

# STATE OF COLORADO

## OFFICE OF THE STATE ENGINEER

Division of Water Resources  
Department of Natural Resources

1313 Sherman Street, Room 818  
Denver, Colorado 80203  
Phone (303) 866-3581  
FAX (303) 866-3589

[www.water.state.co.us](http://www.water.state.co.us)

January 30, 2004



Bill Owens  
Governor

Greg E. Walcher  
Executive Director

Hal D. Simpson, P.E.  
State Engineer

The Honorable Bill Owens  
Governor, State of Colorado  
State Capitol Building  
Denver, CO 80203

The Honorable John Andrews  
President, Colorado State Senate  
State Capitol Building  
Denver, CO 80203

The Honorable Lola Spradley  
Speaker of the House  
Colorado House of Representatives  
State Capitol Building  
Denver, CO 80203

Dear Governor, President and Speaker:

In accordance with Section 37-87-114.4, C.R.S. (2003 Supp.), I am please to submit this report covering the activities of the State Engineer on dam safety in Colorado for Fiscal Year 2002-2003.

Colorado's Dam Safety Program strives to provide the citizens of Colorado with responsible protection from failures of dams. The program has been strengthened with incorporation of emergency preparedness planning and implementation of the regulations for dam safety and dam construction in the past several years. We continue to improve our program by taking advantage of the research and training provisions of The National Dam Safety Program Act of 1996, as well as the assistance offered by matching grants to the states.

The Dam Safety Program achieved a great number of goals and objectives this past fiscal year in the design review and inspection of dams for the determination of safe water storage levels. Although we experienced a number of incidents at dams this year, including sinkholes due to piping failures, serious seepage, cracking, and slope stability failures, because of our program, these incidents resulted in reduced consequences with no loss of life or significant property damage. The emergency managers were notified of these incidents by the owners in most cases, a result of the emergency preparedness planning requirements of our program. The owners responded with emergency actions to prevent the failures of the dams. Our dam safety personnel also responded in a timely manner to assure appropriate actions were being followed to protect the public safety.

We continue to pursue and are beginning to implement the use of risk-based techniques to help evaluate and prioritize the jurisdictional dams in Colorado in order to more efficiently and effectively use the program resources.

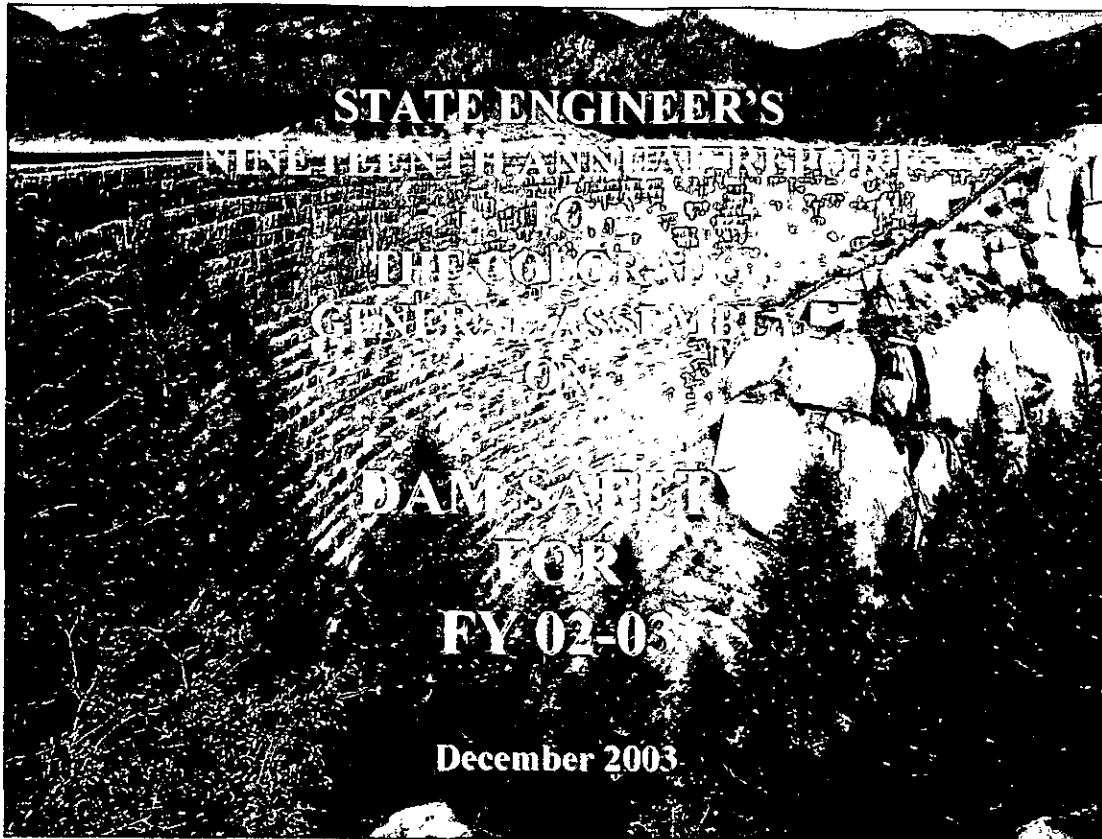
We will continue to work at accomplishing our goals and protecting the public safety in the most efficient matter possible. We appreciate the support that you provide us in this important public safety activity.

Sincerely,

  
Hal D. Simpson, P.E.  
State Engineer

Attachment

cc: Norma Anderson, Senate Majority Leader  
Joan Fitz-Gerald, Senate Minority Leader  
Keith King, House Majority Leader  
Jennifer Veiga, House Minority Leader  
Lewis Entz, Chairman, Senate Agriculture, Natural Resources and Energy Committee (7)  
Diane Hoppe, House Agriculture, Livestock, and Natural Resources Committee (13)  
David T. Owen, Joint Budget Committee (2)  
David Beaujon, State Capitol  
Scott Groscoff, State Capitol  
Hal Simpson, State Engineer  
Greg Walcher, Executive Director, Department of Natural Resources  
Rod Kuharich, Director, CWCB  
Frank McNulty, Executive Director's Office  
Dawn Owens, Executive Director's Office  
Mary Marchun, Executive Director's Office  
Tim Pollard, Executive Director's Office



Prepared by

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



Hal D. Simpson  
State Engineer

Jack G. Byers  
Deputy State Engineer

Douglas D. Boyer  
Chief, Dam Safety Branch



Greg E. Walcher  
Executive Director



Bill Owens  
Governor

**STATE ENGINEER'S  
NINETEENTH ANNUAL REPORT  
TO  
THE COLORADO GENERAL ASSEMBLY  
ON**

**DAM SAFETY  
FOR  
FY 02-03**

**December 2003**

Prepared by

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

Hal D. Simpson  
State Engineer

Jack G. Byers  
Deputy State Engineer

Douglas D. Boyer  
Chief, Dam Safety Branch

Greg E. Walcher  
Executive Director  
Department of Natural Resources

Bill Owens  
Governor

## EXECUTIVE SUMMARY

The Colorado Division of Water Resources' Dam Safety Branch's objective is to prevent property damage and the loss of life, while protecting the loss of water supplies due to the failure of dams in Colorado. The Dam Safety Program includes the enforcement of a comprehensive set of regulations, policies, and procedures for the design, construction, and maintenance of dams; the safe operation of reservoirs; and emergency preparedness planning.

The Dam Safety Program is managed by the State Engineer in accordance with Title 37, Article 87 of C.R.S. (2002 Supp.) and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. (2002 Supp.), as amended. The program is implemented by the State Engineer through the Dam Safety Branch and the Division field offices. The Branch currently consists of a branch chief, dam safety engineers, and design review engineers. Currently, the program oversees a total of about 2,900 dams in Colorado with 1,861 dams of jurisdictional size. Of these, about 1,737 are non-federal dams. Of the non-federal dams, approximately 572, or about one-third of the total non-federal dams in Colorado, are classified as dams that, in the event of a failure, would be expected to cause loss of life and/or significant property damage to a significant portion of the state's population.

For FY 02-03, the Dam Safety Program achieved a great number of goals and objectives in the design review and inspection of dams for the determination of safe water storage levels. Although dam safety incidents were reported again this year, because of our program, these incidents resulted in reduced consequences with no loss of life or significant property damage. This is attributed to the increased awareness and responsibility of the dam owners for their dams - including emergency preparedness planning - and to the enforcement of the regulations, policies, and procedures by our office.

During FY 02-03, the State Engineer's Office approved plans for four new dams and thirty-nine plans for alteration, modification, or enlargement. Twelve separate hydrology studies were also approved for determination of the inflow design flood for spillway design. The estimated cost of construction for the submitted plans was over \$95 million. The increased reservoir storage resulting from the approved new dams and enlargements is approximately 13,500 acre-feet.

During FY 02-03, a total of 573 dam safety inspections and 233 construction inspections were conducted for a total of 806 inspections. In addition, 178 follow-up inspections were performed. At the conclusion of the reporting period, there were 193 dams restricted from full storage due to various structural deficiencies such as significant leakage, cracking and sliding of embankments, and inadequate spillways. Total storage restricted was 144,437 acre-feet. The restrictions provide risk reduction for the public and environment until the problems are corrected. Although many dams were repaired and removed from the restricted list within the last year, a number of dams were also added to the list during the same time period. The change in the restriction from the same time last year resulted in the same number of dams on the restricted list, however, the volume of the restrictions increased approximately 15,000 acre-feet. The increase in the volume of storage restriction can be related, at least in part, due to the increased aging of the dam infrastructure within the state. Approximately half of the dams on the Colorado Division of Water Resources restricted list have been on that list for ten years or longer.

The state has been able to acquire and maintain a solid group of experienced professionals, and has adequate statutes, regulations, policies, and procedures to implement and carry out the program. A recommendation of the recently published "Report Card on Dam Safety in Colorado" by the American Society of Civil Engineers was to "support Colorado's presently successful state dam safety program with increased funding levels."

The Dam Safety Branch continues to use risk-based tools to help evaluate and prioritize the jurisdictional dams in Colorado in order to more efficiently and effectively use program resources.

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## 1.0 INTRODUCTION

### 1.1 Program Mission

The mission of the Dam Safety Program is to prevent property damage and the loss of life, while protecting the loss of water supplies due to the failure of dams in Colorado through the effective and efficient use of available resources. The program includes the enforcement of a comprehensive set of regulations, policies, and procedures for the design, construction, inspection, and maintenance of dams; the safe operation of reservoirs; and emergency preparedness planning. In the event a dam is found to be unsafe, the risk of adverse consequences due to failure of the dam is reduced by restricting the storage in the reservoir to a safe level. The safe reservoir storage levels are determined by the results of engineering analyses, the review and approval of engineered plans for the construction and repair of dams, and regular safety evaluations of existing dams and reservoirs by licensed professional engineers.

The program is managed by the State Engineer in accordance with Title 37, Article 87 of C.R.S. (2002 Supp.) and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. (2002 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.

### 1.2 Report Purpose

This report is submitted in compliance with Section 37-87-114.4 of C.R.S. (2002 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 of C.R.S. (2002 Supp.).

## 2.0 PROGRAM OVERVIEW

### 2.1 Goals and Objectives

The Dam Safety Program, although responsible for the approximately 2,900 dams within the state, concentrates on "jurisdictional" dams and reservoirs as defined in Section 37-87-105 of C.R.S. (2002 Supp.). Jurisdictional dams are dams that are greater than ten feet high as measured at the spillway, impound a reservoir with twenty acres or more in surface area, or 100 acre-feet or more in reservoir capacity at the high water line. Further, dams are classified as to estimated downstream consequences as a result of failure of the dam in the absence of flooding conditions as follows:

Classification	Description
1	Loss of human life is expected in the event of failure of the dam.
2	Significant damage is expected to occur, but no loss of human life is expected.
3	Loss of human life is not expected and damage to structures and public facilities is not expected.
4	No loss of human life is expected and damage will occur only to the dam owner's property.



Identified goals of the program are as follows:

1. In order to protect the public, the Dam Safety Branch shall determine the amount of water that is safe to impound in reservoirs of the state.
2. In order to protect the public from failure of dams, the Dam Safety Branch shall review and recommend approval of plans and specification for the construction, modification, and repairs of dams, in accordance with the Rules and Regulations for Dam Safety and Dam Construction, implemented on September 30, 1988.
3. To reduce the risk of dam failure and adverse consequences and to more efficiently and effectively use the available resources within the program, the Dam Safety Branch shall implement and utilize a risk-based approach to prioritize the jurisdictional dams within the program.
4. 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.
5. In order to improve the technical proficiency of the Branch, the Division of Water Resources shall provide training and professional development of the Branch personnel.
6. In order to improve the Dam Safety Program, 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).

## **2.2 Organization**

The Dam Safety Program is executed by the State Engineer through the Dam Safety Branch and the Division Engineer's offices. The Branch currently consists of a branch chief, dam safety engineers, and design review engineers. The dam safety engineers are responsible for the program in their geographic area. The dam safety review engineers and branch chief are located in Denver. A summary of the Branch organization and personnel is included in Appendix A.

After many years of stability within the branch personnel, FY 02-03 brought about a number of personnel changes. Some of these changes were due to retirements and some due to reorganization within the branch to better utilize the resources.

- John R. Blair was hired as new dam safety engineer in Division 6 after the retirement of Sally Lewis.
- Dennis Miller transferred from Division 1 to Division 7 as the Division 7/3 dam safety engineer after the departure of Brett Nordby.
- Garrett Jackson transferred from Division 2 to Division 5 (Grand Junction) as a Division 4/5 dam safety engineer.

- Douglas Boyer was brought on as the Chief, Dam Safety Branch, through an Intergovernmental Personnel Act (IPA) with the U.S. Bureau of Reclamation after the retirement of Alan Pearson.
- Hired a new dam safety engineer, Bill McCormick, in Division 2 to replace Garrett Jackson who transferred to Division 5. (This hire was completed as of October 27, 2003).

Interagency coordination occurs as necessary. 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 DOW dams. The DOW is making safety inspections of their Class 3 (low hazard) dams.

The Colorado Water Conservation Board (CWCB) makes its construction fund available to assist owners with the repair of their dams. We closely coordinate the review and approval and final acceptance of these dams with the CWCB.

### **2.3 Roles and Responsibilities**

The branch chief has program-wide responsibility for formulating the goals of the program, recommending policies for implementation of the regulations, preparing procedures for carrying out the policies, providing technical guidelines for conduct of the work, communication, training, and coordination. The branch chief directly supervises the Design Review and Construction Inspection Unit activities.

The dam safety engineers' principal duties are to:

1. respond to emergency situations;
2. conduct safety inspections of existing dams;
3. review the adequacy of spillways under the rules;
4. enforce the requirement for emergency planning;
5. assist dam owner in developing their Emergency Preparedness Plans (EPP);
6. provide design review and construction inspection of repairs and alternations when necessary; and
7. investigate complaints on the safety of dams.

Dam safety engineers also investigate the construction of dams in violation of Section 37-87-105 (1) and (4) of C.R.S. (2002 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.

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 of C.R.S. (2002 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, participate in the state's joint review process with the Department of Natural Resources, provide technical assistance to the Division Engineers' offices on dam safety, and perform other related work as assigned.

## **2.4 Summary of Colorado Dams**

Table 1 summarizes the distribution of dams by division, ownership, and hazard class in Colorado. Currently, the program oversees a total of about 2,900 dams within Colorado. Of these, 1,861 are considered jurisdictional dams, of which about 1,737 are non-federal dams. Of the non-federal dams, approximately 572, or about one-third of the total non-federal dams in Colorado, are classified as dams that, in the event of a failure, would be expected to cause loss of life and/or significant property damage.

## **2.5 ASCE Report Card on Dam Safety**

**2.5.1 General** - Recently, the American Society of Civil Engineers (ASCE) spearheaded an effort to evaluate or "grade" the condition of the nations aging infrastructure. This has included buildings, highways, bridges, and dams, among other infrastructure features. In Colorado, this effort has been guided under the Colorado Section of ASCE, Government and Public Affairs Committee (GPAC). Within the GPAC, a Dam Safety Advisory Board was formed in the spring of 2002 to evaluate Colorado's dams. This advisory board consisted of members from federal agencies (U.S. Bureau of Reclamation and Army Corps of Engineers), state agencies (Division of Water Resources and Colorado Water Conservation Board), and representation from private industry.

The full ASCE report card can be viewed at <http://sections.asce.org/colorado/RC/main.htm>.

**2.5.2 Categories and Grading Criteria** - The following general criteria for grading was established by the GPAC for all infrastructure categories:

- (1) condition and performance indices;
- (2) need vs. capacity; and
- (3) funding vs. need.

The Dam Safety Advisory Board reached a consensus on the specific definitions that would be considered for each of these three criteria under the dam safety category. Each criterion was assigned equal weight (33½ percent) to compute the composite grade. The grading criteria are defined as follows:

### **Criterion 1: Condition Index**

The condition index criterion characterizes the *physical condition* of dams in Colorado. Condition index scales are shown on the table below. This scale is based on the Colorado Division of Water Resources categories that are more compatible with our inspection criteria.

### Condition Index Scales

Grade	Condition Description
A or B	Satisfactory: 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.
C	Conditionally Satisfactory: The safety inspection indicates symptoms of structural distress (seepage, evidence of major displacements, etc.) that, if conditions worsen, could lead to failure of the dam. Essential monitoring, inspection, and maintenance must be performed as a requirement for continued full storage.
D	Unsatisfactory: The safety inspection indicates definite signs of hydrologic inadequacy or structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.) that could lead to failure of the dam if operated at full storage.

#### **Criterion 2: Need versus Capacity (Manpower and Assets)**

This criterion, as defined by the advisory board, pertains to the adequacy of the *dam safety programs* that operate in Colorado.

With regard to dam safety programs, the “need” is for adequate dam safety inspections, monitoring, record keeping, and emergency preparedness plans at federal, state, and local levels. The advisory board attempted to define a “grade” for the dam safety programs that considers the technical adequacy of the programs, and their current capacity in regard to manpower and assets such as number of inspectors and support staff, available tools, and possibly other considerations.

#### **Criterion 3: Funding versus Need**

The advisory board chose to define this criterion on the basis of funding needed for *dam rehabilitation* to bring deficient facilities up to current dam safety standards.

**2.5.3 Composite Grades** - Only high hazard, or Class 1, dams were considered in the condition index evaluation. By the Colorado Division of Water Resources, a Class 1 dam is a dam for which loss of human life is expected in the event of failure.

Composite grades were developed by each of the three agencies for high hazard dams under their jurisdiction: (1) Colorado Division of Water Resources (includes state, local governments, private, utilities, and some federal dam owners), (2) Department of the Interior (includes dams owned and operated by U.S. Bureau of Reclamation and U.S. Forest Service), (3) U.S. Army Corps of Engineers dams. The following point scale was assigned to compute the grades: A=4, B=3, C=2, D=1, F=0.

Once composite grades for dams from each agency were developed, a weighted average grade for all dams based on number of dams under each sector in the high hazard (Class 1) classification was computed. The overall composite grade for Colorado dam safety was

computed by weighting the composite grades for each agency according to the ratio of the number of high hazard dams under their jurisdiction to the total number of high hazard dams in the state. An overall composite grade of approximately 2.82 out of a total possible grade of 4.0 was calculated using this method.

#### **2.5.4 Conclusions -** Conclusions of the study include:

1. At the time of the study, there were 192 dams in all hazard categories, and 32 high hazard dams, on the Colorado Division of Water Resources "restricted list" of dams that are not allowed to operate at full reservoir storage capacity. Seventeen of Colorado's high hazard dams were considered unsatisfactory, meaning that the dam safety inspections indicated definite signs of hydrologic inadequacy or structural distress that could lead to failure of these dams if they are operated at full storage capacity. An additional 92 high hazard dams were categorized as conditionally satisfactory, meaning that the safety inspections revealed symptoms of structural distress such as excessive seepage, evidence of major displacements, etc., that could lead to failure of the dam if conditions worsen.
2. The Colorado Division of Water Resources' Dam Safety Program is recognized as one of the best state dam safety programs in the nation. The state has been able to acquire and maintain a solid group of experienced professionals, and has adequate statutes, regulations, policies, and procedures to implement and carry out the program. However, there remains a number of areas where improvements are needed, including the eventual filling of key personnel vacancies within the program, equipment needs, and the strengthening of a number of existing statutes.
3. Approximately half of the dams on the Colorado Division of Water Resources "restricted list" have been on that list for ten years or longer. This is interpreted to reflect the lack of funding to make repairs or upgrades needed to remove the restrictions. Colorado has no state grant programs for these projects. Loans are available for local government and private projects through the Colorado Water Conservation Board, but these loans are underutilized because dam owners are unwilling or unable to take on even these low interest debts. Another possible funding source for bondable entities is through the bond authority of the Colorado Water and Power Development Authority. With the ongoing, nearly unprecedented drought, Colorado's water supply issues have come into sharp focus. Several 2002 drought-related news reports and articles have highlighted the need to repair and rehabilitate existing dams and reservoirs that cannot be filled to capacity because of structural flaws.

#### **2.5.5 Recommendations –** The following are recommendations of the study:

1. Establish a state grant program to facilitate dam rehabilitation and restoration of water storage currently prevented by restrictions.

2. Support additional federal funding for the NRCS small watershed dam rehabilitation program in Colorado.
3. Establish a program to facilitate the local sponsor matching funds for NRCS program dollars to flow to Colorado; possibly a combination of grants and low interest loans. These funds would go, in large part, to sponsors (dam owners) who have the matching funds.
4. Support Colorado's presently successful state dam safety program with increased funding levels.

### **3.0 PROGRAM ACCOMPLISHMENTS**

#### **3.1 General**

The effectiveness of a program can be demonstrated by producing a positive result or accomplishment. For fiscal year 2002-2003, the Dam Safety Program achieved a great number of goals and objectives in the design review and inspection of dams. Although dam safety incidents were reported this year, because of our program, these incidents resulted in reduced consequences with no loss of life or significant property damage. This is attributed to the increased awareness of the dam owners to be responsible for their dams, including emergency preparedness planning, and to the enforcement of the regulations, policies, and procedures by our office.

As is typical, a number of dams experienced serious problems during the period. However, due to the drought conditions that affected the entire state and the subsequent wet spring, many reservoirs that had been dry or substantially lower than in past years resulted in the drying of their associated embankments. The relatively wet spring caused many of these reservoirs to fill quickly. This rapid filling lead to excessive seepage through dams that had experienced drying and cracking of the embankment materials. This lead to an increase in the number of incidents reported this year. However, due to the rapid response and quick thinking of our dam safety engineers, none of the incidents lead to loss of life or property damage. Incidents reported this year include:

- Fisher Canyon Dam, a Class 3 structure, experienced rapid reservoir seepage losses of approximately one vertical foot per day and significantly increased flows from a previously documented spring approximately 500 feet from the dam. The reservoir was drawn down and investigations were conducted to determine the cause of the seepage losses.
- Warren Lake Dam, a Class 3 structure, experienced excessive seepage at the toe of the dam.
- Anderson Dam, a Class 3 structure, experienced excessive seepage along outlet works conduit.

- Haunted Spring Dam, a Class 3 structure, experienced excessive seepage at the toe.
- Ivanhoe Dam, a Class 3 structure, experienced piping of embankment materials at downstream toe. The reservoir was drawn down and an upstream geomembrane liner was installed on the upstream slope of the dam.
- Grimes-Brooks Dam, a Class 1 structure, experienced increased abutment seepage. The reservoir was drawn down to a safe level and monitored on a daily basis.
- Sellers & McClane Dam, a Class 3 structure, experienced excessive seepage through the dam due to extensive muskrat burrows in the dam.
- Western Hillside Dam, a Class 1 structure, experienced snow slide damage to the spillway structure. The reservoir was lowered to a safe level, the spillway repaired, and a ramp constructed to divert future snow slides away from the spillway area.
- Rist-Benson Dam, a Class 3 structure, experienced excessive seepage at downstream toe due to plugging of toe drains. The toe drains were cleaned and repaired.
- Sylvan Park Dam, a non-jurisdictional dam, experienced excessive seepage along outlet works conduit. The reservoir was drawn down and a new outlet conduit was installed.
- Turner Dam, a non-jurisdictional dam, experienced near overtopping failure of the dam due to rapid snowmelt runoff and blocked spillway conduit. The blockage at the spillway conduit was removed by the Water Commissioner and Dam Safety Engineer that prevented the dam from overtopping. The actions prevented the dam from overtopping and possible failure of the dam.

At the conclusion of the reporting period, there were 193 dams restricted from full storage due to various structural deficiencies such as significant leakage, cracking and sliding of embankments, and inadequate spillways. Total storage restricted was 144,437 acre-feet. The restrictions provide risk reduction 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. A list of currently restricted reservoirs is included in Appendix B. Although many dams were repaired and removed from the restricted list within the last year, a number of dams were also added to the list during the same time period. The change in the restriction from the same time last year resulted in the same number of dams on the restricted list, however the volume of the restrictions increased approximately 15,000 acre-feet. The increase in the volume of storage restriction can be related, at least in part, due to the increased aging of the dam infrastructure within the state.

In the event that 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 CWCB construction fund per Section 37-87-122.5 (Supp. 2002).

With the passage of the National Dam Safety Program Act (NDSP), PL 104-303 and its subsequent funding, Colorado has applied for and received assistance grants each year since 1998. An additional grant was approved for 2003. These funds are being used to provide advanced training to the Dam Safety Branch personnel in the field of dam safety and risk analysis. Additional training is provided under the technical seminar provisions of the Act. The grant funds are also used to acquire emergency communication equipment, upgrade computers, and purchase engineering computer software programs and other equipment. Future grants may be available each year under the Act, subject to appropriations.

### **3.2 Approval of Plans and Specifications**

During FY 02-03, the State Engineer's Office approved plans for four new dams and 39 plans for alteration, modification, or enlargement. Twelve separate hydrology studies were also approved for determination of the inflow design flood for spillway design. The estimated cost of construction for the approved plans was \$95,169,302 and \$42,422 was collected for the examination and filing of the submitted plans. The increased reservoir storage resulting from the approved new dams and enlargements is approximately 13,500 acre-feet.

Thirty-nine sets of plans and specifications for construction and twelve hydrology studies were approved by the State Engineer during FY 02-03, as listed in Appendix C. In order to expedite the approval of repair plans for dams, the division dam safety engineers review plans and specifications and perform the construction inspections on selected projects. In addition, six third-party reviews of the plans and specifications were performed in FY 02-03. This enables the owners to repair or construct their dams sooner by shortening the review time. The State Engineer provides review and approval of plans and specifications performed by third parties.

Upon completion of construction, the owner's design 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 and the "AS-CONSTRUCTED" plans serve as the public record as required by the statutes.

Section 37-87-114.5 of C.R.S. (2002 Supp.) exempts certain structures from the State Engineer's approval. These are structures not designed or operated for the purposes of storing water, and include: mill tailing impoundments permitted under Article 32 or Article 33 of title 34 of C.R.S. (Minerals or Coal Mines), uranium mill tailing and liquid impoundment structures permitted under Article 11 of Title 25 of C.R.S., siltation structures permitted under Article 33 of Title 34 of C.R.S. (Coal Mines), and structures that only store water below the natural surface of the ground.

Owners of small dams that do not fall under the jurisdiction of the State Engineer are required to submit a Notice of Intent to Construct a Nonjurisdictional Water Impoundment Structure to the State Engineer prior to beginning construction under Section 37-87-125 of C.R.S. (2002 Supp.).



### 3.3 Safety Inspections and Construction Observations

The statutes specify that a dam safety inspection must 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 dam safety inspection also includes an evaluation of the adequacy of the spillway to pass the appropriate sized flood for the dams' size and hazard class, an evaluation of the dam's hazard classification and whether it has changed, and an assessment of the adequacy of the Emergency Preparedness Plan for the dam. The internal inspection of the outlet works and an evaluation of instrumentation has also been added to the workload as required by the regulations. The hydrologic evaluation of spillways on dams located above elevation 7,500 feet has been postponed, pending the completion of a study of extreme precipitation by the State Engineer and the CWCB as discussed in Section 4.1 of this report.

The findings of the dam safety inspection are documented in a report that 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 that the owner should take care of and any engineering and monitoring requirements that are deemed necessary to assure the safety of the dam. A copy of the Engineers Inspection Report is included in Appendix D.

Procedures have been implemented to begin reporting incidents and the findings of dam safety inspections where orders have been issued to make modifications for safety reasons. Incidents are reported to the Center for the Performance of Dams at Stanford University, in Palo Alto, California. This is a national program that has been developed by the Association of State Dam Safety Officials and the Federal Emergency Management Agency for the accumulation of data for the improvement of design and safety evaluations of dams nationwide.

Orders to repair or maintain the dam usually require the re-inspection 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 dam safety inspection finds that the overall conditions are unsafe, an order is written by the State Engineer restricting the storage of the reservoir to a safe level. 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. If the findings are conditionally satisfactory, full storage is recommended contingent on appropriate monitoring being provided by the owner.

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 visits are 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 dam safety engineers collectively conduct about 800 to 900 dam 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 to be performed is related to the number of dams in each division and their hazard class. Included in these numbers is the annual inspection of all Class 1, one-half of the Class 2, and about one-sixth of the Class 3 dams. Subsequent follow-up and problem solving meetings with dam owners result in additional inspections each year.

In order to track potential problems that could develop at Class 3 dams, the dam safety engineers assign dams to be observed by 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 included in Appendix E.

During FY 02-03, a total of approximately 573 safety inspections and approximately 233 construction inspections were conducted for a total of 806 inspections. In addition, approximately 178 follow-up inspections were made. The safety inspections included 237 Class 1 (High hazard), 190 Class 2 (Significant hazard), 142 Class 3 (Low hazard), 2 Class 4 (No hazard), and 2 (other) dams. Although slightly less dam inspections were performed in FY 02-03 than in FY 01-02, significantly more construction inspections were performed. The increased construction inspections were due to the increased construction activity this year generated by generally lower reservoir levels as a result of the drought conditions. The lower reservoir levels afforded many dam owners the opportunity to construct repairs to their dams without the need of additional draining their already lower reservoirs. The combined safety inspections and construction inspections in FY 02-03 resulted in an overall increase in the workload performed by the dam safety staff. This additional workload was incorporated into the overall schedules of the staff. No additional staff was added as a result of the increased workload.

For inspections of federally-owned and FERC-regulated dams that the State Engineer's Office does not participate in, the reports prepared by the federal agencies are received and reviewed.

### **3.4 Staff Training**

A critical element in the Dam Safety Program is the continued training of our personnel to maintain a high level of technical competency, to keep up with changing technology, to develop additional management and communication skills, and to keep abreast of changes in the development of dam safety programs across the country. The following training opportunities were achieved this fiscal year:

1. ASDSO Annual Conference, Dam Safety 2002, Tampa Bay (attended by one dam safety engineer and the Deputy State Engineer);
2. U.S. Bureau of Reclamation, Safety Evaluation of Existing Dams Seminar, Denver (attended by one dam safety engineer);
3. ASDSO Western Regional Conference and Technical Seminar, Plan Review and Construction Inspection of Dams, Salt Lake City (attended by one dam safety engineer);

4. Federal Emergency Management Agency, Risk Assessments in Dam Safety Emergencies, Emmitsburg, MD (attended by two dam safety engineers);
5. Federal Emergency Management Agency, HEC-HMS software training, Emmitsburg, MD (attended by one dam safety engineer);
6. Slope stability and seepage software training, GEO-SLOPE International, Calgary, Alberta, Canada (attended by one dam safety engineer); and
7. U.S. Bureau of Reclamation, Risk-Based Profiling Training, Denver (attended by all dam safety engineers).

### **3.5 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 across the nation. 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. Although all high hazard dams have such a plan, much work is still needed to update, maintain, and exercise the plans annually. Approximately 102 EPP's were reviewed during the fiscal year.

Approximately 98 percent of the significant hazard dams have plans on file. The owners of significant hazard dams that do not have a plan have been notified of the requirement to prepare them. The dam safety engineers continue to assist dam owners in the preparation of their EPP's. 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.

### **3.6 Security Issues**

Awareness of security issues surrounding the nation's infrastructure has increased following the events of September 11, 2001. Dams are an integral part of the nation's, and this state's, critical infrastructure. Through training and correspondence with others practicing in dam safety, personnel from the Dam Safety Branch have gained an understanding of the need to have security assessments performed for critical dams in the state. The division's personnel have emphasized to owners of dams the importance of performing these security assessments for their structures. As a minimum, these assessments should include a thorough evaluation of the potential threats, consequences, vulnerability, and responses associated with their structures. The performance of security assessments and continued security updates by owners of dams will continue to be emphasized by the Dam Safety Branch.

### **3.7 Dam Safety Management System**

The dams database (DAMS) has been updated and upgraded this fiscal year. While the main database is kept on a computer server in Denver, the dam safety engineers can access and update the data for their divisions through modem connections. 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. This system is used to update the National Inventory of Dams (NATDAM or NID) periodically when requested by the US Army Corps of Engineers.

### **3.8 Publications/Internet**

As a service to dam owners, the Dam Safety Branch makes available, at no cost, a brochure on the construction and operation of dams in Colorado. 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 inspections of their dams. Guidelines for preparing EPP's and a Project Review Guide for submitting plans for approval are provided at no cost.

In addition, the Regulations, Project Review Guide, application forms, sample plans, Livestock and Erosion Control Dam Permits, Notice to Construct a Nonjurisdictional Impoundment Structure, and other policy documents are available on the Dam Safety Web page at <http://water.state.co.us/damsafety/dams.asp>.

### **3.9 Risk-Based Approach**

Colorado has relied on an inspection/standards based program for over 20 years to assure the safety of dams in the state. While inspection activities are necessary and provide a basis for dam inventories, evaluation of hazard classifications, and site conditions at dams, too many serious incidents and even failures of dams in Colorado are still occurring. After attending an ASDSO workshop in 1999 on risk assessment, dam safety engineers decided to explore ways to include risk assessment in the Dam Safety Program as a tool for identifying potential failure modes at existing dam and to focus resources at the dams having the greatest risk of failure and significant consequences.

A pilot project was implemented to train staff and evaluate Failure Modes and Consequence Evaluations (FMCE). Simultaneously, an evaluation began of the U. S. Bureau of Reclamation's Risk Based Profiling System (RBPS). It is an indexing method for ranking dams in accordance with weighted failure modes and consequences. RBPS could be used to create a list of dams to do a more detailed FMCE.

A subset of risk analysis, FMCE, is simplified by qualitatively, rather than quantitatively, estimating the likelihood of adverse consequences from loads on dams (static, hydrologic, and seismic). It includes a comprehensive review of the engineering data, operation, performance history, and record of design construction, as well as information related to the consequences of

failure and planned emergency procedures, by a team of experts in dam safety. The teams use an "expert elicitation" process to develop an understanding of the most significant failure modes, consequences, and any risk reductions that can be implemented with respect to a dam. One session was conducted in 2000 and four have been conducted in 2001. The sessions have proven to be very successful and the process shows promise for further implementation in the program. Future sessions will be planned after the implementation and screening provided by the results of the RBPS.

A review of the RBPS was performed on a number of dams to evaluate the effectiveness of the procedure. In fact, several of the dam safety engineers have ranked many of the dams in their geographic area using this tool. The RBPS results provide a relative ranking of dams that should receive more attention, and in some cases, less attention, in the program. As discussed in Section 4.2 below, based on initial reviews, an agreement was executed with the Bureau of Reclamation for adapting this system for the state. An Intergovernmental Agreement with the Bureau of Reclamation was issued to revise their RBPS based on program needs.

### **3.10 IPA**

The Dam Safety Branch Chief continues to be served through an innovative agreement with the U.S. Bureau of Reclamation. Through some unique resources and abilities, the Deputy State Engineer was able to investigate, request, and obtain approval for an Intergovernmental Personnel Act (IPA) agreement with the Department of the Interior, Bureau of Reclamation, for an individual to provide technical leadership necessary to serve as the Branch Chief. The IPA agreement is valid for up to two years, at the state's discretion, and the Bureau of Reclamation will fund 100 percent of the employee's salary and benefits. The Bureau of Reclamation employee will provide knowledge of the Bureau of Reclamation's efforts to implement risk-based dam safety decision-making processes as attempts are made to implement such processes in the Dam Safety Program.

A highly qualified individual, Mr. Douglas Boyer, was selected in mid-October 2002 and began serving as Branch Chief on November 3, 2002. Mr. Boyer has over 17 years of experience in the investigation, evaluation, analysis, design, and construction of embankment and concrete dams. He has an undergraduate degree in geology and a graduate degree in civil engineering. He has been the principal investigator and/or designer for a number of embankment and concrete dams, including the 275-foot-high Ridges Basin Dam, currently under construction in Colorado. Mr. Boyer has authored or co-authored more than 15 technical papers and has been an invited speaker at university classes, dam safety training courses, and international seminars.

The IPA will expire in November 2004.

## **4.0 SPECIAL STUDIES**

### **4.1 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. A volunteer committee of meteorologists, hydrologists, engineers, federal and state agencies, and private entities assisted in the preparation of the technical portions of the request for proposal. The Department of Atmospheric Science at CSU was selected to develop a new method of estimating extreme precipitation and to develop concepts of how extreme precipitation varies with elevation in Colorado. One of the objectives of the study was to provide a more accurate portrayal of the maximum estimated precipitation in the mountainous areas. It is believed that a more accurate estimate of the maximum estimated precipitation in the mountainous area could save millions of dollars in the construction of spillways for dams.

A technical review group is assisting the Dam Safety Branch 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, U.S. Bureau of Reclamation; and Mr. Stephen Spann, consultant.

The draft final report was submitted by CSU on July 29, 2002 and the technical review group met in February 2003 to discuss the conclusions and recommendations of the report. The conclusions of the study were disappointing to the state and the technical review group. The research group was not able to provide a tool or methodology that could estimate extreme precipitation within the mountainous regions of the state. The recommendations of the study indicated that additional research, data collection, and analyses were required in order to develop a better model to more accurately estimate extreme precipitation events within Colorado.

The CWCB and Dam Safety Branch are currently considering other alternatives to address this issue.

### **4.2 Risk Based Profiling System**

The Dam Safety Branch continued their efforts in using risk-based tools to help evaluate and rank the jurisdictional dams in Colorado in order to more efficiently and effectively use program resources. One tool that has shown promise is the Risk Based Profiling System (RBPS) as developed by the Bureau of Reclamation. The Bureau of Reclamation has been using this tool for a number of years for similar purposes with much success. Based on understanding of the system and initial reviews, an agreement was executed with the Bureau of Reclamation for adapting this system for the state. An Intergovernmental Agreement with the Bureau of Reclamation was issued to revise their RBPS based on program needs. It is the Branch's goal that, by the end of the next fiscal year, a modified RBPS is in place that is fully functional and effective at focusing resources where they are most needed.

## **5.0 COORDINATION WITH NATIONAL DAM SAFETY PROGRAMS**

### **5.1 Association of State Dam Safety Officials**

All of the dam safety 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 the efficiency and effectiveness of state dam safety programs. Mr. Jack Byers, Deputy State Engineer, is the state's representative to the ASDSO.

### **5.2 Federal Dam Safety Programs**

**5.2.1 General** - Routine inspections of federal dams by Dam Safety Engineers have been curtailed in accordance with a legislative audit recommendation. The Branch, however, will participate in the evaluation of the safety of some federal dams for special issues and performance problem evaluations, in accordance with the procedure for obtaining approval to participate in these inspections. Less than about 40 hours were spent this fiscal year participating in these safety inspections at a cost of less than \$1,800.

**5.2.2 Memoranda of Understanding** - Memorandums of Understanding (MOU) have been executed with the U.S. Bureau of Reclamation, the U.S. Bureau of Land Management, 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. A MOU is also being updated with the U.S. Forest Service, Rocky Mountain Region, to provide coordination of mutual responsibilities for dam safety and their Travel Management Plan for the National Forests. This is necessary to provide access to private dams located within the forests. MOU's are being pursued with the other federal agencies such as the U.S. Army Corps of Engineers and the Federal Energy Regulatory Commission to assure that the dams under their jurisdiction are being maintained in a safe condition and to coordinate activities and exchange of information and data.

**5.2.3 Federal Energy Regulatory Commission** - The Branch makes safety inspections of dams that are also regulated by the Federal Energy Regulatory Commission (FERC). In accordance with an agreement with them, they furnish copies of their reports for Branch records. The Branch has curtailed participation in FERC regulated dams in accordance with the audit, but in accordance with the procedures for approval, spent about eight hours on inspections to evaluate specific performance or maintenance issues, at a cost of less than about \$400.

## **6.0 FISCAL RESPONSIBILITY**

### **6.1 Use of Appropriated Funds**

Dam safety personal service expenditures for the fiscal year 2002-03 were \$979,748. Total operating and travel expenditures were approximately \$51,912.

### **6.2 Receipt of Funds Generated by Filing Fees**

Fees collected by the State Engineer and deposited in the General Fund for dam safety amounted to \$42,422.44 for filing plans and specifications during the period.

## **7.0 ENFORCEMENT ORDERS AND PROCEEDINGS**

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

## **8.0 LEGISLATION**

No legislation affecting dam safety was enacted during the period.

## **9.0 SUMMARY OF FY 03-04 PROGRAM GOALS**

In addition to yearly program goals of inspections and design reviews, the following are additional program goals for FY 03-04:

1. Fully implement the modified Risk Based Profiling System.
2. Review and update current policy documents.
3. Review current rules and regulations.
4. Update the long range Dam Safety Plan.
5. Improve coordination and communication of personnel within the program and Division Offices.
6. Perform dam owner training by conducting one-day workshops at various locations throughout the state.



## DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/CLASS

HAZARD RATING	DIVISION	NONFEDERAL	FEDERAL	TOTAL
Class 1	1	139	14	153
Class 2	1	122	8	130
Class 3	1	431	12	443
Class 4	1	37	8	45
Class 1	2	41	6	47
Class 2	2	49	3	52
Class 3	2	98	11	109
Class 4	2	101	4	105
Class 1	3	11	1	12
Class 2	3	15	0	15
Class 3	3	27	4	31
Class 4	3	19	0	19
Class 1	4	31	10	41
Class 2	4	37	0	37
Class 3	4	147	6	153
Class 4	4	5	3	8
Class 1	5	34	7	41
Class 2	5	44	1	45
Class 3	5	116	8	124
Class 4	5	19	0	19
Class 1	6	13	0	13
Class 2	6	13	1	14
Class 3	6	108	9	117
Class 4	6	11	0	11
Class 1	7	16	4	20
Class 2	7	20	1	21
Class 3	7	46	1	47
Class 4	7	7	0	7
<b>TOTALS</b>		<b>1757</b>	<b>122</b>	<b>1879</b>

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 only occur to the dam owner's property in the event of failure of the dam while the reservoir is at the high water line.

**APPENDIX A**  
**DAM SAFETY BRANCH ORGANIZATION**  
**AND PERSONNEL**

## DAM SAFETY BRANCH PERSONNEL

NAME	TITLE	RESPONSIBILITY
<u>Denver Office</u>		
Douglas Boyer <sup>1</sup>		Chief, Dam Safety Branch
Mark Haynes	Professional Engineer II	Design Review/Construction Inspect.
<u>Division Offices</u>		
Michael Cola	Professional Engineer II	Dam Safety Engineer, Division 1
James Dubler	Professional Engineer II	Dam Safety Engineer, Division 1
Gregory Hammer	Professional Engineer II	Dam Safety Engineer, Division 1
Dennis Miller <sup>2</sup>	Professional Engineer II	Dam Safety Engineer, Division 1
Michael Graber	Professional Engineer II	Dam Safety Engineer, Division 2
Garrett Jackson <sup>3</sup>	Professional Engineer II	Dam Safety Engineer, Division 2
William McCormick <sup>4</sup>	Professional Engineer II	Dam Safety Engineer, Division 2
Brett Nordby <sup>5</sup>	Professional Engineer II	Dam Safety Engineer, Division 3/7
Dennis Miller <sup>2</sup>	Professional Engineer II	Dam Safety Engineer, Division 3/7
James Norfleet	Professional Engineer II	Dam Safety Engineer, Division 4
Garrett Jackson <sup>3</sup>	Professional Engineer II	Dam Safety Engineer, Division 2
John G. Blair	Professional Engineer II	Dam Safety Engineer, Division 5
John R. Blair	Professional Engineer II	Dam Safety Engineer, Division 6

Notes:

<sup>1</sup>Began November 2002

<sup>2</sup>Transferred to Division 3/7 in May 2003

<sup>3</sup>Transferred to Division 4/5 in July 2003

<sup>4</sup>Began October 2003

<sup>5</sup>Resigned August 2002

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

FOR DIVISION: 1

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
010104	3	ADAMS & BUNKER #3	6.0 CREST	INADEQUATE FREEBOARD, SEEPAGE	0	5/22/1975	C	150
010115	2	BIJOU #2 DAM #1	GH 16 FT.	SCARPING OF U/S FACE, NO EMER SPWY, SEEPAGE	16	6/1/1993	C	1700
010132	3	J.B. COOKE	3.0 CREST	FREEBOARD	0	5/6/1998	R	0
010138	3	DOVER	10.0 FT. CREST	POOR CONDITION		6/27/1996	I	60
010210	1	EMPIRE (OUTLET EMBANKMENT)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010419	3	D.A. LORD #4	2.0 SPILLWAY	INADEQUATE SPILLWAY	0	9/19/1980	C	400
010505	2	PROSPECT	GH 35.5.	maintenance & monitoring issues	35.5	4/15/1981	R	588
010506	1	RIVERSIDE	GH 33.55 FT.	no spillway; 33.55 is max decree	33.5	5/9/1984	I	0
010612	3	NO NAME 1-1 #1	10 FT. CREST	SCOUR OF D/S SLOPE DUE TO FAILURE OF OUTLET		11/2/2000	I	100
010709	3	JOLLY JOHN	NO STORAGE	SCOUR HOLE FROM OUTLET	0	10/27/2000	I	297
010716	3	HOWARDS LAKE	3.0 FT. SPILLWAY	EROSION OF DAM AND CREST		6/3/1998	I	50
010726	1	EMPIRE (NW EMBANKMENT)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010727	1	EMPIRE (McINTYRE DIKE)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010728	1	EMPIRE (EAST EMBANKMENT)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010729	3	EMPIRE (FREEBOARD DIKE)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
020109	3	BRIGHT VIEW #1	7.0 CREST	INOP. OUTLET, INADEQUATE FREEBOARD	0	9/30/1985	I	17
020113	3	CARLIN	5.0 CREST	NO SPILLWAY	0	7/29/1986	C	0
020115	3	LOWER CHURCH LAKE	3.0 FT CREST	INADEQUATE SPILLWAY		6/22/1999	I	0
020119	3	COLE	NO STORAGE	POOR CONDITION	0	6/30/1994	I	95
020123	2	EAST LAKE #1	NO STORAGE	INADEQUATE SPILLWAY, POOR CONDITION	0	3/19/1992	I	125
020125	2	EAST LAKE #2	NO STORAGE	POOR CONDITION	0	3/19/1992	I	198
020237	3	MARSHALL	5 ft. below dam crest	Obstructed spillway, etc.		10/21/2002	I	10
020314	3	NORTH STAR	5.0 BELOW DAM CREST	SINKHOLE ON DOWNSTREAM SLOPE		2/11/2003	R	
020322	2	SIGNAL #1	5.0 CREST	CONCENTRATD SPG AREAS&QUESTNBLE COND OF OUTLET	0	6/21/1993	R	60
020327	2	RANKIN RESERVOIR	NO STORAGE	POOR CONDITION	0	7/12/1995	I	44
020333	3	THOMPSON	5.0 CREST	INADEQUATE FREEBOARD, GENERALLY POOR CONDITION	0	10/7/1987	R	30
020411	2	NISSEN #2	1.75 SPILLWAY	LACK OF FREEBOARD		9/11/1995	I	50
020606	3	MOWER	3 Feet below Lowest Point of Dam Crest	Inadequate Spillway and Freeboard		5/22/2002	I	8
020615	3	HAVANA STREET DAM	NO STORAGE	NO SPILLWAY	0	6/17/1987	C	0
030107	1	BLACK HOLLOW	4.2 FT. SPILLWAY	INADEQUATE SPILLWAY	31	10/22/1997	I	999
030108	3	BOX ELDER #2	3.0 FT. SPILLWAY	EXCESSIVE SEEPAGE	6.5	8/8/1989	I	49
030122	2	CURTIS LAKE	GH 10 FT.	CREST, SLOPE, EXT. SEEP. AREA BELOW D/S TOE	10	7/2/1985	I	397
030128	3	DRY CREEK	GH 11.5 FT.	OUTLET DETERIORATION,SEEPAGE, INAD SW	11.5	1/17/1996	R	150
030131	1	ELDER	2.0 FT. SPILLWAY	SINKHOLES	0	4/26/1999	I	500
030138	2	GRAY #3	NO STORAGE	SINKHOLE OVER OUTLET	0	5/27/1997	I	100
030214	3	LAW, JOHN	3.0 CREST	INADEQUATE SPILLWAY AND FREEBOARD	11	6/22/1987	C	45

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

FOR DIVISION: 1

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
030220	3	MATTINGLY	2.0 FT. SPILLWAY	EROSION/3-5 FT. SCARP ON U/S FACE		10/23/1997	I	99
030225	3	MOUNTAIN SUPPLY # 1	10 FT. CREST	POOR CONDITION	5	11/5/1997	I	500
030226	3	MOUNTAIN SUPPLY # 2	10 FT. CREST	POOR CONDITION	5	11/5/1997	I	300
030227	3	MOUNTAIN SUPPLY # 6	3.0 CREST	NO SPILLWAY		10/19/2000	C	120
030229	3	MOUNTAIN SUPPLY # 8	NO STORAGE	POOR CONDITION	0	10/3/1978	I	643
030236	2	NORTH POUUDRE # 1	7.0 CREST	SEEP. @ HIGHER STGE. LEVELS/COND. OF UP SLOPE	9	10/17/1988	R	365
030301	2	NORTH POUUDRE # 4	GH 17 FT.	POOR U/S FACE, GENERAL CONDITION	17	4/17/1984	R	562
030509	3	GEIST	5.0 CREST	INADEQUATE SPILLWAY	6.7	6/18/1998	C	58
030512	3	RIST CANYON	3.0 CREST	SEEPAGE, INADEQUATE SPILLWAY	0	4/19/1983	I	33
040101	3	ARROWHEAD	zero storage	sinkhole; inoperable outlet	0	1/14/2003	I	230
040123	2	FAIRPORT	6.0 SPILLWAY	POOR CONDITION	6	6/22/1987	R	30
040211	2	RYAN GULCH	GH 27.6	INADEQUATE SPILLWAY, LEAKAGE	27.6	2/12/1997	R	40
040213	2	SOUTH SIDE	8.0 CREST	DAM UNSAFE FOR ORIG. STOR. AMT.	8	7/7/1978	I	105
040237	3	WESTERDOLL LAKE	8.5 CREST	POOR CONDITION		3/30/1992	I	9
040242	2	ISH #3 (EAST DAM)	3 ft below inlet to New Ish outlet	poor condition of outlet conduit	7.6	10/30/2002	I	7128
045234	3	IDE AND STARBIRD #1	3.0 CREST	POOR MN, ERODED U/S FACE, QUES. SPILLWAY	0	7/3/1985	I	0
050101	2	AKERS & TARR	7.0 CREST OCT. 1 - APRIL 1	SLIDE ON D/S SLOPE, SPGE. IN AREA OF ABAND OTL	0	3/23/1989	R	34
050132	3	HIGHLAND	3.0 BELOW TOP OF CONCRETE WALL AT OUTLET	NO SPILLWAY	0	11/26/1990	R	0
050133	2	HIGHLAND #1		UNCONTROLLED SEEPAGE	11	5/29/2003	I	242
050206	3	KNOTH	NO STORAGE	NEVER COMPLETED DAM	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	10/11/1985	I	60
050230	2	OLIGARCHY #1	restricted to gage height 26.0	point source seep from rodent hole	26	5/20/1999	I	200
050301	3	STEELE BROTHERS #1	4.0 SPILLWAY	SAT. EMBKMT.; INOP. O'S.; INAD. FBD.; SPWY. REPAIR	0	12/1/1987	I	34
050302	3	STEELE BROTHERS #2	3.0 SPILLWAY	TOTAL REHABILITATION REQUIRED	0	11/23/1987	I	14
050304	3	SWEDE	5.0 CREST	EMBANKMENT SEEPAGE & INADEQUATE FREEBOARD	0	11/14/1986	I	75
050308	2	UNION	GH 28.0	spillway design based on GH=28.0	28	12/6/1977	C	0
060115	2	ERIE	3.0 CREST	INSUFFICIENT FREEBOARD	12	6/2/1986	I	29
060122	4	GREEN LAKE NO. 1	3.0 CREST	SEEPAGE, NO SPILLWAY	0	10/12/1984	I	30
060124	4	GREEN LAKE NO. 3	3.0 CREST	LEAKS, INADEQUATE SPILLWAY FREEBOARD	0	10/8/1984	I	60
060202	3	MCKAY LAKE - EAST DAM	GH 11 FT.	INAD. FREEBOARD, SEEPAGE	11	9/11/1995	I	90
060204	3	MESA	NO STORAGE	POOR COND		6/28/2000	I	100
060208	3	PRINCE NO. 1	7.25 CREST	LEAKAGE	4	7/7/1994	I	32
060212	3	SECTION 19	4.0 CREST	NO SPILLWAY	0	7/24/1984	I	10
060306	3	VARSITY POND	1 FT. SPILLWAY	SEEPAGE/SPILLWAY		8/31/1999	I	1
060314	3	HODGSON-HARRIS	6.0 CREST	POOR CONDITION		11/14/1995	I	60
070111	1	IDAHO SPRINGS	8.0 CREST	SEEPAGE, SETTLEMENT & REPAIRS REQD. ON SPWY.	22	2/27/2002	R	19

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

FOR DIVISION: 1

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
070113	3	LOWER CHINNS		SINKHOLES	110	11/24/1999	I	60
070126	2	DEWEY NO. 1	3.0 CREST(NW)	POOR CONDITION	0	11/19/1990	I	15
070201	1	KALCEVIC	11.0 CREST	ERODED UPSTREAM SLOPE	0	2/10/1983	I	43
070202	3	KELLY	3.0 CREST	NO SPILLWAY,	0	12/5/1986	I	30
075311	1	SMITH	1.0 SPILLWAY	SEEPAGE	0	1/26/2000	R	100
080101	3	ALLIS	15.0 CREST	SLOUGHING, SEEPAGE	0	8/25/1992	R	50
080105	3	BAIRD #1	7.0 CREST	SEVERE BEAVER ACTIVITY, PLUGGED OUTLET	0	1/8/1990	I	25
080110	4	CANTRILL	NO STORAGE	NO SPILLWAY, INOPERABLE OUTLET	0	10/22/1987	I	37
080218	3	LAMBERT	8.0 CREST	COMPLETELY REHABILITATE THE DAM	0	7/9/1984	I	50
080306	3	WAKEMAN	NO STORAGE	SPILLWAY EROSION		10/17/1994	I	110
080321	4	QUICK	NO STORAGE	NO SPILLWAY, INOPERABLE OUTLET	0	10/22/1987	I	64
080327	1	SKEEL	2.0 FT. SPILLWAY	POOR CONDITION		4/2/1997	R	10
080422	3	RAINBOW FALLS #5	9.0 CREST	INADEQUATE SPILLWAY	0	9/11/1985	I	25
080424	3	GERLITS	NO STORAGE	DAM PARTIALLY BREACHED DUE TO OVERTOPPING.	0	11/13/1984	I	10
090102	2	BEERS SISTERS LAKE	BELOW DAM CREST	NO SPILLWAY	5	1/8/1999	I	
090115	2	HARRIMAN	GH 19 FT.	EXCESSIVE SEEPAGE	19	11/12/1992	R	300
090138	4	HAYSTACK #1	NO STORAGE	SPILLWAY UNDERMINED	0	5/8/1987	I	3
090204	1	WILLOW SPRINGS #1	1.0 SPILLWAY	EROSION OF US FACE	13.5	9/14/2000	R	10
230102	1	ANTERO	GH 18 FT.	STAB. BERM CONST. & NEW INSTR. MONITORING	18	2/4/1986	R	5100
230104	3	BAYOU SALADO	One-Foot Below Spillway Crest	Unsatisfactory & Unsafe Condition of Spillway		8/29/2002	I	26
230208	1	TARRYALL	ZERO STORAGE	UNSTABLE DURING OVERTOPPING		8/21/2002	I	1963
230308	3	MOUNTAIN	4.0 CREST	INSUFFICIENT FREEBOARD, SEEPAGE AT TOE	0	11/6/1985	I	3
230310	3	STOCKING POND	NO STORAGE	INADEQUATE SPILLWAY	0	6/13/1988	I	10
230311	3	SUN	5.0 CREST	SEEPAGE-RESTRICT 0 8' BELOW CREST	0	12/31/1984	R	6
230312	3	WIND	5.5 CREST	SATURATED D/S SLOPE	0	9/20/1985	C	3
480101	3	JOHNSON	4.0 CREST(3.0 CREST IRR. SEASON)	EROS. ON U/S FACE, IMPROPER FB., SEEP/D/S TOE	0	7/18/1994	C	68
640104	1	JULESBURG #4	GH 24 FT. FOR 90 DAYS, THEN GH 23 FT.	CONDITION OF OUTLET, EXCESSIVE SEEPAGE	24	5/2/1995	R	6964
640108	1	PREWITT	GH 26.5 FT.	NO SPWY & EXCESSIVE SEEPAGE	26.5	8/23/1990	I	2531
650121	3	DUCK	4.0 SPILLWAY	NARROW CREST, STEEP SLOPES	0	3/23/1987	I	15
650123	3	HANSHAW	5.0 CREST	SEEPAGE, SLIDE	0	7/7/1987	I	20
VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 1				49284 AF	TOTAL NUMBER OF DAMS AFFECTED:			102 DAMS

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

FOR DIVISION: 2

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
100123	3	A. MC CRAY	5.0 FT SPILLWAY	INSTABILITY		4/13/1998	I	10
100131	3	GARDEN OF THE GODS GOLF COURSE	3.0 CREST	NO SPILLWAY	0	5/31/1988	I	0
100205	3	KEETON LAKE	10.0 FT. SPILLWAY	EROSION OF SPILLWAY, LEAKAGE, PIPING	0	8/8/1997	I	10
100215	N	MODERN WOODMEN OF AMER. #2	NO STORAGE	INADEQUATE SPILLWAY, POOR REPAIR	0	8/12/1983	R	85
100235	2	PROSPECT LAKE	3.5 CREST	NO SPWY., OTLT OPERABILITY QUESTIONABLE	0	5/31/1988	I	0
100309	3	VALLEY NO. 1	15.0 CREST	INOPERABLE OUTLET & BLOCKED SPILLWAY	0	12/27/1984	I	50
100402	2	VALLEY NO. 2	NO STORAGE	INOPERABLE OUTLET, OBSTRUCTED SPILLWAY	0	9/21/2000	I	185
110106	3	EVANS GULCH	3.0 CREST	INSUFFICIENT FREEBOARD	0	2/2/1985	R	2
120136	3	PARK CENTER L & W #2	8.8 CREST	SLIDE ON DOWNSTREAM SLOPE	0	1/4/1989	R	11
120202	3	PARK CENTER L & W #10	GH 7 FT.	EXTENSIVE CRACKING ON THE CREST	7	10/2/1974	I	48
150116	3	OCCHIATO #1	10 FEET CREST	SLIDE		9/16/1999	I	3
160108	1	CUCHARAS #5	GH 100 FT.	POOR OVERALL CON. EMBKMT. HISTY. MVMNT.	100	7/21/1988	R	33000
160135	4	CLARK #1	8.0 CREST	ERODED UPSTREAM SLOPE	0	2/16/1994	R	80
170118	3	CUDAHY #1	5.0 FT. BELOW DAM CREST	INADEQUATE FREEBOARD AND INOPERABLE OUTLET		7/15/1985	I	900
170217	3	SWINK #1	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	500
170218	3	SWINK #2	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	600
170219	3	SWINK #5	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	750
170220	3	SWINK #6	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	650
170222	3	TIMPAS #3	10.0 CREST	IN DISREPAIR, ABANDONED	0	4/21/1986	I	500
180206	2	APISHAPA	22.0 CREST	SPILLWAY, OUTLET SILTED IN	0	2/18/1994	I	260
180207	3	SEVEN LAKES	7.0 CREST	DILAPIDATED CONDITION OF DAM	0	5/6/1987	I	1200
190114	3	MODEL	3.0 FT SPILLWAY	POOR COND		6/28/2000	I	1000
670218	2	NEE-NOSHE		SAND BOILS IN OUTLET CHANNEL	23.5	6/22/1999	R	6392
670236	1	TWO BUTTES	GH 20 FT.	HYDRAULICALLY INADEQUATE SPILLWAY	20	1/24/1983	I	31465
VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 2				77701 AF	TOTAL NUMBER OF DAMS AFFECTED:			24 DAMS

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

FOR DIVISION: 3

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
200105	3	BRISTOL HEAD #1	ZERO STORAGE	INOPERABLE OUTLET/POOR GENERAL CONDITION	0	8/6/2002	I	121
200110	1	CONTINENTAL	GH 64.5	LEAKAGE	64.5	8/1/1995	R	7679
210102	1	TERRACE	7.0 SPILLWAY	DETERIORATED SPILLWAY	117	7/18/1984	I	2000
VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 3				9800 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	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
400103	3	ARCH SLOUGH	DAM WAS ABANDONED,BUT CAN STILL HOLD WATER	POOR CONDITION	0	12/12/1985	I	66
400112	2	BIG BATTLEMENT	GH 8 FT.	SINKHOLES ON EMBANKMENT	8	9/24/1991	R	750
400212	3	CYPHER #1	4.0 BELOW EMERGENCY SPILLWAY CREST	REPAIRS NOT COMPLETED		1/14/2003	R	8
400306	2	GRANBY #12	GH 17 FT.	D/S FACE SLIDE DUE TO SEEPAGE	17	10/15/1987	R	0
400318	1	HOTEL LAKE	NO STORAGE	WEAKENED CONDITIONS!	0	1/14/2002	I	549
400330	3	KNOX	FULL STORAGE FROM 4/1 TO 8/15 IF MONITORED	EXCESSIVE SEEPAGE AT TOE AND ON EMBANKMENT	17	1/8/1988	R	0
400405	3	LONE STAR #1	30.0 CREST	CRACKS ON CREST, UNAPPROVED PLANS, POOR CONSTR	0	7/31/1996	R	0
400411	3	MILITARY PARK		PIPING	10	9/7/2000	I	150
400413	2	MONUMENT	10.0 SPILLWAY, FILL/MONITORING PLAN IN PLACE	CRACKS ON DAM AND LEFT ABUTMENT SLIDE	33.5	4/29/1993	I	175
400434	3	PITCAIRNE #1	5.5 FT. SPILLWAY	BEAVER DENS ON US FACE		8/2/2000	I	50
400522	3	TODD	10.0 CREST	6' ELEVATION DIFF ALONG CREST WITH NO SPILLWAY	0	10/19/1984	I	112
400524	3	TRIO	8.0 SPILLWAY	SLIDE ON DOWNSTREAM SLOPE	14	1/11/1989	I	75
400601	3	HARRY WHITE #2	5.0 CREST	POOR OUTLET VALVE,LACK OF FREEBOARD,MAINTENANC	0	8/9/1991	I	30
400619	3	LONE STAR #2	10.0 CREST	CONSTRUCTION WITHOUT APPROVED PLANS & SPECS	0	6/2/1988	C	0
400705	3	WEBSTER #1	NO STORAGE	POORLY CONSTRUCTED	0	5/6/1987	C	15
400707	3	WEBSTER #3	NO STORAGE	POORLY CONSTRUCTED	0	5/6/1987	C	15
410201	3	COFFEY RESERVOIR	NO STORAGE	GENERAL POOR CONDITION,CONST. WO/APP. PLANS	0	7/21/1988	C	90
410202	3	MOCK #1	9.0 CREST(AFTER 60 DAYS FULL)	BUILT WITHOUT APPROVED PLANS & SEEPAGE	0	4/26/1989	R	0
420116	2	FRUITA #1	20 FT. CREST	SLIDE ON DOWNSTREAM SLOPE		8/12/1998	I	100
420119	3	G.H. AND S. #2	NO STORAGE	NARROW CREST, STEEP SLOPES, POOR OUTLET	0	8/26/1992	R	29
420120	2	GRAND MESA #1	8 FT. SPILLWAY	OUTLET WORKS FAILURE	12	12/21/2000	I	300
420123	3	GRAND MESA #9	3.4 FT SPILLWAY	OUTLET WORKS PROBLEMS	8	12/21/2000	I	100
420135	3	REEDER	8.0 CREST	SEEP. ON D/S SURFACE,NUMEROUS LARGE TREES	0	8/26/1985	R	96
590113	2	MERIDIAN LAKE PARK #1	2.0 SPILLWAY (PRIN SPWY LOWERED)	SEVERE EROSION OF THE EMERGENCY SPILLWAY	0	6/4/1987	I	10
600105	3	BLUE LAKE #1	5.0 FEET SPILLWAY	POOR CONDITION		11/21/2001	I	100
600117	3	NUCLA DOMESTIC	NO STORAGE	POOR CONDITION	0	11/21/2001	I	50
600118	3	PAXTON	2.5 SPILLWAY	SEEPAGE	0	8/8/1988	R	100
600126	3	CUSHMAN	6.0 CREST	OUTLET-INOP. SPWY-INAD. EMB. SEEPS	0	7/29/1975	I	36
600127	1	PRIEST	3.0 CREST	INSUFFICIENT FREEBOARD	0	9/16/1985	I	25

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 4

3031 AF

TOTAL NUMBER OF DAMS AFFECTED: 29 DAMS

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

FOR DIVISION: 5

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
370116	3	G G LOWER	4.0 CREST	INADEQ FRBD., STABILITY OF DOWNSTREAM SLOPE	0	12/14/1992	R	6
370205	3	FORIER #3	NO STORAGE	ILLEGAL DAM /INADEQUATE SPILLWAY	0	11/9/1995	I	2
380207	2	WARREN LAKE #3	NO STORAGE	INADEQUATE SPILLWAY	0	11/1/1995	I	27
380212	2	FLANNERY	1.0 FT SPILLWAY	SPILLWAY EROSION		9/17/2001	I	20
380217	2	CHRISTINE LAKE	3.5 FT CREST	NO SPILLWAY		5/4/2001	I	10
450101	3	BATTLEMENT #2	NO STORAGE	INADEQUATE SPILLWAY	0	9/18/1995	I	23
450102	3	BATTLEMENT #1	NO STORAGE	POOR CONDITION OF OUTLET	0	10/1/1990	C	70
500113	2	MATHESON	FULL STOR IN SPRING. DRAIN TO GH 30 BY 9/1	MONITORING DEVISE INSTALLED	30	10/30/2002	R	719
500126	3	MILK CREEK	15.0 CREST (AUG 1 THRU MAY 1)	EXCESSIVE LEAKAGE	0	5/10/1991	R	56
510114	2	LITTLE KING RANCH	10.0 SPILLWAY	EXCESSIVE SEEPAGE	41	3/7/1978	C	439
510124	2	SCHOLL	NO STORAGE	SINKHOLES	0	8/2/2001	I	51
510129	N	ROCK CREEK	NO STORAGE	DAM BREACHED BY OWNER BUT WANTS TO REPAIR	0	6/28/1989	C	66
530119	3	KELLY	5.0 CREST	SPILLWAY EROSION	0	9/20/1985	C	0
530125	3	NEWTON GULCH	20.0 CREST	EXCESSIVE SEEPAGE THROUGH ABUTMENTS	17	7/20/1990	I	465
530129	3	STERNER	RELAX 5/1-8/15, 3.0 SPILLWAY	UNCONTROLLED LEAKAGE		8/2/1995	R	71
720117	3	CARPENTER	NO STORAGE	PIPING HOLE		8/23/1994	I	27
720126	3	CURRIER #2	5.0 SPILLWAY	SLIDE ON HILL ABOVE SPILLWAY, BACKCUTTING		5/24/1995	I	100
720237	3	Y T RANCH	6' BELOW DAM CREST LOW POINT	SLOUGHING OF UPSTREAM SLOPE AND SEEPAGE		5/28/2003	I	21

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 5      2173 AF      TOTAL NUMBER OF DAMS AFFECTED:      18 DAMS

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

FOR DIVISION: 6

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
430205	3	BAXTER	5.0 FT. SPILLWAY	SEEPAGE, EROSION OF U/S FACE		11/13/1997	I	30
430212	3	WILSON #3	3.0 SPILLWAY	INOPERABLE OUTLET, INAD SPWY	3	9/30/1989	I	10
440106	3	BISKUP	5.0 SPILLWAY	DILAPIDATED CONDITION	0	8/19/1987	C	55
440120	3	DRESCHER	8.0 SPILLWAY	SEEPAGE & INSTABILITY	8	8/1/1988	R	159
440124	3	ELLGEN #2	NO STORAGE	POOR OUTLET CONDITION	0	5/30/1986	I	60
440213	3	FLATTOP	5.0 FT CREST MAIN DAM	BREACHED, BEAVER DAMS, FREEBOARD		8/2/1999	J	50
560107	3	BASSET #2	5-FEET BELOW SPILWAY CREST	ILLEGAL DAM, POOR CONDITION		10/21/2002	R	25
570114	3	LAKE EMRICH	15.0 CREST	SLIDES ON DOWNSTREAM SLOPE	0	8/30/1988	C	330
580303	N	LOWER SPRING CREEK	5.0 Ft Spillway	Seepage, Inadequate spillway, Erosion		7/14/1999	I	10
VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 6				729 AF	TOTAL NUMBER OF DAMS AFFECTED:			9 DAMS

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

FOR DIVISION: 7

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
340106	3	HURST	NO STORAGE	OUTLET FAILURE	0	3/29/1999	I	35
340117	3	SELLERS AND MCCLANE	4 FT BELOW DAM CREST	SEEPAGE, MUSKRAT DAMAGE		5/29/2003	I	12
340119	3	J. O. SPENCER	NO STORAGE	INOPERABLE OUTLET	0	5/8/2000	I	16
340203	1	SUMMIT	NOT TO EXCEED 1.1' BELOW SPILL FOR > 3 WEEKS	EXCESSIVE SEEPAGE	23.6	6/3/1998	R	579
340205	1	SUMMIT - SOUTH DAM	NOT TO EXCEED 1.1' BELOW SPILL FOR > 3 WEEKS	EXCESSIVE SEEPAGE	23.6	6/3/1998	R	579
770103	2	SPENCE	NO STORAGE	OUTLET PIPE BLOCKAGE	0	6/19/2001	I	441
780111	2	PINON LAKE	3 FEET SPILLWAY	POOR CONDITION		7/27/2001	I	40
VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 7				1702 AF	TOTAL NUMBER OF DAMS AFFECTED:			7 DAMS

**APPENDIX C**

**APPROVED PLANS AND SPECIFICATIONS LIST**

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

NAME	DAMID	C-NO	CONST TYPE	APPROVAL	USE
HARWOOD'S STORAGE RESERV	090117	C-0702A	REPAIR	7/10/2002	RECREATION
WERHONIG & GARDNER	450105	LTR	MODIFICATION	7/17/2002	FISH AND WILDLIFE
SYLVAN LAKE	370106	C-0458A	MODIFICATION	7/17/2002	RECREATION
BRIDAL VEIL	600107	C-1826	REPAIR	7/17/2002	DOMESTIC
DALE	510104	C-1828	REPAIR	8/29/2002	IRRIGATION
WINDSOR #8	030337	C-1596A	MODIFICATION	8/29/2002	IRRIGATION
LAKE CAROLINE	070211	C-1830	REPAIR	9/4/2002	IRRIGATION
NOFSTGER	570123		REPAIR	10/3/2002	FISH AND WILDLIFE
HOTEL LAKE	400318	C-0650A	MODIFICATION	10/4/2002	IRRIGATION
LAKE HENRY	170203	C-0555C	REPAIR	10/31/2002	IRRIGATION
GOLD LAKE #1	050127	C-1396A	REPAIR	10/31/2002	FISH AND WILDLIFE
LOWER HOFFMAN LAKE	040225	C-1576A	MODIFICATION	11/4/2002	IRRIGATION
OLIGARCHY #1	050230	C-1693A	MODIFICATION	11/18/2002	IRRIGATION
ERIE	060115	C-0800B	MODIFICATION	11/18/2002	DOMESTIC
OWL CREEK	010437	C-1812	REPAIR	11/18/2002	IRRIGATION
GIFFIN #1 (LOWER)	010215	C-1832	REPAIR	11/18/2002	IRRIGATION
GIFFIN #2 (UPPER)	010216	C-1847	REPAIR	11/18/2002	IRRIGATION
COLLEGE #3	030120	C-1507A	REPAIR	11/20/2002	IRRIGATION
MARIANO	040203	C-0775A	REPAIR	11/25/2002	IRRIGATION
LOVELAND WATER STORAGE	040217	C-1448B	MODIFICATION	12/27/2002	DOMESTIC
CHEROKEE NW	070317	C-1825	NEW	12/27/2002	OTHER
GREAT WESTERN	020212	C-0857H	REPAIR	1/13/2003	DOMESTIC
WOODMOOR LAKE	100311	C-1199D	REPAIR	1/14/2003	IRRIGATION
OASIS	400419	C-1835	REPAIR	1/27/2003	IRRIGATION
RAMPART	100221	C-1225E	MODIFICATION	2/11/2003	DOMESTIC
A. MC CRAY	100123	C-1829	BREACH	2/11/2003	RECREATION
EAST LAKE #2	020125	C-1837	MODIFICATION	2/26/2003	FLOOD CONTROL
CHAPEL HILLS #1	100406	C-1613A	MODIFICATION	3/14/2003	FLOOD CONTROL
ERICKSON	020637	C-1839	MODIFICATION	3/17/2003	IRRIGATION
BEAR CREEK	580311	C-1775A	MODIFICATION	3/26/2003	RECREATION
ISH #3 (MAIN DAM)	040131	C-0014C	REPAIR	4/4/2003	IRRIGATION
FREDERICK	055319	C-0894C	MODIFICATION	4/17/2003	FISH AND WILDLIFE
BATTLEMENT #2	450101	LTR	MODIFICATION	4/24/2003	IRRIGATION
TARRYALL	230208	C-0221B	MODIFICATION	5/20/2003	RECREATION
GUANELLA	07__D	C-1833	NEW	5/20/2003	
DE WEESE	130103	C-0124B	MODIFICATION	6/10/2003	IRRIGATION
GRAND MESA #9	420123	C-1844	MODIFICATION	6/18/2003	IRRIGATION
GRAND MESA NO.1	420120	C-1843	MODIFICATION	6/18/2003	IRRIGATION
EAST LAKE #1	020123		BREACH	6/19/2003	FLOOD CONTROL
SAWMILL	360109	C-1236A	REPAIR	6/19/2003	RECREATION
BASIN	570102	C-1838	NEW	6/20/2003	IRRIGATION
SPENCE	770103	C-1842	MODIFICATION	6/23/2003	IRRIGATION
SOUTH PLATTE	080446	C-1836	NEW	6/26/2003	DOMESTIC



**MONITORING**

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

(114) SURVEY MONUMENTS  (115) OTHER \_\_\_\_\_

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

Comments: \_\_\_\_\_

GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR

**MONITORING**

**MAINTENANCE AND REPAIR**

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

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

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

(67) GATE AND OPERATING MECHANISM NEED MAINTENANCE  (68) OTHER \_\_\_\_\_

Comments: \_\_\_\_\_

GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR

**MAINTENANCE AND REPAIRS**

**OVERALL CONDITIONS**

REMARKS: \_\_\_\_\_

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

71 SATISFACTORY  72 CONDITIONALLY SATISFACTORY  73 UNSATISFACTORY

**OVERALL CONDITIONS**

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

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**

(101) FULL STORAGE

(102) CONDITIONAL FULL STORAGE RESTRICTED LEVEL

(103) RECOMMENDED RESTRICTION 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: \_\_\_\_\_



**GUIDELINES FOR DETERMINING CONDITIONS**

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

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
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**

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
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**

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
Instrumentation and monitoring described under acceptable are being exceeded, as described under comments in the report.	Instrumentation is provided in accordance with the rules. Special instrumentation and monitoring deemed necessary is provided. The owner monitors the dam and records data in accordance with the rules, and submits the data annually or more frequently if required.	Required instrumentation and monitoring 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**

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
Owner has a plan for annual maintenance. Dam consistently receives effective on-going maintenance and repair.	Dam receives maintenance in accordance with a plan, but some maintenance items need to be addressed. No major repairs are required.	No annual maintenance plan in effect. Dam does not appear to receive adequate maintenance. One or more items needing maintenance or repair have begun to threaten the safety of the dam. Lack of maintenance prevents thorough inspection.

**OVERALL CONDITIONS**

<b>SATISFACTORY</b>	<b>CONDITIONALLY SATISFACTORY</b>	<b>UNSATISFACTORY</b>
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.	The safety inspection indicates symptoms of structural distress (excessive seepage, evidence of major 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 storage in the reservoir or storage at a reduced level. There are no requirements if maintained at the restricted level.	The safety inspection indicates definite signs of hydrologic inadequacy or structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which could lead to the failure of the dam if operated at full storage.

**SAFE STORAGE LEVEL**

<b>FULL STORAGE</b>	<b>CONDITIONAL FULL STORAGE</b>	<b>RESTRICTION</b>
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 1 - Loss of human life is expected in the event of failure of the dam.	Class 2 - Significant damage is expected in the event of failure of the dam, but no loss of human life is expected.	Class 3 - A small amount of damage is expected. Loss of human life and significant damage are not expected.
	Class 4 - No loss of human life is expected and damage will occur only to the dam owner's property.	

**APPENDIX E**

**WATER COMMISSIONER DAM OBSERVATION REPORT FORM**

# WATER COMMISSIONER • DAM OBSERVATION REPORT • OFFICE OF THE STATE ENGINEER

DIVISION OF WATER RESOURCES • DAM SAFETY BRANCH

1313 SHERMAN STREET, ROOM 818, DENVER, CO 80203, (303) 866-3681

**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.**

<b>UPSTREAM SLOPE</b>	PROBLEMS NOTED: <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) CRACKSWITH DISPLACEMENT <input type="checkbox"/> (4) SINKHOLE (5) APPEARS TO STEEP <input type="checkbox"/> (6) DEPRESSIONS OR BULGES (7) SLIDES <input type="checkbox"/> (8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED <input type="checkbox"/> (9) OTHER _____
<b>CREST</b>	PROBLEMS NOTED: <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 _____
<b>DOWNSTREAM SLOPE</b>	PROBLEMS NOTED: <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 _____
<b>SEEPAGE</b>	PROBLEMS NOTED: <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 OUTFALL SEEN <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> (37) FLOW INCREASED/MUDDY (38) DRAIN DRY/OBSTRUCTED <input type="checkbox"/> (39) OTHER _____
<b>OUTLET</b>	PROBLEMS NOTED: <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 (45) OUTLET OPERATED DURING INSPECTION? <input type="checkbox"/> YES <input type="checkbox"/> NO 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 _____
<b>SPILLWAY</b>	PROBLEMS NOTED: <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 _____
<b>MAINTENANCE</b>	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"/> (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE <input type="checkbox"/> (68) OTHER _____

See Guidelines on Back of this Sheet				<b>Conditions Observed</b>			
				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
GOOD	ACCEPTABLE	POOR	MAINTENANCE				

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

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

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**