

**State Engineer's
24th Annual Report on Dam Safety
to the
Colorado General Assembly
Water Year 2007-08**



Crystal Dam, Montrose County, Division 4, High Hazard

Prepared by

**Colorado Division of Water Resources
Office of the State Engineer**

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February 2009

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EXECUTIVE SUMMARY

This report is submitted in compliance with Section 37-87-114.4, C.R.S., concerning the dam safety activities of the State Engineer and the Colorado Division of Water Resources relating to Sections 37-87-105 to 37-87-114, C.R.S. The reporting period for this report is from November 1, 2007 through October 31, 2008 (Water Year 2007-08) to better represent the dam safety activities over a full calendar year.

The mission of the Colorado Division of Water Resources' Dam Safety Branch is to prevent the loss of life and property damage and protect against the loss of water supplies due to the failure of dams in Colorado. The Dam Safety Branch accomplishes that mission primarily through Safety Evaluations of Existing Dams (SEED) to determine the safe storage levels of reservoirs within the state. Additional program tools include 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 Branch is managed by the State Engineer in accordance with Title 37, Article 87 of Colorado Revised Statute (C.R.S.) and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. The program is implemented by the State Engineer through the Dam Safety Branch and Water Division field offices. The Colorado Dam Safety Branch oversees a total of about 2,900 dams with 1,936 dams of jurisdictional size. Of these, about 1,808 are non-federal dams. Of the non-federal dams, approximately 626 (306 High Hazard and 320 Significant Hazard), or about 35 percent of the total non-federal dams are classified as dams that, in the event of a failure, would be expected to cause loss of life and/or significant property damage within the flood plain areas below the dams.

For WY 2007-08, the Dam Safety Branch accomplished a number of the goals and objectives identified in the past annual report. Through the diligent field observations of dam safety engineers statewide, several near-failure incidents were acted upon in time to diffuse potentially dangerous situations and possible loss of life. As a direct result of these actions, no loss of life or significant property damage occurred in Colorado in the 2007-08 timeframe. This is attributed to the increased awareness and responsibility of the dam owners for their dams, including emergency action planning and to the enforcement of the regulations, policies, and procedures by the Division of Water Resources.

During WY 2007-08, the State Engineer's Office approved seven plans for new dams and 37 plans for alteration, modification, or enlargement of existing dams. Hydrology studies for seven dams were also approved for determination of the inflow design flood for spillway adequacy or design. The estimated cost of construction for the submitted plans was over \$24.4 million. Six new dam construction projects and one reservoir enlargement project were approved for full water storage resulting in 20,000 acre-feet of additional storage in the State of Colorado.

During WY 2007-08, a total of 575 dam safety inspections and 204 construction inspections were conducted by dam safety engineers for a total of 779 inspections. In addition, 147 follow-up inspections were performed. At the conclusion of this reporting period, there are a total of 168 dams restricted from full storage due to inadequate spillways and various structural deficiencies such as significant leakage, cracking and sliding of embankments. The restrictions

provide risk reduction for the public and environment until the deficiencies identified 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 restricted list. More specifically, 4 High Hazard; 3 Significant Hazard; 4 Low Hazard structures dams were restricted amounting to a total of 4,715 acre-feet of storage restricted. This reporting period showed a slight decrease in the number of dams on the restricted list by three dams and the storage volume of the restrictions increased by approximately 2,436 acre-feet.

The Dam Safety Branch has been able to acquire and maintain a full staff of experienced professional engineers, and has adequate statutes, regulations, policies, and procedures to implement and carry out the program.

The following is a brief summary of Branch activities during WY 2007 - 08 in addition to the dam safety activities previously mentioned:

1. Completed the development of the Extreme Precipitation Analysis Tool (EPAT) for the Western Slope and for the Front Range above elevation 5,500 feet. The EPAT tool was developed by the consulting firm of HDR. Beta testing of EPAT continued by the Dam Safety Branch engineers resulting in the identification of modifications that need to be made to EPAT.
2. Provided assistance to the National Dam Safety Review Board (NDSRB) on developing a schedule tracking system, which will allow the board to track on going research, publications, and trainings.
3. Mark Haynes, Chief of the Dam Safety Branch, replaced Jack Byers as state representative to the Association of Dam Safety Officials (ASDSO) and was elected to serve on the Board of Directors of ASDSO. Mark is also serving as a representative from the State of Colorado for the Dam Sector of the Government Coordinating Council for the Department of Homeland Security.
4. URS Corporation submitted an evaluation of the Dam Safety Branch's program. The evaluation included an overview of the program for consistency with the National Dam Safety Act Reauthorization (NDSAR) of 2006. The evaluation concluded that the Dam Safety Program is well organized and administered in a way and that it is generally consistent with NDSAR 2006. The evaluation also states that one of the greatest strengths of the program is the small dedicated and well-trained staff that is devoted to the core missions of the program, leaving limited time available for other initiatives. The evaluation also made specific suggestions to improve the program that include: improving on the inclusion of risk-based methods, which will assist in adjusting staff priorities; review the large compilation of written policies to eliminate those that are no longer applicable and create a more limited volume of applicable policies; update the Dam Safety Project Review Guide to reflect the changes in the *2007 Rules and Regulations for Dam Safety and Dam Construction*; establish plans to review and revise, as necessary the *Rules and Regulations for Dam Safety and Dam Construction* every five years; and develop specific plans for replacing retiring staff with qualified individuals, which is a growing challenge throughout the dam safety community.

5. The Dam Safety Branch's Performance Evaluation Parameters were updated and submitted to the Corps of Engineers via the Dam Safety Program Management Tools (DSPMT). The program tracks the performance of the Dam Safety Branch at a National level and compares the program to other dam safety programs.
6. Paul Perri, Design Review Engineer was selected to serve a two-year appointment representing the Division of Water Resources on the National Committee on Levee Safety (NCLS). The NCLS convened in October and was tasked with developing recommendations for a National Levee Safety Program, including a strategic implementation plan by January 15, 2009. A summary of the recommendations and strategic plan will be presented in WY 2008-09 annual report.
7. Several special studies were performed by the Dam Safety Branch including: an analysis to estimate the potential impacts of a sudden and catastrophic release of water built up within the U.S. Bureau of Reclamation Leadville Mine Drainage Tunnel to be used for planning purposes by the Colorado Division of Emergency Management; an analysis to determine the potential flooding hazard in Pagosa Springs that would result should the active landslide form a natural dam across the East Fork of the San Juan River as a result of the landslide progressing into the river at a rate of approximately four feet per day.
8. The Branch held a one day Emergency Action Plan (EAP) workshop for Boulder County and separately for the National Weather Service. The workshops presented an overview of the new EAP format and methods for exercising an EAP.
9. The Branch held a one day dam safety training workshop for dam owners and Federal agencies in Division 4. The workshop covered the following topics: overview of the State Engineer's Office function and personnel and their responsibilities; review of the dam owner's responsibilities; reviewed fundamentals of dam safety; addressed dam security and threat assessments; and, presented funding resources available for dam rehabilitation projects.
10. A total of 19 dam incidents occurred this reporting period requiring emergency responses and investigations by the Dam Safety Branch. The incidents ranged from damage to a dam embankment due to a tornado to failure of the upstream slope of a dam due to the misoperation of the inlet conduit.
11. Several presentations were made by the Dam Safety Branch ranging from emergency action planning to results of the beta testing of EPAT. These presentations were made to various organizations such as the National Weather Service, real estate agents from Enterprise Title Company, and at national conferences.
12. Due to heavy snowpack on the Grand Mesa and in the Colorado River Basin, an aerial reconnaissance over several dams with limited access that are prone to heavy snow problems was performed by two dam safety engineers in cooperation with the Colorado Division of Wildlife. Also, due to snow clogging of emergency spillways at a few dams, an effort was undertaken by several DWR employees and the Dam Safety Branch to remove these blockages by the use of snow blowers.

1.0 INTRODUCTION

1.1 Program Mission

The mission of the Colorado Dam Safety Branch is to prevent the loss of life and property damage, determine the safe storage levels of reservoirs, and protect the state's water supplies from the failure of dams through the effective and efficient use of available resources. The Dam Safety Branch's program is firmly grounded in the use of periodic field observation of existing dams by highly qualified licensed professional engineers. The field observations, combined with engineering analyses form a basis for determining the safe storage levels of reservoirs within the state. Additional program tools include a comprehensive set of regulations, policies, and procedures for the design, construction, inspection, and maintenance of dams; the safe operation of reservoirs, emergency preparedness planning and emergency response. 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. Plans for new dams in Colorado must be approved prior to construction. A comprehensive review and approval process ensures the highest possible standards are met with regard to public safety. The Dam Safety Branch is managed by the State Engineer in accordance with Title 37, Article 87 of Colorado Revised Statute (C.R.S.) and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. 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.



**Upper Blue Dam, Summit County
Division 5, High Hazard**

1.2 Report Purpose

This report is submitted in compliance with Section 37-87-114.4, C.R.S., concerning the dam safety activities of the State Engineer and the Colorado Division of Water Resources relating to Sections 37-87-105 to 37-87-114, C.R.S. The reporting period for this report is from November 1, 2007 through October 31, 2008 (WY 2007-08) to better represent the dam safety activities over a full calendar year.

2.0 BRANCH OVERVIEW

2.1 Goals and Objectives

The Dam Safety Branch is responsible for the approximately 2,900 jurisdictional and non-jurisdictional dams within the state. To effectively and efficiently allocate available resources, the Dam Safety Branch concentrates on the jurisdictional dams and reservoirs as defined in Section 37-87-105, C.R.S., as "*Dams that are greater than ten feet high as measured at the spillway, that impound a reservoir with twenty acres or more in surface area, or one hundred acre-feet or more in reservoir capacity at the high water line qualify as Jurisdictional.*"

Both jurisdictional and non-jurisdictional dams are classified as to the estimated downstream consequences as a result of the failure of a dam absent of flooding conditions. Table 1 describes the State of Colorado Dam Hazard Classifications for jurisdictional and non-jurisdictional dams as stated in the 2007 edition of the Rules and Regulations for Dam Safety and Dam Construction.

TABLE 1
STATE OF COLORADO DAM HAZARD CLASSIFICATIONS

Classification	Definition
High	Loss of human life is expected to result from failure of the dam.
Significant	Significant damage is expected to occur, but no loss of human life is expected from the failure of the dam.
Low	Loss of human life is not expected and significant damage to structures and public facilities is not expected to result from failure of the dam.
No Public Hazard (NPH)	No loss of human life is expected and damage will occur only to the dam owner's property will result from failure of the dam.

The following goals of the program have been identified:

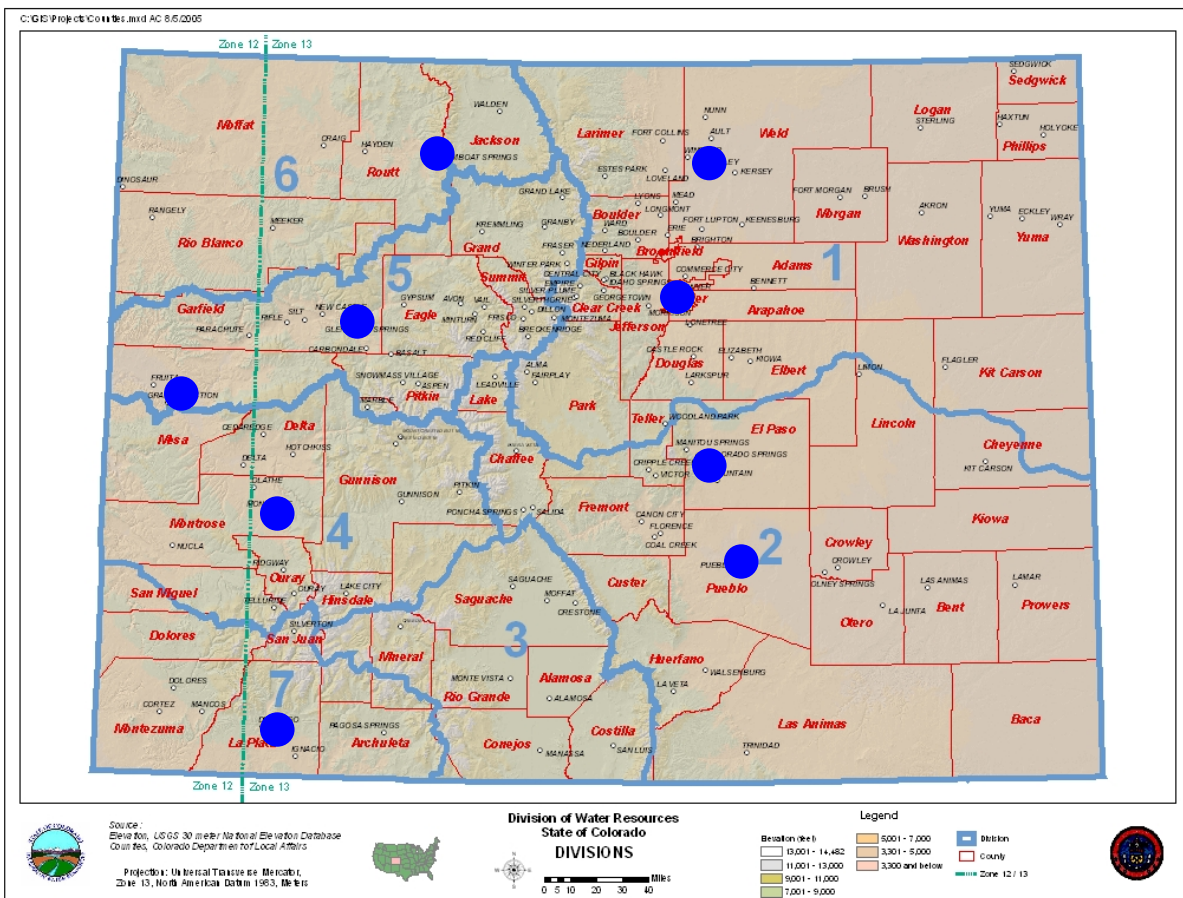
1. To protect the public, the Dam Safety Branch shall determine the amount of water that is safe to impound in reservoirs of the state in accordance with State Statutes.
2. To protect the public from failure of dams, the Dam Safety Branch shall review and recommend approval of plans and specifications for the construction, modification and repairs of dams, in accordance with the current Rules and Regulations for Dam Safety and Dam Construction, implemented on January 1, 2007.
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. 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. To improve the technical proficiency of the Branch, the Division of Water Resources shall provide for training and professional development of the Branch personnel.
6. To improve the Dam Safety Branch, to participate in the development of national policies on dam safety, and to take advantage of the continuing education and information available, to accomplish this the state shall be a full voting member of the Association of State Dam Safety Officials (ASDSO).

2.2 Organization

The State Engineer, through the Dam Safety Branch and the Division Engineers' offices, executes the Colorado Dam Safety Program. The Branch is overseen by the Deputy State Engineer and consists of a branch chief, dam safety engineers, and design review engineers. Starting in the mid-1980s, the Dam Safety Branch was decentralized from the Denver office to enable a statewide presence. Dam safety engineers were transferred from the Denver office to the Division offices throughout the state. Dam safety engineers were located in Greeley, Pueblo, Durango, Montrose, Glenwood Springs, and Steamboat Springs. This allowed a more even distribution of dam safety engineers and allowed the engineers to be in close proximity to the dams they are assigned to regulate. The process of relocating dam safety engineers to the Division offices took until approximately the mid 1990s. After several years of working with the newly decentralized Dam Safety Branch, the need for additional strategic positioning of dam safety engineers within the state was identified. Between 2003 and 2005, two dam safety engineers were relocated to field offices in Grand Junction and Colorado Springs. Figure 1 shows the current distribution of dam safety and design review engineers within the state.

Figure 1

Map of Colorado Showing Locations of Dam Safety Branch Personnel



Dam safety engineers are responsible for execution of the program in their geographic area. The design review engineers and branch chief have responsibilities throughout the state and are located in Denver. A summary of the branch organization and personnel organizational chart are included in Appendix A.

Interagency coordination occurs as necessary. A Memorandum of Understanding has been executed with the Colorado Division of Wildlife (DOW) regarding the responsibilities of each agency in carrying out the safety inspection of DOW dams. The DOW is performing safety inspections of DOW-owned low hazard dams.

The Colorado Water Conservation Board (CWCB) construction fund is available to assist owners with the repair of their dams. The Dam Safety Branch closely coordinates the review, approval, and final acceptance of CWCB funded dam construction and/or rehabilitation projects.

2.3 Roles and Responsibilities

The branch chief has program-wide responsibility for formulating the goals of the program, recommending policies for implementing the rules and 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 and Denver-based dam safety engineers.



**Williams Fork Dam, Grand County
Division 5, High Hazard**

The dam safety engineers' principal duties are to:

1. Respond to emergency situations.
2. Conduct dam safety field inspections of existing dams which provide the basis for determining the safe storage level of the reservoir.
3. Review the adequacy of spillways under the rules.
4. Set the safe storage level of reservoirs based in part on the results of field inspections and spillway adequacy reviews.
5. Review and recommend changes to dam hazard classifications.
6. Enforce the requirement for emergency action planning.
7. Assist dam owners in developing their Emergency Action Plans (EAP).
8. Provide design review and construction inspection of repairs and alterations when necessary.
9. Investigate complaints on the safety of dams.

Safety Evaluations of Existing Dams (SEED) field inspections are performed periodically with the frequency of inspections determined by the hazard classification. High Hazard dams are inspected annually, Significant Hazard dams are inspected every other year, Low Hazard dams are inspected every six years, and No Public Hazard (NPH) dams do not have a set inspection

frequency. NPH dams are typically only inspected at the owner's request or in the event of a specific event such as a complaint or for a hazard classification review. In recent years, a pilot program was developed to set forth the standards and procedures to reevaluate the frequency of inspections for High and Significant Hazard dams based on the Risk Based Profiling System (RBPS) results. Further discussion of this pilot program and the RBPS are presented later in this report.

Dam safety engineers also investigate dams constructed in violation of Section 37-87-105 (1) and (4), C.R.S., 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 Water-tank and Erosion Control Dam applications and do other related work as assigned.



**Homestake Dam, Eagle County
Division 5, High Hazard**

The design review engineer's primary duties are to review the design and construction documents for the construction, alteration, modification, repair, and enlargement of reservoirs or dams in accordance with Section 37-87-105, C.R.S. This involves comprehensive engineering reviews of the design and construction documents prepared by registered professional engineers experienced in the design and construction of dams. The reviews determine the adequacy of the design, compliance with the applicable state statutes, the current Rules and Regulations for Dam Safety and Dam Construction, and industry standards. The design review engineer recommends approval of

the project for construction to the State Engineer once all conditions have been met. Design review engineers also perform periodic inspections during dam construction to assure compliance with the approved plans and specifications and to evaluate proposed change orders. Upon successful completion of the projects, the design review engineer recommends to the State Engineer issuance of orders to allow water storage. Design review engineers also provide dam related technical assistance to other state agencies such as the Department of Health, the Division of Wildlife, Oil and Gas Conservation Commission, the Division of Minerals and Geology, the state's joint review process with the Department of Natural Resources, and the Division Engineers' offices, and perform other related work as required.

2.4 Summary of Colorado Dams

Currently, the Dam Safety Branch oversees a total of approximately 2,900 dams within Colorado. Of these, 1,936 are considered jurisdictional dams, of which about 1,808 are non-federal dams. Of the non-federal dams, approximately 626 (306 High Hazard and 320 Significant Hazard) or about 35 percent 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. Table 2 summarizes the distribution of dams by water division and hazard classification in Colorado.

TABLE 2

SUMMARY OF DAMS BY HAZARD CLASSIFICATION AND WATER DIVISION

HAZARD CLASS	WATER DIVISION							NON FEDERAL DAMS	FEDERAL DAMS	TOTAL
	1	2	3	4	5	6	7			
High	151	42	12	31	40	13	17	306	42	348
Significant	135	50	15	38	50	13	19	320	13	333
Low	427	94	29	147	108	110	53	968	62	1,030
NPH	50	97	16	5	25	13	8	214	11	225
TOTAL	763	289	73	221	223	149	97	1,808	128	1,936

3.0 BRANCH ACCOMPLISHMENTS

3.1 Dam Safety Branch Staff

The Dam Safety Branch acquired a couple of quality engineers to maintain a complete and diverse staff to achieve the mission and goals of the branch. The branch was fully staffed during this reporting period, for the first time in eight years.

In July 2008, Jack Byers, retired after serving 12 years as Deputy State Engineer for Public Safety. Jack's position will be filled in early December.

3.2 Dam Safety Inspections

Each dam safety engineer's highest priority is to perform periodic field SEED of the dams in their territory of responsibility. Dams rarely fail without first showing visible signs of distress, which, when detected by a highly educated and trained eye, can be the difference between a catastrophic failure and prompt corrective action. Regular visual observation is, therefore, the most important tool available to each dam safety engineer.

The statutes specify that dam safety inspections consist not only of field inspections of the dam and appurtenant structures, but also include the review of previous inspection reports, drawings, and periodic monitoring reports provided by dam owners. This review of each dam safety inspection also includes an evaluation of the adequacy of the spillway, a review of the current hazard classification, and a review of the Emergency Action Plan (EAP) for High and Significant hazard dams. Spillways for all dams are required to be able to pass the appropriate inflow design flood. The determination of the appropriate inflow design flood for a given dam is based on the size and hazard classification of the dam.

The hazard classification review accounts for changes in the development of the flood plain below the dam. Recent suburban development below once rural dams may result in the potential for increased property damage or likely loss of life in the event of a dam failure. An increased hazard classification results in more diligence on the part of the dam safety engineer and dam owner, and may result in requiring safety modifications to the dam. EAPs are required for High and Significant Hazard dams due to the increased potential for loss of life and/or property damage in the event of a dam failure. EAPs must be kept up to date to be effective and yearly reviews and updates are normally appropriate.

Periodic internal inspection of the outlet works and an annual evaluation of dam instrumentation monitoring data are also part of the workload as required by the regulations. Large diameter outlets can be inspected by man-entry using confined space procedures. Small diameter outlets are typically inspected by remote methods using video cameras designed for that purpose. The video inspection of outlets is the responsibility of the dam owner, with review of the videotape or DVD provided being performed by the dam safety engineers.

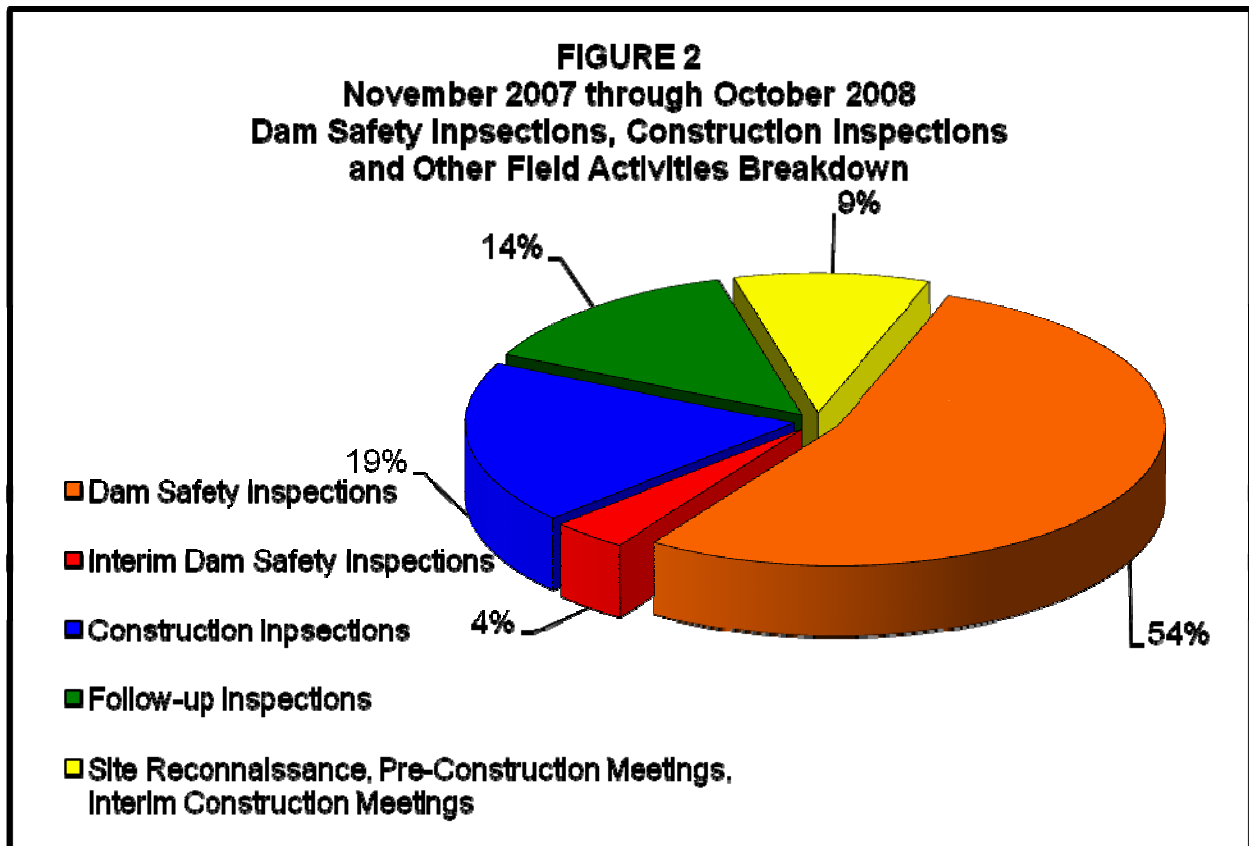
The findings of the dam safety inspection are documented in a report that rates the condition of the dam and appurtenant structures based on the field observations and document reviews. A copy of the Dam Safety Inspection Report Form is shown in Appendix B.

The overall condition of the dam and reservoir is rated according to the categories defined in Table 3 for full storage and a recommendation is made for the safe storage level of the reservoir.

**TABLE 3
OVERALL DAM CONDITON RATING DEFINITIONS**

OVERALL CONDITIONS	DEFINITION
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. Most of the required monitoring is being performed.
CONDITIONALLY SATISFACTORY	The safety inspection indicates symptoms of structural distress (seepage, evidence of minor displacements, etc.), which, if conditions worsen, could lead to the failure of the dam. Essential monitoring, inspection, and maintenance must be performed as a requirement for continued full storage in the reservoir.
UNSATISFACTORY	The safety inspection indicates definite signs of structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which could lead to the failure of the dam if the reservoir is used to full capacity. The dam is judged unsafe for full storage of water.

The report also identifies repair and maintenance work the owner should perform to extend the useful life of the structure through normal annual activities. For items requiring more than a normal level of maintenance, and any engineering and monitoring requirements that are deemed necessary to assure the safety of the dam, the dam safety engineer may require the owner hire a Colorado licensed professional engineer to design and direct the work. Figure 2 shows a breakdown of the different field activities performed by the dam safety engineers during this reporting year.



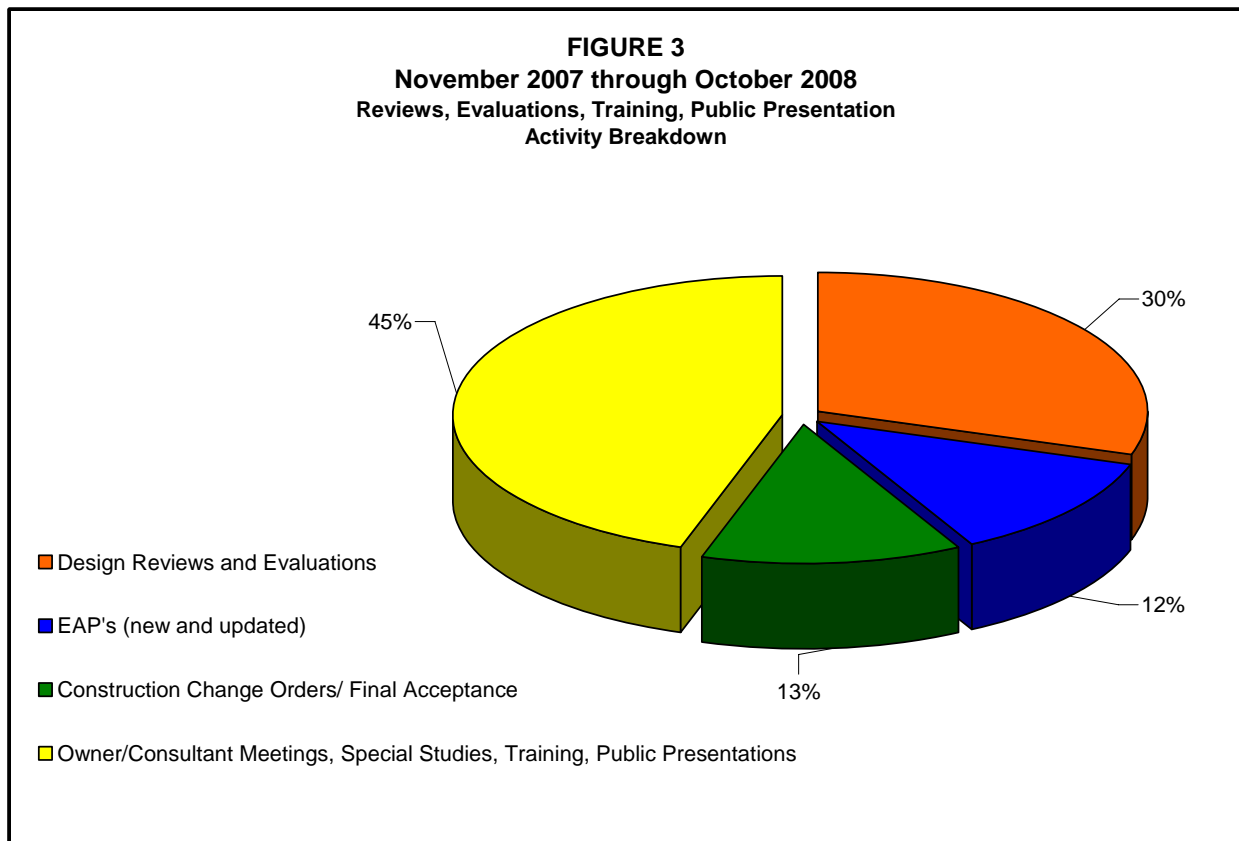
As shown previously in Table 2, over half of the jurisdictional dams in Colorado fall within the Low Hazard classification and are, therefore, only inspected every six years. In order to maintain a high level of confidence regarding the condition of these dams between regular inspections, water commissioners within the various water districts are often tasked to observe the condition of Low Hazard dams. Dam safety engineers and water commissioners both spend much of their time working in the field. This cooperative working arrangement allows efficient use of the water commissioners' field time when they are near jurisdictional dams as part of their regular water administration duties. They are also dispatched as needed to make specific observations and report on the condition of dams at critical times, such as during runoff season or following storms. A sample water commissioner observation report form is shown in Appendix C.

Dam safety engineers review the reports and observations of the water commissioners to determine if additional work is warranted or necessary on their part. Efficient use of the water commissioners' field time and observational abilities allows the Dam Safety Branch to allocate this important resource to maintain a consistent level of public safety at all times.

For inspections of federally-owned dams that the State Engineer's Office does not typically participate in, the reports prepared by the federal agencies are received and reviewed in accordance with Memoranda of Understanding (MOU) between the Dam Safety Branch and the various federal agencies.

3.3 Design Review and Construction Inspection

A summary of the activities related to Design Review and Construction inspection November 2007 through October 2008 is shown in Figure 3.



The State Engineer's Office approved plans for seven for new dams and 37 plans for alterations, modifications, enlargements or breaching of existing dams. The estimated cost of construction for the approved plans was \$24,400,000. Fees collected for the examination and filing of the submitted design and construction documents was \$40,500. Also, during this reporting period, seven hydrology studies were reviewed and approved along with one special study.

A complete listing of the plans submitted for review and approval are contained in Appendix D. In order to expedite the approval of repair plans for dams, the dam safety engineers located in the division offices review plans and specifications and perform the construction inspections on selected projects. In addition, one third-party review of the plans and specifications and one third-party site specific probable maximum precipitation analysis was performed from November 2007 through October 2008. This enables the owners to repair or construct their dams sooner by shortening the review time. The State Engineer provides oversight and approval of the plans and specifications performed by third parties.



**Stevens Dam, Archuleta County
Division 7, Significant Hazard**



**Crow Lane No. 1 Dam, Larimer County
Division 1, High Hazard**

Construction inspections are important to assure that the approved plans are being followed and to assure changed conditions encountered during construction do not jeopardize the safety of the design. The construction site visits are typically preceded by a review of the file and history of performance. In addition, coordination with the dam owner, owner’s engineer, division staff, and other interested parties is made so they also have an opportunity to take part in the inspection.

“As-Constructed” plans and completion documents showing any changes made during construction. These plans and documents are reviewed by the engineer who monitored the construction for completeness before being accepted for filing. The superseded plans are disposed of and the “As-Constructed” plans serve as the public record as required by the statutes.

Upon completion of construction, the dam owner’s design engineer submits copies of the

Section 37-87-114.5, C.R.S., 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, 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, C.R.S.



**James Tingle Dam, Park County
Division 1, High Hazard**

(Coal Mines), and structures that only store water below the natural surface of the ground.

Owners of small size dams that do not meet the jurisdiction size category of the State Engineer are required to submit a Notice of Intent to Construct a Non-Jurisdictional Water Impoundment Structure to the State Engineer 45 days prior to beginning construction under Section 37-87-125, C.R.S.

3.4 Dam Safety Incidents

3.4.1 Bull Canal Dam



**Bull Canal Dam, Weld County
Division 1, High Hazard**

Bull Canal Dam is a High Hazard dam located in Weld County. The dam consists of a 35-foot high zoned embankment with an upstream asphalt-lined face. The reservoir is filled with treated wastewater from the City of Northglenn's water treatment plant. On June 24, 2008, the dam owner reported a large depression on the upstream face of the dam just below the outfall structure that fills the reservoir. An investigation was performed by John Batka and observed that the asphalt lining had collapsed and sloughed down the embankment leaving an approximately 10-foot diameter scarp two to three feet deep. No wet

areas or signs of seepage were noticed along the downstream slope. John directed the owner to lower the reservoir a minimum of three feet so that the extent of the damages could be observed. Due to the observed damage, John recommended that the City of Northglenn retain an engineer to design the repairs that will need to be completed.

3.4.2 Windsor Lake

Windsor Lake Dam is a High Hazard dam located in Weld County. On May 22, 2008, a large tornado passed through the northeast corner of the Town of Windsor and directly over Windsor Lake Dam. Jeremy Franz observed an uprooted tree located at the downstream toe of the dam and a resulting hole approximately 10 feet in diameter and two to three feet in depth. Jeremy observed no evidence of active seepage due to the fact that there was no water being impounded on this portion of the dam at the time. Plans and specifications for repair of the hole left by the fallen tree as well as removal of other trees that are on the dam are being prepared by the owner's engineer.



**Windsor Lake Dam, Weld County
Division 1, High Hazard**

3.4.3 Sand Creek Detention Dam #6

Sand Creek Detention Basin #6 is a component of the Sand Creek flood control scheme in Colorado Springs extending from Dam #1 at Constitution Avenue and Sand Creek to Dam #6 at Woodman Road and Sand Creek. On January 29, 2007, this office wrote a letter to the design engineer and to the dam owner instructing them to suspend construction until plans and specifications are reviewed and approved by the State Engineer. The Dam Safety Branch received no correspondence from the owner or the engineer as requested. On August 15, 2008, Bill McCormick received a phone call that informed him that the reservoir behind Sand Creek Detention Dam #6 was full and spilling. Bill visited the site and observed a large sinkhole about 20 feet wide and 4 feet deep along the upstream side of the embankment and one foot below the grade along the downstream side of the embankment. From Bill's observations it was estimated the hazard of the structure to be in the low to significant category. To prevent further rise in the reservoir and possible failure, a temporary spillway was excavated in the right abutment of the dam and the reservoir was lowered. As a result of Bill's actions and in the interest of public safety, the City of Colorado Springs closed Woodmoor Road to traffic during the incident.



**Sand Creek Detention Dam, El Paso County
Division 2, Non Roster**

3.4.4 Hopkins Dam

Hopkins Dam is a Significant Hazard dam located in Garfield County. John G. Blair observed an intermittent flow that was producing impulses of turbid water exiting the toe drain as a result of the reservoir filling above the restricted level with the heavy spring snowmelt runoff. The outlet was opened and the water level was lowered to below the current restricted level. An order to lower the spillway or breach the dam was issued as a result of this action.



**Hopkins Dam, Garfield County
Division 6, Significant Hazard**

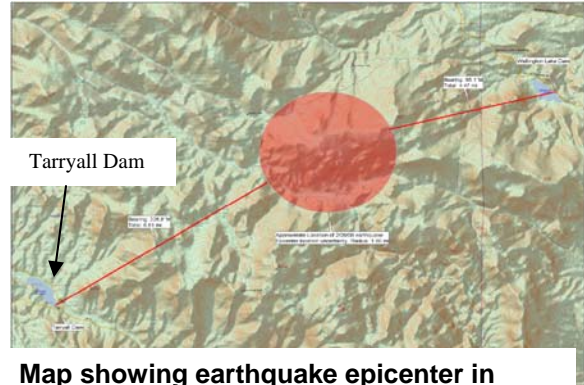
3.4.5 Big Battlement

Big Battlement Dam is a Significant Hazard dam located in Delta County. On June 5, 2008, the dam owner observed a new seep area along the downstream toe of the dam flowing at a rate of about 60 to 90 gallons per minute. As a result of Jason Ward's investigation and recommendation, a restriction has been placed on the reservoir and the dam owner is required to closely monitor the condition of the dam.

3.4.6 Tarryall Dam

Tarryall Dam is a High Hazard dam located in Park County. On February 26, 2008 a magnitude 2.9 earthquake was detected in eastern Park County. Bill McCormick determined that the epicenter was within 50 miles of Tarryall Dam and was concerned that the concrete dam might have been damaged.

Carl Copeman with the Division of Wildlife, the caretaker of the dam, observed no unusual conditions. From the observations made at the dam and Bill's subsequent investigation and evaluation, it was determined that the dam received no significant damage as a result of the seismic event.



Map showing earthquake epicenter in Park County

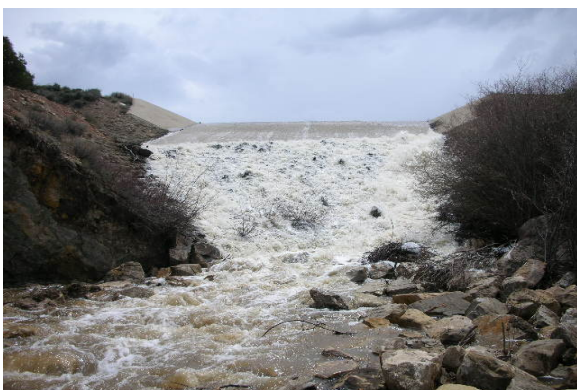
3.4.7 Biskup Dam

Biskup Dam is a Low Hazard dam located in Moffat County. Biskup Dam experienced a downstream slope failure. The slope failure occurred in an area where recent construction activities occurred without prior review and approval of the design by the Dam Safety Branch and State Engineer.



**Biskup Dam, Moffat County
Division 6, Low Hazard**

3.4.8 McElroy Dam



**McElroy Dam, Grand County
Division 5, Low Hazard**

McElroy Dam is a Low Hazard dam located in Grand County. McElroy dam was recently rehabilitated after a large sinkhole developed as the result of a failed 18-inch diameter corrugated metal pipe outlet that compromised the integrity of the dam. In the spring, the reservoir filled to capacity and began to discharge through the emergency spillway. With the reservoir above the maximum normal pool elevation, a seep developed along the left abutment contact of the dam. The seep was discharging clear water at a varying rate depending on the reservoir elevation. The outlet conduit was fully opened and, over time, the reservoir level was lowered to a point where the seep stopped flowing. The dam owner is monitoring the conditions and the reservoir is being maintained below the restricted level.

3.4.9 Green Valley Retention Dam

Green Valley Retention Dam is a Low Hazard dam located in Jefferson County. During the 2007 dam safety inspection, it was noted that a large slough and scarp occurred on the downstream slope of the dam due to piping of the dam embankment material as a result of the failure of the outlet conduit. A zero storage restriction was placed on the dam in January 2008. The dam owner disregarded the restriction and in May 2008, further failure of the outlet

conduit resulted in additional sloughing and damage to the downstream slope of the dam. The owner is now under orders to breach the dam to remove this public safety hazard.



**Green Valley Retention Dam, Jefferson County
Division 1, Low Hazard**

3.4.10 Other Notable Incidents

- Upper Urad Dam – Low hazard dam in Clear Creek County. Blockage of the outlet conduit resulted in a reduced release capacity during the peak of the spring snowmelt runoff.
- Dry Creek Dam – High hazard dam in Larimer County. Longitudinal cracking in the crest of the dam near the spillway of this recently constructed dam.
- Idaho Springs Dam – High hazard dam in Clear Creek County. Cracking and a depression noted at the upstream edge of the crest near the spillway.
- Dillon Dam – High Hazard dam in Summit County. Suspicious activities on the dam in the middle of winter raised concerns about dam security.
- Metroz Park Lower Dam – Low hazard dam in Mineral County. Failure of the upstream slide gate of the outlet works rendering the outlet inoperable.

3.5 Reservoir Storage Restrictions

If a dam safety inspection reveals that the overall conditions of a dam 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 and repair being provided by the owner.



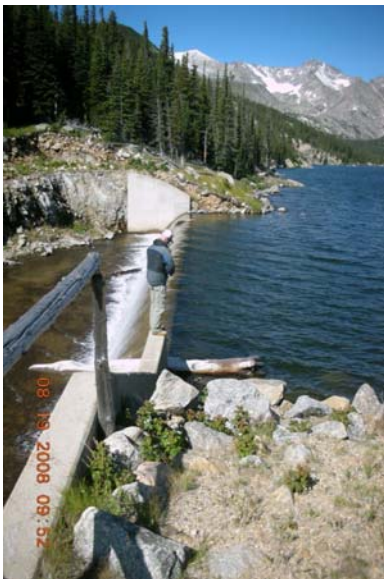
**Humphreys Dam, Mineral County
Division 3, High Hazard**

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, C.R.S.

At the conclusion of this reporting period, there were total of 168 dams restricted from full storage due to inadequate spillways and various structural deficiencies such as significant leakage, cracking and sliding of embankments. Figure 4 shows a chart of the number of reservoirs restricted around the state by hazard classification.



**Trujillo Meadows Dam, Conejos County
Division 3, Significant Hazard**



**Silver Lake, Boulder County
Division 1, High Hazard**

The total volume of storage lost due to storage restrictions is 117,650 acre-feet. Figure 5 presents a chart of the lost volume of reservoir storage due to reservoir restrictions around the state in each of the hazard classifications.

A storage restriction on dams provides 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 complete list of the restricted reservoirs at the end of the reporting period is included in Appendix E. 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 a slight decrease in the number of dams on the restricted list by three dams and the volume of the storage restrictions increased by approximately 2,436 acre-feet.

Figure 4
Number of Restricted Dams By Hazard Classification

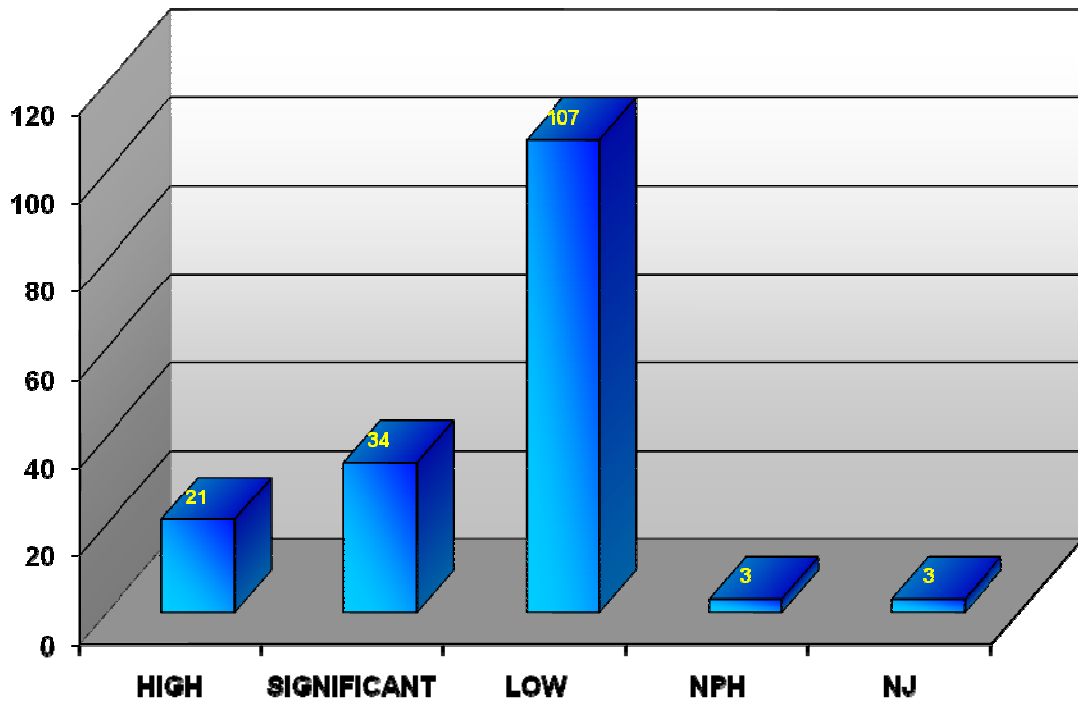
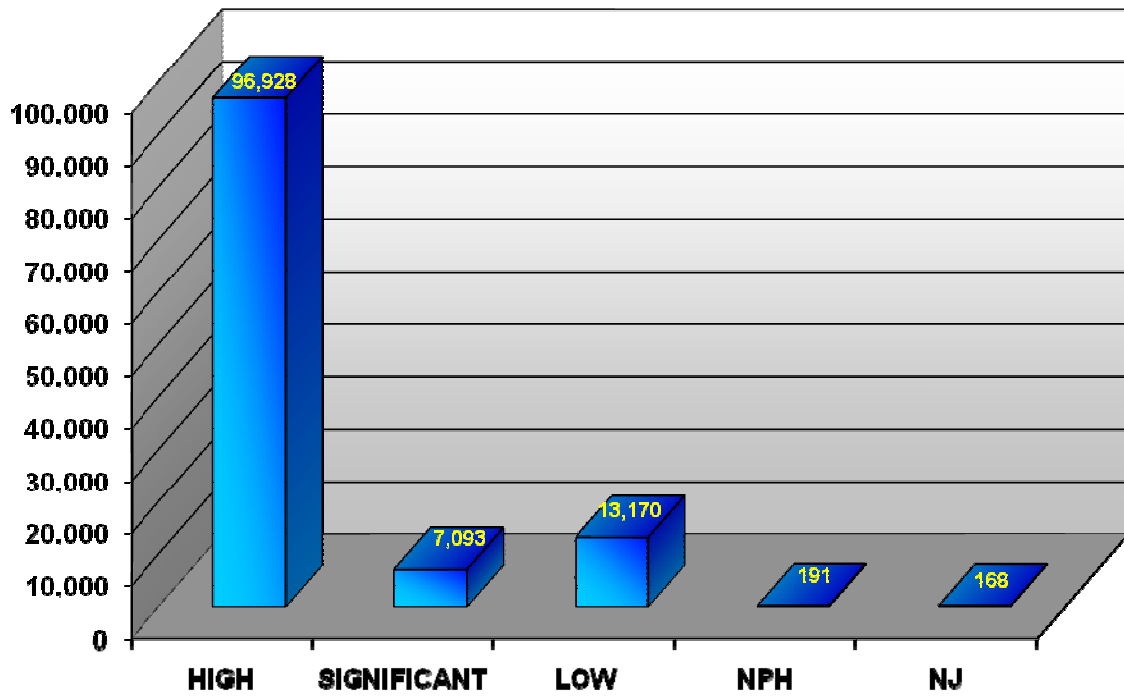


Figure 5
Restricted Storage In Acre-Feet by Hazard Classification



3.6 Staff Training



**Margaret-Carpenter Dam, Adams County
Division 1, Low Hazard**

A critical element in the Dam Safety Branch 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 year:

November 2007

- A three-day branch meeting attended by all dam safety engineers and dam safety officials with the Division of Wildlife and the U.S. Forest Service, and Jack Byers, Deputy State Engineer, was held in Colorado Springs, Colorado. The main focus of the meeting was to train all attendees in GeoSlope seepage (SEEP/W) and stability (SLOPE/W) analysis computer tools.

December 2007

- ASDSO On-Line Design Review Workshop was watched by all Dam Safety Engineers.

January 2008

- John Redding and Matt Gavin attended HEC-HMS/HEC-RAS Dam Break Analysis training by FEMA in Emmitsburg, Maryland.
- Jason Ward, Bill McCormick, and Mark Haynes attended an ASDSO technical seminar on Emergency Action Plans (EAP) in San Diego, California.

February 2008

- Jeremy Franz attended a FEMA Technical Seminar on Lessons Learned from Dam Failure in Emmitsburg, Maryland.
- Matt Gavin attended Earth School sponsored by the U.S. Bureau of Reclamation in Lakewood, Colorado.
- Bill McCormick held a one-day training session on HEC-HMS in Glenwood Springs which was attended by several dam safety engineers.
- John Redding and Garrett Jackson attended an open channel design seminar sponsored by Urban Drainage and Control District in Denver, Colorado.



**Robinson Dam, Summit County
Division 5, High Hazard**

March 2008

- Bill McCormick attended an ASDSO Technical Seminar on Earthquake Engineering for Dams in St. Louis, Missouri.

April 2008

- A three-day branch meeting attended by all dam safety engineers and dam safety officials with the Division of Wildlife and the U.S. Forest Service, personnel from CWCB and Jack Byers, Deputy State Engineer, was held in Montrose, Colorado. During the three-day meeting, the following topics were discussed:

- Review comments on the Basin Response Study prepared by George Sabol.
- Policy on flood control structures.
- Short course on GIS and the EPAT tool.

- Jack Byers, Mark Haynes, and Paul Perri attended the U.S Society on Dams (USSD) annual conference in Portland, Oregon.
- John R. Blair attended the Association of State Dam Safety Officials (ASDSO) Southeast Regional Conference.

May 2008

- Jeremy Franz and Matt Gavin attended the U.S. Bureau of Reclamation (USBR) Safety Evaluation of Existing Dams (SEED) in Lakewood, Colorado.
- John Redding attended a HEC-RAS training by FEMA in Emmitsburg, Maryland.

June 2008

- John Redding participated in an on-line seminar on the fundamentals of Hydrology.
- All dam safety engineers participated in a one day in-house training on GIS.

September 2008

- Mark Haynes, Paul Perri, Bill McCormick, Jason Ward, and Jeremy Franz, attended the ASDSO Annual Conference in Indian Wells, CA. Bill McCormick presented a paper on EPAT and Paul Perri moderated a technical session. Mark Haynes was elected to the Board of Directors of ASDSO and attended various meetings as the State Representative.

October 2008

- John Batka, Jeremy Franz, and John Redding attended portions of the Colorado Water Officials Association (CWOA) Annual Meeting.



**Eagle Park Dam, Eagle County
Division 5, High Hazard**

3.7 Presentations

This year, the Dam Safety Branch presented various topics to different audiences. These presentations include:

- John Batka and Greg Hammer presented an Emergency Action Plan (EAP) workshop to Boulder County.
- Greg Hammer, with assistance from Mark Haynes, presented two emergency action planning and response workshops for the National Weather Service.
- Bill McCormick gave a presentation on the roles and responsibilities of the Dam Safety Program at a Colorado Water Resources training for the Enterprise Title Company.
- Jason Ward with assistance from Mark Haynes conducted a half-day dam safety training session for dam owners and federal agencies in Division 4.
- Bill McCormick provided a presentation on the East Fork of the San Juan River Landslide at an America Water Resources Association (AWRA) luncheon.
- Bill McCormick presented a paper on EPAT at the ASDSO Annual Meeting.



**Left Hand Park Dam, Boulder County
Division 1, High Hazard**

3.8 Emergency Action 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. The entire 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 in the event of a dam failure. Colorado has been actively involved in this area since 1981, ultimately requiring that Emergency Action Plans (EAPs) be prepared for High Hazard and Significant Hazard dams



**Jolly John Dam, Arapahoe County
Division 1, Low Hazard**

as part of the regulations for dam safety adopted in September 1988. The revised Rules and Regulations clearly define standards in which EAPs are to be prepared and maintained. As a result of the revised EAP requirements in the 2007 *Rules and Regulations for Dam Safety and Dam Construction*, Jason Ward and Bill McCormick developed a Guideline on Preparing an

Emergency Action Plan (EAP). A sample EAP in Microsoft Word format was also developed that assists dam owners in assembling an EAP. Both documents are located on the Dam Safety Branch website: <http://water.state.co.us/damsafety/dams.asp>. These documents will provide dam owners with core information on developing or strengthening their EAP(s).



**South Catamount, Teller County
Division 2, High Hazard**

Although all High Hazard dams have such a plan, much work is still needed to update, maintain, and exercise the plans annually. Approximately 89 EAPs were reviewed and updated during this reporting period. However, 60 percent of the existing EAPs are over three years old and outdated. With the new guidelines it is anticipated that dam owners can update their EAPs in an efficient and effective manner.

Approximately 98 percent of the Significant Hazard dams have EAPs 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 EAPs. In some cases, we have prepared the plans for the owners.

The Dam Safety Branch also participated in five EAP tabletop exercises for the City of Aurora's High and Significant Hazard dams. The purpose of the tabletop exercises is to identify any gaps in the EAP, by going through the steps that one would take in the event of an emergency.

3.9 Dam Safety Data Management Systems

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 network connections. Recent upgrades to DAMS provides the dam safety engineers with access to the database while in the field and the ability to prepare safety inspection reports remotely and upload the reports to the database. 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 U.S. Army Corps of Engineers. Mark Haynes, Branch Chief, made a presentation on DAMS at the ASDSO National Conference.



**Crystal Dam, Montrose County
Division 4, High Hazard**

3.10 Publications/Internet

A number of publications are available at no cost on the Dam Safety web page at <http://water.state.co.us/damsafety/dams.asp>. The documents are in a variety of common formats including Microsoft Word and Adobe Acrobat PDF. Documents available include the Revised Rules and Regulations for Dam Safety and Dam Construction, Project Review Guide, application forms, sample plans, Livestock and Erosion Control Dam Permits, and Notice to Construct a nonjurisdictional Water Impoundment Structure, and the Guide to Construction and Administration of Dams in Colorado.



**Boehmer and Mason Dams
Teller County
Division 2, Low Hazard**

3.11 Risk-Based Approach

In the late 1990s, the Dam Safety Branch embarked on a program to utilize Risk-Based methods to rank dams according to potential failure modes and consequences. An Intergovernmental Agreement between the Bureau of Reclamation (USBR) and the Dam Safety Branch was issued to allow the USBR to revise their Risk-Based Profiling System (RBPS) to meet the needs of the Colorado Dam Safety Branch. The goal of the Colorado RBPS program was to develop a relatively simple (to the user) software tool to quickly rank the relative condition of High Hazard and Significant Hazard dams in the state. The rankings would then be used to more efficiently allocate resources to those dams determined to present the greatest risk to public safety.



**Trout Lake Dam, Hinsdale County
Division 3, Low Hazard**

After several iterations of evaluating prototype software, in the summer of 2005, a RBPS software tool suitable for use by the Dam Safety Branch was delivered. Since the software was delivered at a time when safety evaluations of existing dams by the dam safety engineers were at their peak, the tool was temporarily shelved. More recently, a commitment was made by all dam safety engineers to have RBPS rankings for the High and Significant Hazard dams in their areas of responsibility by the spring of 2006. These ranking were an important tool for the dam safety engineers as they develop schedules and priorities for the future inspection season.

In December 2006, a committee of dam safety engineers was assembled to establish the criteria to be used to determine the inspection frequency of High and Significant Hazard dams based on the results of the RBPS tool rankings. As a result of the committee activity, a policy memorandum was drafted that set forth the standards and procedures for a pilot program to determine the inspection frequency of High and Significant Hazard dams. The reduction in the

current inspection frequency of High and Significant Hazard dams is intended to allow for the re-allocation of resources to allow the dam safety engineers to concentrate on other dam safety related functions such as verification of the hydrology adequacy of existing dams, development and updating of emergency action plans, hazard classification re-evaluation and inundation mapping, public awareness activities, National Weather Service and emergency response personnel coordination, reduction of restricted dams, and the performance of Potential Failure Modes Analysis (PFMA) for existing dams.

Based on the results of the RBPS tool rankings and the recommendation of the committee, the inspection frequency of all High and Significant Hazard dams was based on the summation of the Static and Operation and Maintenance scores and as presented in the Table 4.

TABLE 4
INSPECTION FREQUENCIES FOR HIGH AND SIGNIFICANT HAZARD DAMS

RBPS Scores	High Hazard	Significant Hazard	Restricted Dams
> 135	Each Year	Each Year	Each Year
76 to 135	Each Year	Every Two Years	Each Year
51 to 75	Every Two Years	Every Three Years	Each Year
0 to 50	Every Three Years	Every Three Years	Each Year

The effectiveness of the pilot program to look at the reallocation of resources is still under review and evaluation. Preliminary indications have been that this approach could result in a significant imbalance of dam safety inspections from year to year for the dam safety engineers. Continued revisions to the program during this reporting period resolved some of the imbalance and result in an improved and more efficient program.

3.12 Federal Energy Regulatory Commission Non-Federal Dams

This year, several dam safety engineers participated in the Federal Energy Regulatory Commission (FERC) Part 12D Periodic Inspections and Potential Failure Mode Analysis (PFMA) workshops for non-federal dams regulated by FERC.

A PFMA workshop is an informal examination of potential failure modes for an existing dam and its appurtenances by a team of independent consultants, dam owner personnel and other people who are qualified either by experience or education to evaluate the dam and its appurtenances. A PFMA was conducted at the Cabin Creek Dam in Clear Creek County of Division 1.

FERC also requires the dam owners of non-federal dams regulated by them to periodically exercise their Emergency Action Plan (EAP). This practice is also required and performed by other federal agencies for their dams and is a requirement of our Rules and Regulations.

An EAP tabletop exercise was conducted for the following dams regulated by FERC or other federal dams and was attended by personnel of the Dam Safety Branch:

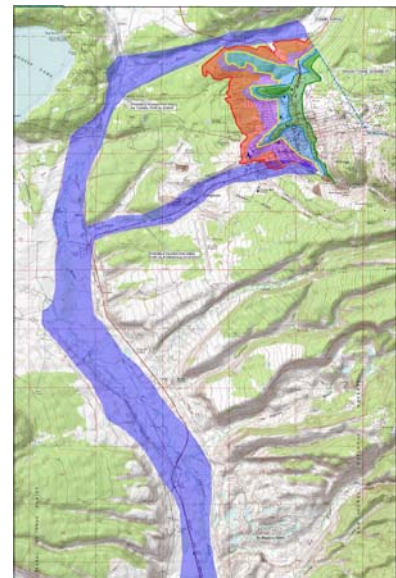
- Trout Lake Dam – FERC regulated in Division 7
- Horsetooth Lake Dam – U.S. Bureau of Reclamation regulated in Division 1

In the past, the Branch has performed safety inspections of dams that are also regulated by FERC. In accordance with an agreement (since a formal MOU was not completed) with them, they were to furnish copies of their reports for branch records. More recently, the Branch had curtailed participation in FERC-regulated dams in accordance with a 1998 State of Colorado internal audit. However, during a recent review of the agreement and procedures for administration of FERC-regulated dams, the need for a change in the current policy was identified. It was determined that the Dam Safety Branch does not regularly receive copies of FERC safety inspection reports. Further, it was clarified that unlike USBR and USCOE dams, the FERC does not own the dams they regulate and, in most cases, the dams are owned by Colorado based entities. To ensure the safety of the citizens of Colorado, it was determined that Dam Safety Branch engineers would resume performing dam safety inspection of FERC-regulated dams in Colorado. Policy Memorandum No. 06-02 modifies recommendation #3 of the 1998 legislative audit resuming inspections on non-federal dams that are regulated by FERC.

4.0 OTHER ACTIVITIES

4.1 Leadville Mine Drainage Tunnel

At the request of the Colorado Department of Emergency Management (DEM), the Dam Safety Branch was asked to perform an analysis to estimate the potential impacts of a sudden and catastrophic release of water built up within the U.S. Bureau of Reclamation Leadville Mine Drainage Tunnel. The volume of water in the tunnel was estimated at 1.5 billion gallons of water. Bill McCormick, dam safety engineer located in Colorado Springs, performed the analysis to estimate the potential impacts of the failure of the tunnel. Bill used the Army Corps of Engineers HEC-HMS hydrologic Modeling program to determine the peak flow as a result of the sudden release of the estimated volume of water in the tunnel. Using published documentation, Bill estimated the attenuation of the peak flow downstream of the tunnel. Bill used Arkansas River historical flow data obtained from Colorado's Decision Support System (CDSS) to estimate the effects of the attenuated flows on the areas downstream of the tunnel. The study was completed in a short period of time and was intended to provide DEM with information to be used for planning and evacuation purposes only.



**Inundation map
downstream of the
Leadville Mine Drainage
Tunnel, Lake County**

4.2 East Fork of the San Juan River Landslide

A landslide progressing into the river at a rate of approximately four feet per day on the East Fork of the San Juan River above Pagosa Springs generated concern over the potential flooding hazard that would result should the landslide form a natural dam across the river. The slide was located about 14 river miles upstream of Pagosa Springs. Paul Perri, Matt Gavin, and Bill McCormick performed an analysis to determine the peak discharge as a result of a failure of the natural dam. Due to the unpredictable nature of landslides, various dam heights and subsequent reservoir volumes were generated for dam heights up to 210 feet. Using empirical formulas and storage volumes generated at each dam height, peak breach flows were estimated. The peak flows for the various dam heights were routed downstream to estimate the potential impacts of the flood waters on downstream facilities and structures. After the spring snowmelt runoff season, the slide stabilized and did not continue to advance forward.



Landslide area above East Fork of the San Juan River, Archuleta County

4.3 Flight Reconnaissance of Dam in Division 4 and 5



Dams on the Grand Mesa

Because of the heavy snowpack that existed in the Western Slope mountains in 2008, the dam safety engineers out of our Glenwood Springs and Grand Junction offices flew over dams with poor access that are prone to heavy snow problems. These dams are on the Grand Mesa in Water Districts 40, 42, and 72 and in Districts 38, 39, 45, 53 and 63 in Garfield, Mesa and Pitkin Counties. Potential problems that were being looked for consisted of blockage in spillways and seepage or slope stability problems due to abnormally high reservoir levels. The purpose of this flight was to identify potential concerns from the air and then, if needed, make a ground inspection after the flight.

Approximately 70 dams were looked at in a two-hour period, which proved to be a very efficient way to identify major snow-pack related problems.

The flight generally identified no major problems in that all the spillways were basically clear and performing well and no other significant issues were identified. However, one Significant Hazard dam in district 38 in Garfield County with a restriction due to excessive seepage appeared to have an abnormally high reservoir level due to heavy runoff. As intended, this prompted a ground inspection, which involved hiking into the reservoir because of snow blockage of the access road. The inspection revealed a reservoir about five feet above the

restricted level with excessive seepage transporting turbid water. This prompted immediate lowering of the reservoir level and daily monitoring of the seepage and then an order to breach the dam in the fall. Without the flight first identifying the problem, this dam may have failed. The flight also identified two dams that did not need to be inspected this year because they stored no water. As such, the flight turned out to be very beneficial in protecting the public safety and an efficient use of funds. The flight was performed in cooperation with the Colorado Division of Wildlife.

4.4 Spillway Blockage Removal

Division 4 Dam Safety Engineer Jason Ward spent two days in late May 2008 assisting Water Commissioners on the Grand Mesa with clearing ice and snow from spillway channels. Many of the dams in this area are remote and clearing the spillways just prior to spring runoff helps prevent potential ice blockage and subsequent overtopping events. This annual collaborative effort between the Water Commissioners and water users has been going on for several years and is a valuable contribution to ensuring safe dams on the Grand Mesa.



**Donnelly #1 Dam, Delta County
Division 4, Significant Hazard**

4.5 Extreme Precipitation Analysis Tool

Funded by the Dam Safety Branch NDSP grant and the CWCB, the final version of the Extreme Precipitation Analysis Tool (EPAT) for the West and East (down to Elevation 5,500) slopes was released to be used by consultants and by the Dam Safety Branch to analyze extreme precipitation events. The Dam Safety Branch performed a rigorous quality assurance analysis using the EPAT tool that resulted in several minor modifications to EPAT. The results of the quality assurance analysis were presented at the 2008 ASDSO Annual conference held in September.

4.6 Evaluation of the Dam Safety Program

URS Corporation's evaluation of the Dam Safety Program was submitted to the branch in June. The evaluation included an overview of the program in the following areas:

- The Dam Safety Program for consistency with the National Dam Safety Act Reauthorization (NDSAR) of 2006.
- The Extreme Precipitation Analysis Tool (EPAT) methodology and other aspects of the program for incorporation of consideration of risk into the Dam Safety Program.
- Emergency Action Plan requirements and procedures.
- The revised Rules and Regulations for Dam Safety and Dam Construction, the Dam Safety Design Manual, and Inspection Manual.



**Albion Lake Dam, Boulder County
Division 1, Significant Hazard**

The review was completed by Mr. John W. France, P.E. of the URS Denver office. Mr. France has been practicing in the dam safety field for more than 25 years. Overall, Mr. France believes that the Dam Safety Program is well organized and administered in a way that is generally consistent with NDSAR 2006. Mr. France points out that one of the greatest strengths of the program is the dedicated and well-trained staff. Mr. France also mentions that the accomplishments of the staff are somewhat limited by the size of the staff and resources available to the program. Mr. France further

explains that most of the staff time is devoted to the core missions of the program, leaving limited time available for other initiatives.

Mr. France also offered several specific suggestions to consider implementing into the Dam Safety Program in the future. Some of the suggestions include:

1. Improve inclusion of risk-based methods in the program, which will assist in adjusting staff priorities.
2. Take whatever steps are practical toward having all Emergency Action Plans for High Hazard dams converted to the new format expeditiously.
3. Review the large compilation of written policies to eliminate those that are no longer applicable and create a more limited volume of applicable policies.
4. Update the Dam Safety Project Review Guide to reflect the changes in the *2007 Rules and Regulations for Dam Safety and Dam Construction*.
5. Establish plans to review and revise, as necessary the *Rules and Regulations for Dam Safety and Dam Construction* every five years.
6. Develop specific plans for replacing retiring staff with qualified individuals, which is a growing challenge throughout the dam safety community.

5.0 COORDINATION WITH NATIONAL 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, serving on task groups and committees, and taking advantage of ASDSO-sponsored training opportunities.

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 the state dam safety program. Mark Haynes, Chief of the Dam Safety Branch, has replaced Jack Byers as the state's representative to ASDSO, and has also been selected to serve on the Board of Directors of ASDSO.



**Trout Lake Dam, Hinsdale County
Division 3, Low Hazard**

5.2 Government Coordinating Council (GCC)

Mark Haynes was selected to serve as one of eight state representatives on the Dam Sector committee of the Department of Homeland Security (DHS) Government Coordination Council (GCC) and Paul Perri was selected to be his alternate. The purpose of the GCC is to bring together a diverse federal, state, local, and tribal interests to develop and identify collaborative strategies that advance critical infrastructure protection and security. Participation on the GCC will include reviewing ongoing initiatives and discuss relevant issues as they relate to security and protection of state-regulated Dams Sector assets. In addition, participation will also involve the organizing, coordinating and facilitating a series of technical training meetings and workshops to provide valuable educational and professional development as it relates to dam security issues.



**Levee along Templeton Gap in
Colorado Springs**

5.3 National Committee on Levee Safety

In October 2008, Paul Perri was selected to serve a two-year appointment representing the Department of Water Resources on the National Committee on Levee Safety (NCLS). The committee is comprised of 16 members, each an expert in some aspect of levee safety: one from USACE, one from FEMA, eight from state levee safety agencies, two from the private sector, two from local/regional governments, and two from Indian Tribes. The NCLS convened in October and was tasked with developing recommendations for a National Levee Safety Program, including a strategic implementation plan by January 15, 2009. A summary of the recommendations and strategic plan will be presented in WY 2008-09 annual report.

5.4 Federal Dam Safety Programs

5.4.1 General

Routine inspections of federal dams by dam safety engineers have been curtailed in accordance with a 1998 legislative audit recommendation. The branch, however, participates 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 activities and inspections. During this reporting period, participation in these safety inspections was minimal and was primarily used to maintain communication between the dam safety branch and the various federal agencies.



**Manitou Dam, El Paso County
Division 2, High Hazard**



**Upper Blue Dam, Summit
County, Division 1, High Hazard**

5.4.2 Memoranda of Understandings

Memorandums of Understanding (MOU) have been executed with the U.S. Bureau of Reclamation (USBR), the U.S. Bureau of Land Management, and the Air Force Academy (AFA) relating to dam safety activities in Colorado. An MOU is also in development for the Fort Carson Army installation. The MOUs provide for the exchange of safety-related information of dams under each agency's jurisdiction.

An 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. MOUs are being pursued with the other federal agencies such as the U.S. Army Corps of Engineers (USCOE) 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.

6.0 FISCAL RESPONSIBILITY

6.1 Use of Appropriated Funds

Dam safety personal service expenditures for fiscal year 2007-08 were approximately \$1,650,000.

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 2007. These funds are used to provide advanced training to the Dam Safety Branch personnel in the fields 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.

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 \$40,500 for filing plans and specifications during the period.

7.0 ENFORCEMENT ORDERS, PROCEEDINGS, AND LEGISLATION

No enforcement orders or proceedings on dam safety were issued or conducted during the period. Also, no legislation affecting dam safety was enacted during the period.

8.0 SUMMARY OF WY 2008-09 DAM SAFETY BRANCH GOALS

In addition to yearly program goals of inspections and design reviews, the following are additional branch goals for WY 2008-09:

1. Continue to perform dam owner training by conducting one-day workshops at various locations throughout the state.
2. Expand the Division of Water Resources Dam Safety Branch's involvement in National Dam Safety and Security activities.
3. Establish a policy on evaluating dam hazard classifications.
4. Establish a policy on determining dam breach parameters.
5. Establish a policy on performing hydrology studies.
6. Update or establish Memorandums of Understanding (MOUs) with FERC, BLM, and DOW.
7. Review and update current policy documents.
8. Update the Owners Dam Safety Manual.
9. Update the Design Review Guide to be consistent with the 2007 Rules and Regulations.
10. Continue to provide professional training of branch personnel.
11. Improve coordination and communication of personnel within the program and Division Offices.
12. Continue efforts in communicating and educating dam owners in the need to maintain and update their Emergency Action Plans.
13. Continue to evaluate the inclusion of risk-based methods in the dam safety program.
14. Continue to communicate and educate the public on dam safety.



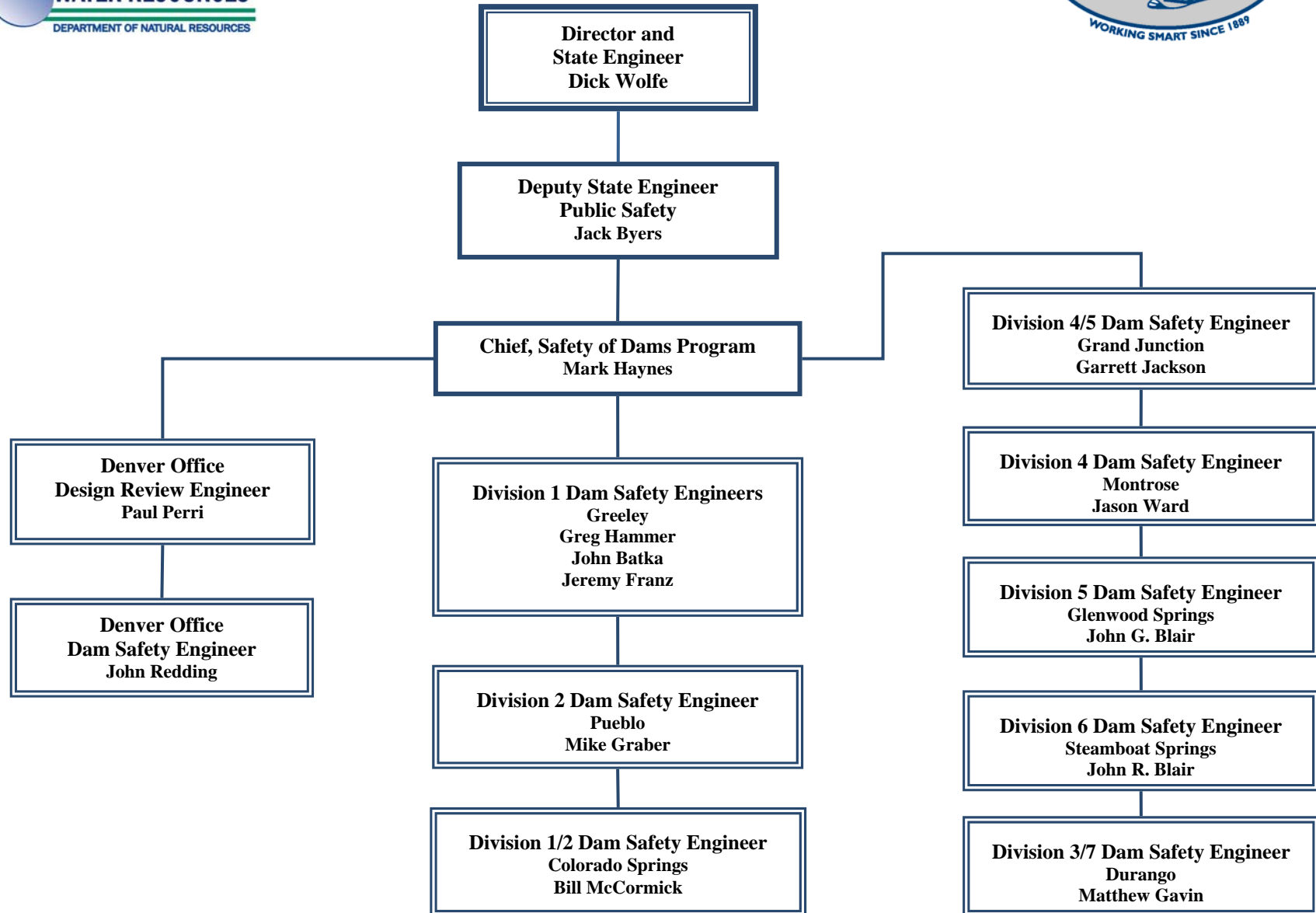
**Terrace Dam, Conejos County
Division 3, High Hazard**

APPENDIX A

DAM SAFETY BRANCH ORGANIZATION AND PERSONNEL



COLORADO DIVISION OF WATER RESOURCES SAFETY OF DAMS PROGRAM ORGANIZATIONAL CHART



APPENDIX A
DAM SAFETY BRANCH ORGANIZATION AND PERSONNEL

NAME	LOCATION	GRADE	TITLE	RESPONSIBILITY
Jack Byers	Denver	PE IV	Deputy State Engineer	Oversight of Colorado Dam Safety Branch Program, ASDSO State Representative and board member, national Dam Safety Review Board, Government Coordination and Security Council, Colorado Infrastructure Protection Committee
Mark Haynes	Denver	PE III	Branch Chief, Dam Safety Branch	Oversight of Safety Evaluations of Existing Dams and Design Review and Construction Inspection Activities
Paul Perri	Denver	PE II	Design Review/Const. Inspect. Engineer	Engineering review of design documents and construction inspection
Jeremy Franz	Greeley	PE II	Dam Safety Engineer	Safety Evaluations of existing Dams in Water Division 1
John Batka	Greeley	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Division 1
Greg Hammer	Greeley	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Division 1
Bill McCormick	Colorado Springs	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Divisions 1 and 2
Mike Graber	Pueblo	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Division 2
Matt Gavin	Durango	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Divisions 3 and 7
Jason Ward	Montrose	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Division 4
John G. Blair	Glenwood Springs	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Division 5
Garrett Jackson	Grand Junction	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Divisions 4 and 5, and review of design documents on the Western Slope
John R. Blair	Steamboat Springs	PE II	Dam Safety Engineer	Safety Evaluations of Existing Dams in Water Division 6
John Redding	Denver	PE I	Dam Safety Engineer	Safety Evaluations of Existing Class 3 Dams in Water Division 1, and assistance to Denver Design Review Unit staff

APPENDIX B

DAM SAFETY ENGINEER DAM SAFETY INSPECTION REPORT FORM

ENGINEERS INSPECTION REPORT

INSPECTOR:

OFFICE OF THE STATE ENGINEER - DIVISION OF WATER RESOURCES - DAM SAFETY BRANCH

1313 SHERMAN STREET, ROOM 818, DENVER, CO 80203, (303) 866-3581

DAM NAME: 	T: 	R: 	S: 	COUNTY: 	DATE OF INSPECTION:
DAM ID: 	YR Compl: 	DAM HEIGHT(FT): 	SPILLWAY WIDTH(FT): 		PREVIOUS INSPECTION:
CLASS: 		DAM LENGTH(FT): 	SPILLWAY CAPACITY(CFS): 		CAPACITY(AF):
DIV: 	WD: 	CRESTWIDTH(FT): 	FREEBOARD (FT): 		SURFACE AREA(AC):
EPP: 	8/5/2002	CRESTELEV(FT): 	DRAINAGE AREA (AC.): 		OUTLET INSPECTED:

CURRENT RESTRICTION

OWNER: 	CONTACT NAME:
ADDRESS: 	CONTACT PHONE:

INSPECTION PARTY: _____
 REPRESENTING: _____

FIELD CONDITIONS OBSERVED	WATER LEVEL: BELOW DAM CREST _____ FT. Above Spillway _____ FT.	GAGE ROD READING _____
	GROUND MOISTURE CONDITION: DRY <input type="checkbox"/> WET <input type="checkbox"/> SNOWCOVER <input type="checkbox"/> OTHER <input type="checkbox"/>	

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

UPSTREAM SLOPE	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) CRACKS WITH DISPLACEMENT <input type="checkbox"/> (4) SINKHOLE <input type="checkbox"/> (5) APPEARS TOO STEEP <input type="checkbox"/> (6) DEPRESSIONS OR BULGES <input type="checkbox"/> (7) SLIDES <input type="checkbox"/> (8) CONCRETE FACING - HOLES, CRACKS, DISPLACED, UNDERMINED <input type="checkbox"/> (9) OTHER
CREST	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
DOWNSTREAM SLOPE	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) DEPRESSIONS OR BULGES <input type="checkbox"/> (27) SLIDE <input type="checkbox"/> (28) SOFT AREAS <input type="checkbox"/> (29) OTHER
SEEPAGE	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 OUTFALLS SEEN <input type="checkbox"/> No <input type="checkbox"/> Yes <small>Show location of drains on sketch and indicate</small> <input type="checkbox"/> (37) FLOW INCREASED / MUDDY <input type="checkbox"/> (38) DRAIN DRY / OBSTRUCTED <input type="checkbox"/> (39) OTHER
OUTLET	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 <input type="checkbox"/> (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
SPILLWAY	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

Conditions Observed		
GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR
GOOD	ACCEPTABLE	POOR

See Guidelines on Back of this Sheet

MONITORING	EXISTING INSTRUMENTATION FOUND <input type="checkbox"/> (110) NONE <input type="checkbox"/> (111) GAGE ROD <input type="checkbox"/> (112) PIEZOMETERS <input type="checkbox"/> (113) SEEPAGE WEIRS / FLUMES <input type="checkbox"/> (114) SURVEY MONUMENTS <input type="checkbox"/> (115) OTHER _____ MONITORING OF INSTRUMENTATION <input type="checkbox"/> (116) NO <input type="checkbox"/> (117) YES PERIODIC INSPECTIONS BY: <input type="checkbox"/> (118) OWNER <input type="checkbox"/> (119) ENGINEER _____ _____	GOOD ACCEPTABLE POOR	MONITORING
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MAINTENANCE AND REPAIR	PROBLEMS NOTED: <input type="checkbox"/> (60) NONE <input type="checkbox"/> (61) ACCESS ROAD NEEDS MAINTENANCE <input type="checkbox"/> (62) CATTLE DAMAGE <input type="checkbox"/> (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (66) DETERIORATED CONCRETE - FACING, OUTLET SPILLWAY <input type="checkbox"/> (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE <input type="checkbox"/> (68) OTHER _____ _____ _____	GOOD ACCEPTABLE POOR	MAINTENANCE AND REPAIR
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OVERALL CONDITIONS	Based on this Safety Inspection and recent file review, the overall condition is determined to be: <input type="checkbox"/> (71) SATISFACTORY <input type="checkbox"/> (72) CONDITIONALLY SATISFACTORY <input type="checkbox"/> (73) UNSATISFACTORY	OVERALL CONDITIONS
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The State Engineer, by providing this dam safety inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages caused by leakage or overflow of waters from the reservoir or floods resulting from a failure of the dam.	ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM
MAINTENANCE - MINOR REPAIR - MONITORING <input type="checkbox"/> (80) PROVIDE ADDITIONAL RIPRAP: _____ <input type="checkbox"/> (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE _____ <input type="checkbox"/> (82) CLEAR TREES AND/OR BRUSH FROM: _____ <input type="checkbox"/> (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES: _____ <input type="checkbox"/> (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE: _____ <input type="checkbox"/> (85) PROVIDE SURFACE DRAINAGE FOR: _____ <input type="checkbox"/> (86) MONITOR: _____ <input type="checkbox"/> (87) DEVELOP AND SUBMIT AN EMERGENCY PREPAREDNESS PLAN: _____ <input type="checkbox"/> (88) OTHER _____ <input type="checkbox"/> (89) OTHER _____	
ENGINEERING - EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO: (Plans and Specifications must be approved by State Engineer prior to construction) <input type="checkbox"/> (90) PREPARE PLANS AND SPECIFICATIONS FOR REHABILITATION OF THE DAM: _____ <input type="checkbox"/> (91) PREPARE AS-BUILT DRAWINGS OF: _____ <input type="checkbox"/> (92) PERFORM A GEOTECHNICAL INVESTIGATION TO EVALUATE THE STABILITY OF THE DAM: _____ <input type="checkbox"/> (93) PERFORM A HYDROLOGIC STUDY TO DETERMINE REQUIRED SPILLWAY SIZE: _____ <input type="checkbox"/> (94) PREPARE PLANS AND SPECIFICATIONS FOR AN ADEQUATE SPILLWAY: _____ <input type="checkbox"/> (95) SET UP A MONITORING SYSTEM INCLUDING WORK SHEETS, REDUCED DATA AND GRAPHED RESULTS: _____ <input type="checkbox"/> (96) PERFORM AN INTERNAL INSPECTION OF THE OUTLET: _____ <input type="checkbox"/> (97) OTHER: _____ <input type="checkbox"/> (98) OTHER: _____ <input type="checkbox"/> (99) OTHER: _____	

SAFE STORAGE LEVEL RECOMMENDED AS A RESULT OF THIS INSPECTION	
<input type="checkbox"/> (101) FULL STORAGE <input type="checkbox"/> (102) CONDITIONAL FULL STORAGE <input type="checkbox"/> (103) RECOMMENDED RESTRICTION <input type="checkbox"/> (104) CONTINUE EXISTING RESTRICTION	RESTRICTED LEVEL OFFICIAL ORDER TO FOLLOW { _____ } FT. BELOW DAM 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

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

CONDITIONS OBSERVED - APPLIES TO SEEPAGE

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

CONDITIONS OBSERVED - APPLIES TO MONITORING

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

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

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

OVERALL CONDITIONS

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

SAFE STORAGE LEVEL

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

CLASSIFICATION OF DAMS

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

APPENDIX C

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.

UPSTREAM SLOPE	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 _____
CREST	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 _____
DOWNSTREAM SLOPE	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 _____
SEEPAGE	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 OUTPALL SEEN ___ No ___ Yes <input type="checkbox"/> (37) FLOW INCREASED/MUDDY (38) DRAIN DRY/OBSTRUCTED <input type="checkbox"/> (39) OTHER _____
OUTLET	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 _____
SPILLWAY	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 _____
MAINTENANCE	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 _____

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

See Guidelines on Back of this Sheet

The State Engineer, by providing this dam safety observation report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of the 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.

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

APPENDIX D

WY 07 - 08

APPROVED PLANS AND SPECIFICATIONS

FOR

NEW DAMS AND ALTERATIONS, ENLARGEMENTS

OR REPAIRS OF EXISTING DAMS

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

Dam Name	DAMID	Construction No.	Construction Type	Approval Date
DALBO PICEANCE CREEK EVAPORATION POND 1	430__A	C-1920	NEW	02-Nov-07
DALBO PICEANCE CREEK EVAPORATION POND 2	430__B	C-1921	NEW	02-Nov-07
DALBO PICEANCE CREEK EVAPORATION POND 3	430__C	C-1922	NEW	02-Nov-07
HODER RECREATION	805108	C-1074A	REPAIR	05-Nov-07
EMPIRE (EAST EMBANKMENT)	010728	C-0465D	REPAIR	03-Dec-07
CHIEF CREEK #4	650105	C-0771F	REPAIR	24-Jan-08
PLATTE VALLEY RESERVOIR #1	02__A	C-1924	NEW	24-Jan-08
FELLOWS	070131	C-1177B	MODIFICATION	04-Feb-08
LESTER CREEK	580113	C-0968E	REPAIR	13-Feb-08
SOUTH SIDE	040213	C-0155B	REPAIR	29-Feb-08
STONEWALL SPRINGS CENTRAL	14__	C-1927	NEW	14-Mar-08
JAMES TINGLE	23__A	C-1932	NEW	14-Mar-08
HORSESHOE LAKE (SOUTH DAM)	040244	C-0807G	MODIFICATION	16-Apr-08
FOOTHILLS HOLDING POND	080402	C-1574A	MODIFICATION	16-Apr-08
MARSTON LAKE - NORTH DAM	090129	C-0970D	MODIFICATION	16-Apr-08
TRAIL RIDGE MV 1-23 WATER IMPOUNDMENT	390128	C-1947	MODIFICATION	25-Apr-08
SUMMITVILLE TAILINGS	210103	C-1245A	ENLARGEMENT	02-Jun-08
PINE BROOK	060328	C-1878A	MODIFICATION	19-Jun-08
LAKE GRANT	590115	C-1754B	MODIFICATION	24-Jun-08
JOE KING #2	420130	C-0620A	ENLARGEMENT	24-Jun-08
RITSCHARD	500133	C-1725A	REPAIR	11-Jul-08
JUNIATA	420128	C-0661D	ENLARGEMENT	14-Jul-08
MOUNTAIN	230308	C-1934	REPAIR	15-Jul-08
WOODMOOR LAKE	100311	C-1199E	MODIFICATION	28-Jul-08
PDC FRESH WATER PIT	390127	C-1940	BREACH	01-Aug-08
BULL CREEK #4	720115	C-1877	MODIFICATION	11-Aug-08
DEER CREEK #3	620126	C-1939	MODIFICATION	25-Aug-08
LAKE GRACE	100207	C-0242A	MODIFICATION	25-Aug-08
LEO LAKE	100460	C-1931	REPAIR	25-Aug-08
TRUJILLO MEADOWS	220103	C-0722E	MODIFICATION	25-Aug-08
BIG MOLAS LAKE	300138	C-1926	MODIFICATION	27-Aug-08
LAMBERTSON LAKE #3	020645	C-1935	MODIFICATION	22-Sep-08
MESA CREEK #2	720214	C-0622C	REPAIR	22-Sep-08
GURLEY	600108	C-0460D	REPAIR	03-Oct-08
INTERQUEST SOUTH POND A	100461	C-1945	NEW	03-Oct-08
CRAIG #2	630106	C-0607B	REPAIR	09-Oct-08
BULL CANAL (MAIN RESERVOIR)	020607	C-1573C	REPAIR	14-Oct-08
SOUTH SIDE	040213	C-0155C	MODIFICATION	16-Oct-08
PROSPECT	010505	C-1439E	REPAIR	16-Oct-08
HOPKINS	380113	C-0090B	BREACH	17-Oct-08
MESA CREEK #3	720215	C-1218A	REPAIR	22-Oct-08
SIGNAL #2	020323	C-1476A	MODIFICATION	22-Oct-08
7 W GUEST RANCH POND	530209	C-1946	MODIFICATION	30-Oct-08
BEAVER	400115	C-0830D	REPAIR	30-Oct-08

APPENDIX E

**State of Colorado
Dam Safety Branch
Listing of Dams under Storage Restriction Orders**

DIVISION 1

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

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
010506	1	RIVERSIDE	GH 33.55 FT.	no spillway; 33.55 is max decree	33.5	5/9/1984	I	0
010728	1	EMPIRE (EAST EMBANKMENT)	Restricted to Gage Height 29.0	Wave Erosion Damage at Full Storage	29	11/16/2007	I	2500
030107	1	BLACK HOLLOW	4.2 FT. SPILLWAY	INADEQUATE SPILLWAY	31	10/22/1997	I	999
040208	1	RIST - BENSON	Restricted to Below Gage Height 10	Seepage at Toe and on Embankment	10	7/5/2005	I	160
060203	1	MARSHALL LAKE	Gage Height 61 or 3 Feet below Spillway	Spillway Construction Protection Crest	61	6/23/2008	I	915
075311	1	SMITH	1.0 SPILLWAY	SEEPAGE	0	1/26/2000	R	100
080327	1	SKEEL	5.0 Feet Below Spillway Crest	Poor Condition, seepage		11/2/2007	R	75
090204	1	WILLOW SPRINGS #1	2.0 FEET BELOW SPILLWAY	CONTINUAL EROSION AND DENSE VEGETATION	16	5/12/2008	R	16
230102	1	ANTERO	GH 18 FT.	STAB. BERM CONST. & NEW INSTR. MONITORING	18	2/4/1986	R	6500
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
010115	2	BIJOU #2 DAM #1	GH 16; not > GH 15 for more than 30 days	scarping, seepage, no spillway	16	6/1/1993	C	2400
010505	2	PROSPECT	GH 35.5.	maintenance & monitoring issues	35.5	4/15/1981	R	588
020322	2	SIGNAL #1	5.0 CREST	CONCENTRATED SPG AREAS & QUESTIONABLE COND OF OUTLET	0	6/21/1993	R	60
020411	2	NISSEN #2	1.75 SPILLWAY	LACK OF FREEBOARD		9/11/1995	I	50
030122	2	CURTIS LAKE	GH 10 FT.	CREST, SLOPE, EXT. SEEP. AREA BELOW D/S TOE	10	7/2/1985	I	397
030129	2	EATON - LAW	5 Feet below Spillway Crest	Deteriorated Outlet Works and subsidence		6/23/2008	I	300
030138	2	GRAY #3	NO STORAGE	SINKHOLE OVER OUTLET	0	5/27/1997	I	100
030301	2	NORTH POUDE # 4	GH 17 FT.	POOR U/S FACE, GENERAL CONDITION	17	4/17/1984	R	562
040123	2	FAIRPORT	ZERO STORAGE	POOR CONDITION AND DETERIORATED OUTLET CONDUIT	0	1/3/2007	R	563
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
050308	2	UNION	GH 28.0	spillway design based on GH=28.0	28	12/6/1977	C	0
070126	2	DEWEY NO. 1	3.0 CREST(NW)	POOR CONDITION	0	11/19/1990	I	15
090115	2	HARRIMAN	GH 19 FT.	EXCESSIVE SEEPAGE	19	11/12/1992	R	300
010104	3	ADAMS & BUNKER #3	6.0 CREST	INADEQUATE FREEBOARD, SEEPAGE	0	5/22/1975	C	150

DIVISION 1

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

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
010132	3	J.B. COOKE	3 ft below top of headwall	provide minimum freeboard		5/6/1998	R	0
010138	3	DOVER	10.0 FT. CREST	POOR CONDITION		6/27/1996	I	60
010419	3	D.A. LORD #4	2.0 SPILLWAY	INADEQUATE SPILLWAY	0	9/19/1980	C	400
010526	3	TROJANOVICH	Zero Storage	Plugged Spillway, Deteriorated Outlet Conduit	0	3/7/2008	I	47
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
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
020314	3	NORTH STAR	5.0 BELOW DAM CREST	SINKHOLE ON DOWNSTREAM SLOPE		2/11/2003	R	
020333	3	THOMPSON	5.0 CREST	INADEQUATE FREEBOARD, GENERALLY POOR CONDITION	0	10/7/1987	R	30
020606	3	MOWER	5 FEET BELOW LOWEST POINT OF DAM	CONTINUAL DETERIORATION OF DAM CREST		6/27/2007	R	24
020615	3	HAVANA STREET DAM	NO STORAGE	NO SPILLWAY	0	6/17/1987	C	0
030108	3	BOX ELDER #2	3.0 FT. SPILLWAY	EXCESSIVE SEEPAGE	6.5	8/8/1989	I	49
030128	3	DRY CREEK	GH 11.5 FT.	OUTLET DETERIORATION,SEEPAGE, INAD SW	11.5	1/17/1996	R	150
030214	3	LAW, JOHN	3.0 CREST	INADEQUATE SPILLWAY AND FREEBOARD	11	6/22/1987	C	45
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
030512	3	RIST CANYON	3.0 CREST	SEEPAGE, INADEQUATE SPILLWAY	0	4/19/1983	I	33
045234	3	IDE AND STARBIRD #1	3.0 CREST	POOR MN, ERODED U/S FACE, QUES. SPILLWAY	0	7/3/1985	I	0
050132	3	HIGHLAND	3.0 BELOW TOP OF CONCRETE WALL AT	NO SPILLWAY OUTLET	0	11/26/1990	R	0

DIVISION 1

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

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
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
050301	3	STEELE BROTHERS #1	4.0 SPILLWAY	SAT. EMBKMT.; INOP. OS.; INAD. FBD; SPWY.REPAR	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
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
070202	3	KELLY	FIVE FEET BELOW DAM CREST	ABANDON FACILITY AND NO MAINTENANCE		7/7/2008	R	50
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
080306	3	WAKEMAN	NO STORAGE	SPILLWAY EROSION		10/17/1994	I	110
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
080445	3	FREDERICKSON LAKE	No staff gage present.	Inadequate spillway.	0	8/27/2001	I	
230311	3	SUN	5.0 CREST	SEEPAGE-RESTRICT O 8FT 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
650121	3	DUCK	4.0 SPILLWAY	NARROW CREST, STEEP SLOPES	0	3/23/1987	I	15
650123	3	HANSHAW	5.0 CREST	seepage, slide, overall poor	0	7/7/1987	I	12
800139	3	GREEN VALLEY RETENTION	Zero Storage	Scarp at Outlet, PoorCondition Inoperable Gate	0	1/28/2008	I	10
080110	4	CANTRILL	NO STORAGE	NO SPILLWAY, INOPERABLE OUTLET	0	10/22/1987	I	37
080321	4	QUICK	NO STORAGE	NO SPILLWAY, INOPERABLE OUTLET	0	10/22/1987	I	64
020109	N	BRIGHT VIEW #1	7.0 CREST	INOP. OUTLET, INADEQUATE Feeboard	0	9/30/1985	I	17

TOTAL NUMBER OF DAMS AFFECTED: 75

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION: 30,271 AF

DIVISION 2

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

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
100459	1	STRATTON	Gage Height 10 Feet	Outlet Not Modified to Allow No Storage	10	1/28/2008	I	32
160108	1	CUCHARAS #5	GH 100 FT.	POOR OVERALL CON. EMBKMT. HISTY. MVMNT	100	7/21/1988	R	33000
670236	1	TWO BUTTES	GH 20 FT.	HYDRAULICALLY INADEQUATE SPILLWAY	20	1/24/1983	I	31465
100402	2	VALLEY NO. 2	NO STORAGE	INOPERABLE OUTLET, OBSTRUCTED SPILLWAY	0	9/21/2000	C	185
180206	2	APISHAPA	22.0 CREST	SPILLWAY, OUTLET SILTED IN	0	2/18/1994	I	260
100131	3	GARDEN OF THE GODS GOLF COURSE	3.0 CREST	NO SPILLWAY	0	5/31/1988	I	0
100309	3	VALLEY NO. 1	15.0 CREST	INOPERABLE OUTLET & BLOCKED SPILLWAY	0	12/27/1984	I	50
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
120240	3	GILLETT RESERVOIR	ZERO STORAGE, MAINTAIN BREACH	BREACHED DAM	0	11/18/2006	I	12
150116	3	OCCHIATO #1	10 FEET CREST	SLIDE		9/16/1999	I	3
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
180207	3	SEVEN LAKES	7.0 CREST	DILAPIDATED CONDITION OF DAM	0	5/6/1987	I	1200
160135	4	CLARK #1	8.0 CREST	ERODED UPSTREAM SLOPE	0	2/16/1994	R	80
100215	N	MODERN WOODMEN OF AMER. #2	NO STORAGE	INADEQUATE SPILLWAY, POOR REPAIR	0	8/12/1983	R	85

TOTAL NUMBER OF DAMS AFFECTED: 20

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION: 70,331 AF

DIVISION 3**STATE OF COLORADO - DAM SAFETY
BRANCH LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS**

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
200110	1	CONTINENTAL	GH 64.5	LEAKAGE	64.5	8/1/1995	I	7679
210102	1	TERRACE	7.0 SPILLWAY	DETERIORATED SPILLWAY	117	7/18/1984	I	2000
220103	2	TRUJILLO MEADOWS	1 foot below spillway crest	Excessive Seepage	23.6	8/25/2004	I	69
240101	3	EASTDALE #1	1.3 feet below spillway crest	Erosion of upstream slope	23	7/1/2004	I	420
260101	3	SAGUACHE	Zero storage	General neglect, inoperable U/S gate	0	6/28/2004	I	450

TOTAL NUMBER OF DAMS AFFECTED: 5**VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION: 10,618 AF**

DIVISION 4

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

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
400115	1	BEAVER	16 FEET BELOW SPILLWAY	SINKHOLES	60	23-Oct-08	I	651
400112	2	BIG BATTLEMENT	Two feet below emergency spillway crest	Seepage	19	7/28/2008	I	105
400306	2	GRANBY #12	GH 17 FT.	D/S FACE SLIDE DUE TO SEEPAGE	17	10/15/1987	R	0
420116	2	FRUITA #1	20 FT. CREST	SLIDE ON DOWNSTREAM SLOPE		8/12/1998	I	100
420120	2	GRAND MESA #1	8 FT. SPILLWAY	OUTLET WORKS FAILURE	12	12/21/2000	I	300
590113	2	MERIDIAN LAKE PARK #1	2.0 SPILLWAY (PRIN SPWY LOWERED)	SEVERE EROSION OF THE EMERGENCY SPILLWAY	0	6/4/1987	I	10
400208	3	COLE #5	1.1 FT BELOW EMERGENCY SPILLWAY	ENLARGED RESERVOIR WITHOUT SEO APPROVAL	16.4	10/2/2008	I	19.1
400212	3	CYPHER #1	4.0 BELOW DAM CREST	REPAIRS NOT COMPLETED		11/10/2008	R	0
400228	3	ELLA	7-Foot Below Dam Crest	Inadequate Spillway & Overtopping Damage		9/20/2005	I	30
400330	3	KNOX	FULL STORAGE FROM 4/1 TO 8/15 IF	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 CONSTRUCTION	0	7/31/1996	R	0
400419	3	OASIS	3 FEET BELOW NORMAL WATER SURFACE	UNCONTROLLED SEEPAGE		9/30/2003	I	40
400508	3	RYAN	ZERO STORAGE	POOR CONDITION OF OUTLET WORKS		11/9/2004	I	60
400522	3	TODD	10.0 CREST	6FT ELEVATION DIFF ALONG CREST WITH NO SPWY	0	10/19/1984	I	112
400524	3	TRIO	8.0 SPILLWAY	SLIDE ON DOWNSTREAM SLOPE	14	1/11/1989	I	75
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. W/O APPROVED 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
420135	3	REEDER	Zero Storage	EXTENSIVE SEEPAGE, SINKHOLES AND DISREPAIR	0	12/14/2005	R	299
600105	3	BLUE LAKE #1	5.0 FEET SPILLWAY	POOR CONDITION		11/21/2001	I	100
600126	3	CUSHMAN	6.0 CREST	OUTLET-INOP. SPWY-INAD. EMB. SEEPS	0	7/29/1975	I	36
620122	3	FISH CREEK #1	zero storage	stability, seepage, outlet control	0	9/11/2003	I	85
630103	3	BURG	ZERO STORAGE	DAMAGED OUTLET CONTROLS		9/30/2003	I	91

TOTAL NUMBER OF DAMS AFFECTED: 25

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION: 2,233.1 AF

DIVISION 5

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

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
380219	1	POLARIS	16.5 FT BELOW DAM CREST	INADEQ SPWY & FB, BASIN SEEP, POOR FOUNDATION	4	11/1/2007	R	770
450123	1	ALSBURY	5.5 ft BELOW SPILLWAY, 10.5 ft BELOW	EXCESSIVE SEEPAGE CREST	9055	6/7/2004	I	100
720115	1	BULL CREEK #4	3 FEET BELOW EMERGENCY SPILLWAY	POOR CONDITION OF OUTLET AND DAM, SEEPAGE		8/18/2005	I	71
370113	2	WELSH	Zero Storage	Seepage, Deteriorated Outlet Conduit	0	7/7/2006	I	105
380113	2	HOPKINS	10 feet below crest, 7 feet below spillway	Excessive seepage		11/23/2004	R	55
380204	2	CHRISTENSON	Zero Storage	Sloughing of Downstream Slope	0	7/6/2005	I	11
380209	2	LAZY O RESERVOIR NO 2	ZERO STORAGE	SLOUGH ON U/S SLOPE AND OUTLET PIPE COLLAPSE	0	11/13/2008	I	14
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
380231	2	VALANA K RESERVOIR NO. 1	ZERO STORAGE	UNAPPROVED SPILLWAY AND POOR CONDITION	0	11/13/2008	I	19
390127	2	PDC FRESH WATER PIT	Zero Storage	illegally and Poorly Built Dam		10/3/2007	I	16
500113	2	MATHESON	FULL STOR IN SPRING. DRAIN TO GH 30	MONITORING DEVISE INSTALLED BY 9/1	30	10/30/2002	R	0
510114	2	LITTLE KING RANCH	10.0 SPILLWAY	EXCESSIVE SEEPAGE	41	3/7/1978	C	439
530209	2	7 W GUEST RANCH POND	3 FEET BELOW LOWEST POINT ON DAM	INADEQUATE SPILLWAY, POOR CONDITION OF DAM		11/3/2006	I	6
360117	3	OLD DILLON	ZERO STORAGE	CONTINUAL DETERIORATION OF DAM	0	7/17/2008	I	46
370116	3	G G LOWER	4.0 CREST	INADEQ FRBD., STABILITY OF DOWNSTREAM SLOPE	0	12/14/1992	R	7
500126	3	MILK CREEK	15.0 CREST (AUG 1 THRU MAY 1)	EXCESSIVE LEAKAGE	0	5/10/1991	R	56
530114	3	HOLDEN	Zero Gage Height, No Storage	Seepage above serv Spwy on Downstream slope	0	8/21/2006	R	31
530116	3	JONES #2	10 FEET BELOW EMERGENCY SPILLWAY	SEEPAGE CONDITION AND VOIDS IN DAM CREST		12/18/2008	I	260
530119	3	KELLY	3.5 FT BELOW SERVICE SPILLWAY	INCREASE IN SEEPAGE	96.5	6/29/2006	R	84
530125	3	NEWTON GULCH	GAGE HEIGHT 17 TO TEST REPIR WORK	SINKHOLE REPAIRED	17	4/7/2008	R	419
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	39
720136	3	HAWXHURST	Zero Gage Height, No Storage	Hole in Outlet Conduit and Sinkholes	0	8/21/2006	R	207
720203	3	KENDALL	Zero Storage Restriction	Wave Erosion, Dam Instability & Blocked Spill	0	8/27/2007	I	61
510129	N	ROCK CREEK	NO STORAGE	DAM BREACHED BY OWNER BUT WANTS TO REPAIR	0	6/28/1989	C	66

TOTAL NUMBER OF DAMS AFFECTED: 26

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION: 2,983 AF

DIVISION 6**STATE OF COLORADO - DAM SAFETY
BRANCH LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS**

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
540104	2	ELK LAKE	A point below the beaver den.	Beaver den, badger holes	30	3/6/2006	I	100
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	ZERO STORAGE	SLIDE AT LEFT ABUTMENT	0	5/29/2008	R	136
440120	3	DRESCHER	8.0 SPILLWAY	SEEPAGE & INSTABILITY	8	8/1/1988	R	159
440124	3	ELGEN #2	Full Storage	New outlet pipe. Recommend restriction lifted		2/16/1999	R	
440213	3	FLAT TOP	5.0 FT CREST MAIN DAM	BREACHED, BEAVER DAMS, FREEBOARD		8/2/1999	I	50
560107	3	BASSETT #2	5-FEET BELOW SPILLWAY CREST	ILLEGAL DAM, POOR CONDITION		10/21/2002	R	25
570114	3	LAKE EMRICH	15 FEET BELOW CREST	SLIDES ON DOWNSTREAM SLOPE	0	8/30/1988	C	330
570128	3	SEATON	Zero Storage Restriction	Slide on Downstream Slope & Inoperable Outlet	0	8/27/2007	I	21

TOTAL NUMBER OF DAMS AFFECTED: 10**VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION: 861 AF**

DIVISION 7**STATE OF COLORADO - DAM SAFETY
BRANCH LISTING OF DAM,S UNDER STORAGE RESTRICTION ORDERS**

DAMID	Hazard Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Action Type	Volume Lost
300144	3	UPPER RAILROAD	5 Feet below Dam Crest	Inadequate Spillway& Unstable Downstream slope	9/8/2005		I	4
320202	3	E. G. MERRITT	Zero Storage	Deteriorated Outlet Conduit, Inoperable Outlet	6/13/2006		I	41
320209	3	BISHOP	4 Feet Below Dam Crest	Seepage, Inadequate Spillway, Inoperable Outlet	6/13/2006		I	4
340106	3	HURST	NO STORAGE	OUTLET FAILURE	0	3/29/1999	I	35
340109	3	L.A. BAR	3 feet below dam crest	Insufficient freeboard, broken gate operator		11/2/2005	I	10
340119	3	J. O. SPENCER	NO STORAGE	INOPERABLE OUTLET	0	5/8/2000	I	16
340203	1	SUMMIT - MAIN DAM	NOT TO EXCEED 1.1 FT BELOW SPILL FOR	EXCESSIVE SEEPAGE >3 WKS	23.6	6/3/1998	R	400
690101	2	BELMEAR LAKE	3 Feet Below Spillway Crest	Severe Wave Erosion on Upstream Slope		8/21/2008	I	90

TOTAL NUMBER OF DAMS AFFECTED: 7**VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION: 600 AF**