GH 64.5 | LEAKAGE | 64.5 | 08/01/1995 | R | 7679 |
| 200221 | 3 | WEE RUBY | 5.0 CREST | CORRODED OUTLET, INADEQUATE FREEBOARD | 0.0 | 01/18/1991 | I | 60 |
| 210102 | 1 | TERRACE | 7.0 SPILLWAY | DETERIORATED SPILLWAY | 117.0 | 07/18/1984 | I | 2000 |

VOLUME OF STORAGE LOST DUE TO RESTRICTION FOR DIVISION 3 = 9739 AF TOTAL NUMBER OF DAMS AFFECTED = 3 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
 LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 4

| DAMID | A | DAM NAME | RESTRICTED RESERVOIR LEVEL | REASON FOR RESTRICTION | GAGE ACTDATE | ACT TYPE | VOLUME LOST |
|--------|---|-----------------------|--|--|-----------------|----------|-------------|
| 400103 | 3 | ARCH SLOUGH | DAM WAS ABANDONED, BUT CAN STILL HOLD WATER | POOR CONDITION | 0.0 12/12/1985 | I | 66 |
| 400112 | 2 | BIG BATTLEMENT | GH 8 FT. | SINKHOLES ON EMBANKMENT | 8.0 09/24/1991 | R | 750 |
| 400135 | 1 | CEDAR MESA | 10.0 FT. SPILLWAY | SEEPAGE | 24.5 07/14/1999 | I | 380 |
| 400212 | 3 | CYPHER #1 | 4.0 CREST | INADEQUATE FREEBOARD, OUTLET INOPERABLE | 0.0 10/13/1988 | I | 10 |
| 400306 | 2 | GRANBY #12 | GH 17 FT. | D/S FACE SLIDE DUE TO SEEPAGE | 17.0 10/15/1987 | R | 0 |
| 400307 | 2 | GRANBY #11 | 4.0 SPILLWAY (PROVISIONAL DURING WINTER) | SEEPAGE | 19.0 10/15/1987 | R | 0 |
| 400330 | 3 | KNOX | FULL STORAGE FROM 4/1 TO 8/15 IF MONITORED | EXCESSIVE SEEPAGE AT TOE AND ON EMBANKMENT | 17.0 01/08/1988 | R | 0 |
| 400405 | 3 | LONE STAR #1 | 30.0 CREST | CRACKS ON CREST, UNAPPROVED PLANS, POOR CONSTR | 0.0 07/31/1996 | R | 0 |
| 400413 | 2 | MONUMENT | 10.0 SPILLWAY, FILL/MONITORING PLAN IN PLACE | CRACKS ON DAM AND LEFT ABUTMENT SLIDE | 33.5 04/29/1993 | I | 175 |
| 400522 | 3 | TODD | 10.0 CREST | 6' ELEVATION DIFF ALONG CREST WITH NO SPILLWAY | 0.0 10/19/1984 | I | 112 |
| 400524 | 3 | TRIO | 8.0 SPILLWAY | SLIDE ON DOWNSTREAM SLOPE | 14.0 01/11/1989 | I | 75 |
| 400601 | 3 | HARRY WHITE #2 | 5.0 CREST | POOR OUTLET VALVE, LACK OF FREEBOARD, MAINTENANC | 0.0 08/09/1991 | I | 30 |
| 400619 | 3 | LONE STAR #2 | 10.0 CREST | CONSTRUCTION WITHOUT APPROVED PLANS & SPECS | 0.0 06/02/1988 | C | 0 |
| 400705 | 3 | WEBSTER #1 | NO STORAGE | POORLY CONSTRUCTED | 0.0 05/06/1987 | C | 15 |
| 400707 | 3 | WEBSTER #3 | NO STORAGE | POORLY CONSTRUCTED | 0.0 05/06/1987 | C | 15 |
| 410201 | 3 | COFFEY RESERVOIR | NO STORAGE | GENERAL POOR CONDITION, CONST. WO/APP. PLANS | 0.0 05/06/1987 | C | 15 |
| 410202 | 3 | MOCK #1 | 9.0 CREST (AFTER 60 DAYS FULL) | BUILT WITHOUT APPROVED PLANS & SEEPAGE | 0.0 07/21/1988 | C | 90 |
| 420116 | 2 | FRUITA NO.1 | 20 FT. CREST | SLIDE ON DOWNSTREAM SLOPE | 0.0 04/26/1989 | R | 0 |
| 420119 | 3 | G.H. AND S. #2 | NO STORAGE | NARROW CREST, STEEP SLOPES, POOR OUTLET | 0.0 08/12/1998 | I | 100 |
| 420120 | 3 | GRAND MESA #1 | 3.0 CREST | INADEQUATE FREEBOARD | 0.0 08/26/1992 | R | 29 |
| 420135 | 3 | REEDER | 8.0 CREST | SEEP. ON D/S SURFACE, NUMEROUS LARGE TREES | 0.0 01/27/1988 | R | 48 |
| 590113 | 2 | MERIDIAN LAKE PARK #1 | 2.0 SPILLWAY (PRIN SPWY LOWERED) | SEVERE EROSION OF THE EMERGENCY SPILLWAY | 0.0 08/26/1985 | R | 96 |
| 600118 | 3 | PAXTON | 2.5 SPILLWAY | SEEPAGE | 0.0 06/04/1987 | I | 10 |
| 600126 | 3 | CUSHMAN | 6.0 CREST | OUTLET-INOP. SPWY-INAD. EMB. SEEPS | 0.0 08/08/1988 | R | 100 |
| 600127 | 1 | PRIEST | 3.0 CREST | INSUFFICIENT FREEBOARD | 0.0 07/29/1975 | I | 36 |
| | | | | | 0.0 09/16/1985 | I | 25 |

VOLUME OF STORAGE LOST DUE TO RESTRICTION FOR DIVISION 4 = 2162 AF TOTAL NUMBER OF DAMS AFFECTED = 25 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 5

| DAMID | A | DAM NAME | RESTRICTED RESERVOIR LEVEL | REASON FOR RESTRICTION | GAGE HGT | ACT DATE | ACT TYPE | VOLUME LOST |
|--------|---|--------------------------------------|-------------------------------|---|-------------|-------------|-------------|----------------|
| 370116 | 3 | LOWER G.G. | 4.0 CREST | INADEQ FRBD., STABILITY OF DOWNSTREAM SLOPE | 0.0 | 12/14/1992 | R | 6 |
| 370205 | 3 | FORIER NO.3 | NO STORAGE | ILLEGAL DAM /INADEQUATE SPILLWAY | 0.0 | 11/09/1995 | I | 2 |
| 380207 | 2 | WARREN LAKE NO.3 | NO STORAGE | INADEQUATE SPILLWAY | 0.0 | 11/01/1995 | I | 27 |
| 450101 | 3 | BATTLEMENT NO. 2 | NO STORAGE | INADEQUATE SPILLWAY | 0.0 | 09/18/1995 | I | 23 |
| 450102 | 3 | BATTLEMENT #1 | NO STORAGE | POOR CONDITION OF OUTLET | 0.0 | 10/01/1990 | C | 70 |
| 500126 | 3 | MILK CREEK | 15.0 CREST (AUG 1 THRU MAY 1) | EXCESSIVE LEAKAGE | 0.0 | 05/10/1991 | R | 56 |
| 510104 | 3 | DALE | ORDER TO BREACH BY 01/15/97 | OUTLET DISTRESS, SLOUGHING AT OUTLET | 0.0 | 12/20/1996 | R | 39 |
| 510114 | 2 | LITTLE KING RANCH AKA KING MTN RANCH | 10.0 SPILLWAY | EXCESSIVE SEEPAGE | 41.0 | 03/07/1978 | C | 439 |
| 510125 | 1 | SYLVAN | 14.0 CREST | SLIDE ON DOWNSTREAM SLOPE | 0.0 | 07/08/1998 | R | 650 |
| 510129 | N | ROCK CREEK | NO STORAGE | DAM BREACHED BY OWNER BUT WANTS TO REPAIR | 0.0 | 06/28/1989 | C | 66 |
| 530119 | 3 | KELLY | 5.0 CREST | SPILLWAY EROSION | 0.0 | 09/20/1985 | C | 0 |
| 530125 | 3 | NEWTON GULCH | 20.0 CREST | EXCESSIVE SEEPAGE THROUGH ABUTMENTS | 17.0 | 07/20/1990 | I | 465 |
| 530129 | 3 | STERNER | RELAX 5/1-8/15, 3.0 SPILLWAY | UNCONTROLLED LEAKAGE | 0.0 | 08/02/1995 | R | 71 |
| 530137 | 3 | WINSLOW | NO STORAGE | SEEPAGE, UNAPPROVED PLANS | 0.0 | 07/07/1999 | I | 65 |
| 720117 | 3 | CARPENTER RESERVOIR | NO STORAGE | PIPING HOLE | 0.0 | 08/23/1994 | I | 27 |
| 720126 | 3 | CURRIER NO.2 | 5.0 SPILLWAY | SLIDE ON HILL ABOVE SPILLWAY, BACKCUTTING | 0.0 | 05/24/1995 | I | 100 |
| 720410 | 3 | PALISADE #3 | 5.0 SPILLWAY | UNSTABLE D/S SLOPE & NARROW CREST | 0.0 | 07/05/1990 | I | 9 |

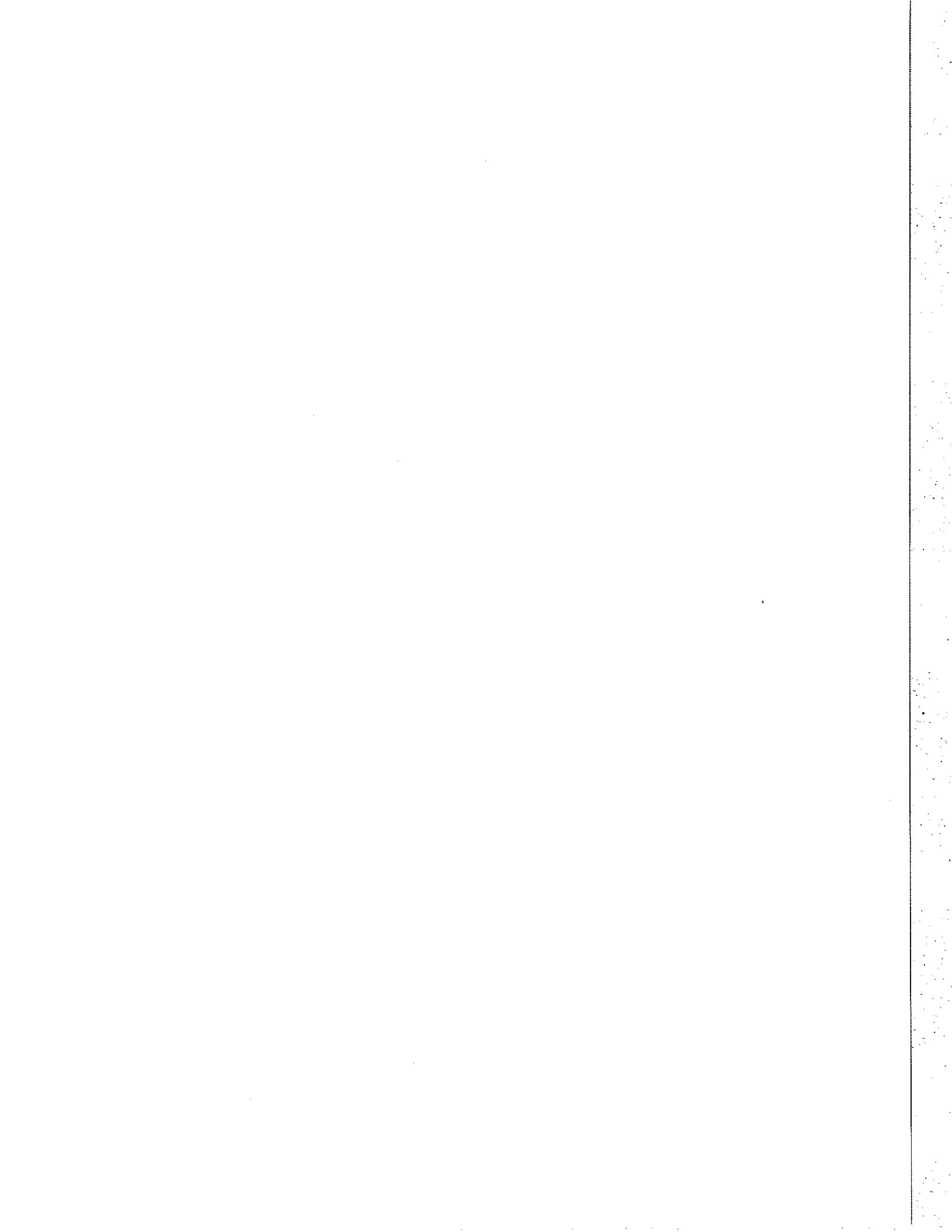
VOLUME OF STORAGE LOST DUE TO RESTRICTION FOR DIVISION 5 = 2115 AF TOTAL NUMBER OF DAMS AFFECTED = 17 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
 LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 6

| DAMID | A | DAM NAME | RESTRICTED RESERVOIR LEVEL | REASON FOR RESTRICTION | GAGE HGT | ACT TYPE | VOLUME LOST |
|--------|---|--------------------|-------------------------------|---------------------------------------|-----------------|-------------|----------------|
| 430205 | 3 | BAXTER DAM | 5.0 FT. SPILLWAY | SEEPAGE, EROSION OF U/S FACE | 0.0 11/13/1997 | I | 30 |
| 430212 | 3 | WILSON #3 | 3.0 SPILLWAY | INOPERABLE OUTLET, INAD SPWY | 3.0 09/30/1989 | I | 10 |
| 440106 | 3 | BISKUP | 5.0 SPILLWAY | DILAPIDATED CONDITION | 0.0 08/19/1987 | C | 55 |
| 440120 | 3 | DRESCHER | 8.0 SPILLWAY | SEEPAGE & INSTABILITY | 8.0 08/01/1988 | R | 159 |
| 440124 | 3 | ELGEN #2 | NO STORAGE | POOR OUTLET CONDITION | 0.0 05/30/1986 | I | 60 |
| 440213 | 3 | FLATTOP | 5.0 FT CREST MAIN DAM | BREACHED, BEAVER DAMS, FREEBOARD | 0.0 08/02/1999 | I | 50 |
| 470210 | 2 | POLE MOUNTAIN | | UPSTREAM SLOPE FAILURE | 25.0 06/20/2000 | R | 100 |
| 570114 | 3 | LAKE EMRICH | 15.0 CREST | SLIDES ON DOWNSTREAM SLOPE | 0.0 08/30/1988 | C | 330 |
| 580118 | 1 | LONG LAKE DAM | NO STORAGE BY MARCH 31, 1996 | SLIDES ON DOWNSTREAM SLOPE | 0.0 02/05/1996 | R | 396 |
| 580304 | 2 | LOWER SPRING CREEK | 5.0 FT SPILLWAY | SEEPAGE, INADEQUATE SPILLWAY, EROSION | 0.0 07/14/1999 | I | 10 |

VOLUME OF STORAGE LOST DUE TO RESTRICTION FOR DIVISION 6 = 1200 AF TOTAL NUMBER OF DAMS AFFECTED = 10 DAMS



STATE OF COLORADO --- DAM SAFETY BRANCH
 LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION 7

| DAMID | A | DAM NAME | RESTRICTED | REASON FOR RESTRICTION | GAGE HGT | ACTDATE | ACT TYPE | VOLUME LOST |
|--------|---|------------------------------|---|-------------------------------|----------|------------|----------|-------------|
| 290103 | 3 | HARRIS BROTHERS & BOONE NO.2 | NO STORAGE | POOR CONDITION | 0.0 | 07/08/1996 | I | 206 |
| 340101 | 2 | BAUER LAKE #1 | 3.0 SPILLWAY | SATURATION HIGH ON EMBANKMENT | 0.0 | 08/27/1984 | R | 144 |
| 340106 | 3 | HURST | NO STORAGE | OUTLET FAILURE | 0.0 | 03/29/1999 | I | 35 |
| 340119 | 3 | J.O. SPENCER | NO STORAGE | INOPERABLE OUTLET | 0.0 | 05/08/2000 | I | 16 |
| 340203 | 1 | SUMMIT | NOT TO EXCEED 1.1' BELOW SPILL FOR > 3 WEEKS | EXCESSIVE SEEPAGE | 23.6 | 06/03/1998 | R | 579 |

VOLUME OF STORAGE LOST DUE TO RESTRICTION FOR DIVISION 7 = 980 AF TOTAL NUMBER OF DAMS AFFECTED = 5 DAMS

