

EMERGENCY ACTION PLAN (EAP)

Notifications and Essential Resource Information

THE SPIRES DRAINAGE ASSOCIATION – aka SPIRES BROADMOOR - SOUTH DEBRIS DAM

El Paso County, Colorado

HAZARD CLASSIFICATION: HIGH

State of Colorado DAMID: **100458** NATID (National Inventory of Dams): CO-02867

Water Division: **2** Water District: **10**

Location Map:



EAP Revision Date: 20 July 2015

Vicinity Map 1:

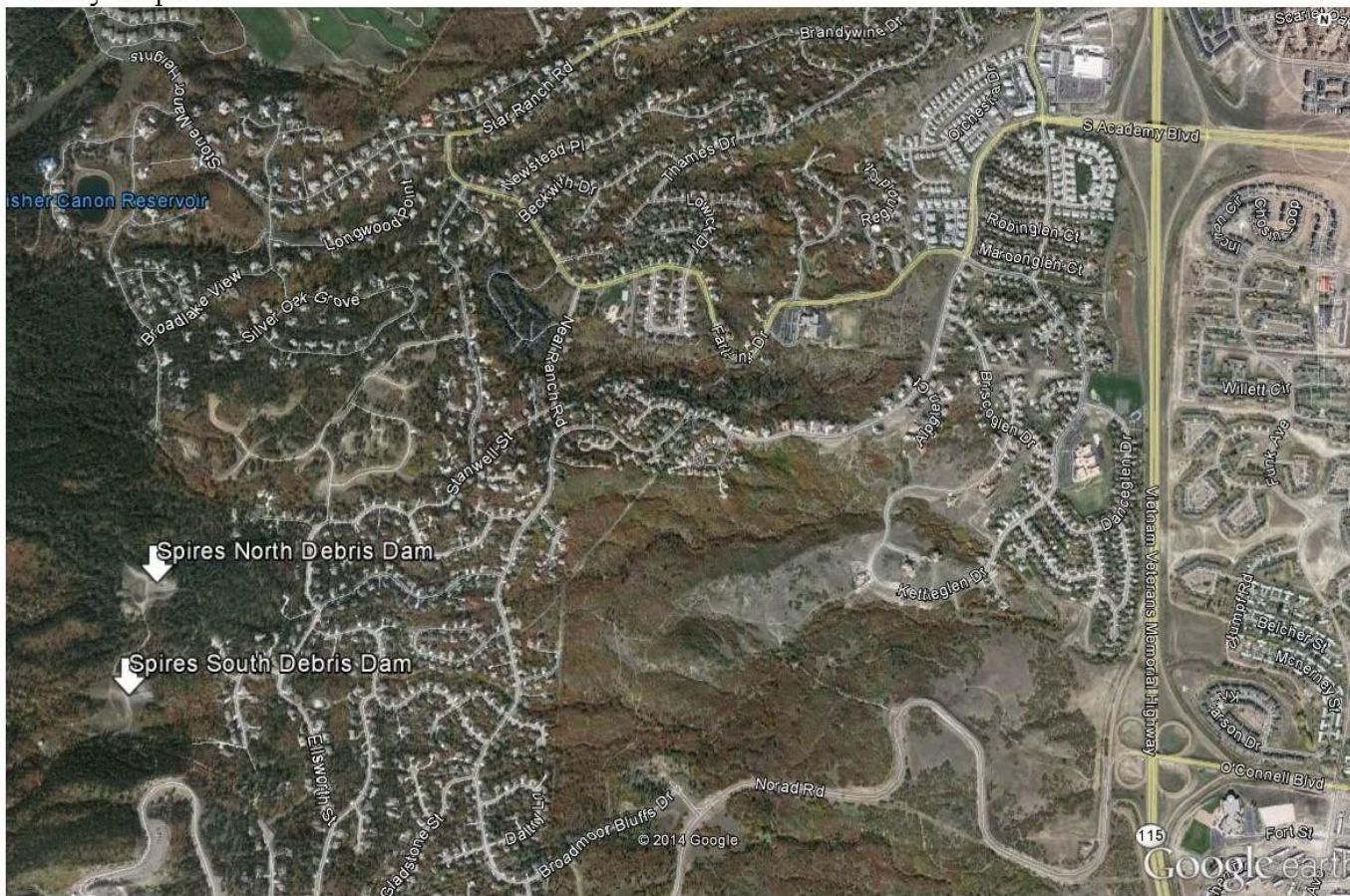


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Purpose

The purpose of this EAP is to reduce the potential for loss of life and injury and to minimize property damage during an unusual or emergency event at THE SPIRES DRAINAGE SOUTH DEBRIS Dam.

Directions to the Dam

Also see *Location and Vicinity Maps*.

Begin Highway 115 & South Academy Boulevard, Colorado Springs, CO.

-South Academy Boulevard becomes Broadmoor Bluffs Drive on west side of Hwy 115.

-Continue West 1.75 Miles on Broadmoor Bluffs Drive.

-Turn Right (west) on Ellsworth Street, continue 0.5 miles

-Turn Right (west) on Irvington Court, continue 0.1 miles

-Turn Right (north) on Wellfleet Street (aka Washington), continue 0.1 miles

-At end of street is Green Cattle Gate.

-Proceed on the dirt road from the gate and when the road forks (left and right), proceed Left and follow the road to the South Debris Dam.

Potentially Impacted Areas

Also see Inundation Mapping and Summary of People/Structures at Greatest Risk

Residents Adjacent to Dam Drainage on Following Streets:

- Irvington Court
- Wellfleet Street
- Ellsworth Street
- Buttermere Drive
- Balmoral Drive
- Kirkstone Lane
- Ravenglass Way
- Broadmoor Bluffs Drive

Description of the Dam

Dam Name: THE SPIRES DRAINAGE SOUTH DEBRIS

DAM State of Colorado DAMID: 100458
NATID (Nat. Inventory of Dams): CO-02867
Dam Owner: THE SPIRES DHA C/O Z&R MANAGEMENT
Type of Dam: RE
Hazard Classification: High
County: EL PASO
Location: Section 13, Township 15N, Range 067W
Latitude: 38.749443, Longitude: -104.844723

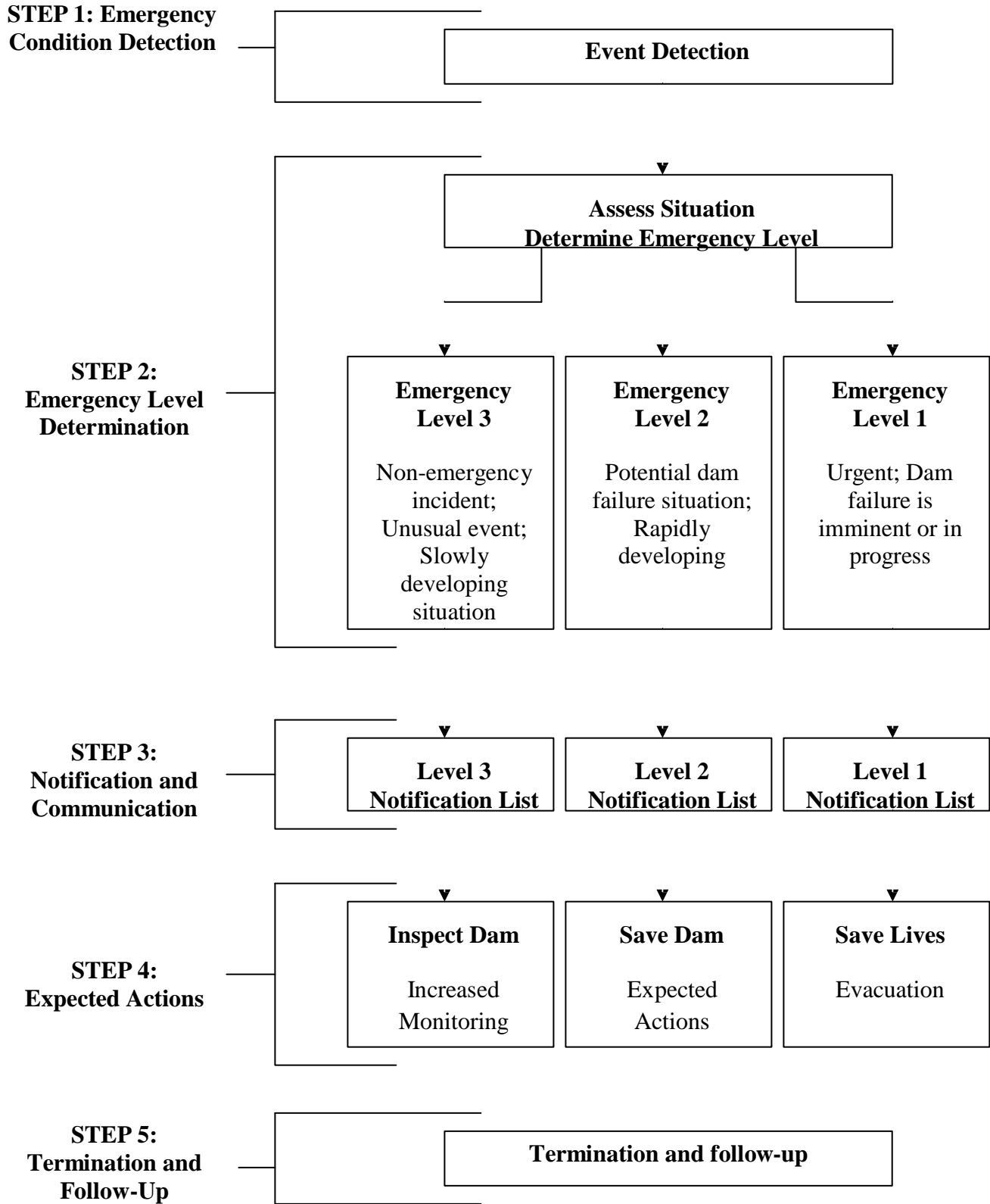
Nearest Town:
Distance to Nearest Town: (miles)
Name of Drainage, River, or Stream:

Year Constructed: 2005
Dam Height: 27.0 (feet)
Crest Length: 285 (feet)
Crest Width: 15 (feet)
Drainage Basin Area: 73 (acres)
Maximum Reservoir Surface Area: 1 (acres)
Reservoir Normal Capacity: 5 (acre-feet)
Reservoir Maximum Capacity: 7 (acre-feet)

Outlet Diameter: (feet)
Outlet Type:
Outlet Max. Discharge Capacity: (cfs)

Emergency Spillway Type: UCOND
Emergency Spillway Width: 3. (feet)
Spillway Freeboard: 16.5 (feet)
Maximum Spillway Capacity: (cfs)

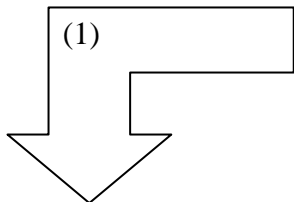
EMERGENCY ACTION PLAN OVERVIEW



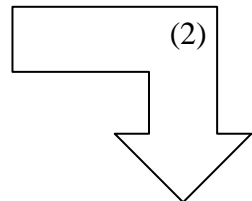
NOTIFICATIONS AND COMMUNICATION

EMERGENCY LEVEL 3 NOTIFICATIONS

**Non-emergency incident; unusual event;
slowly developing situation**



Dam Owner
Name: The Spires DHA Organization: c/o Derek Patterson Z&R MANAGEMENT 719-594-0506 (Office) 719-331-0295 (Cell) www.TheSpiresHOA.com



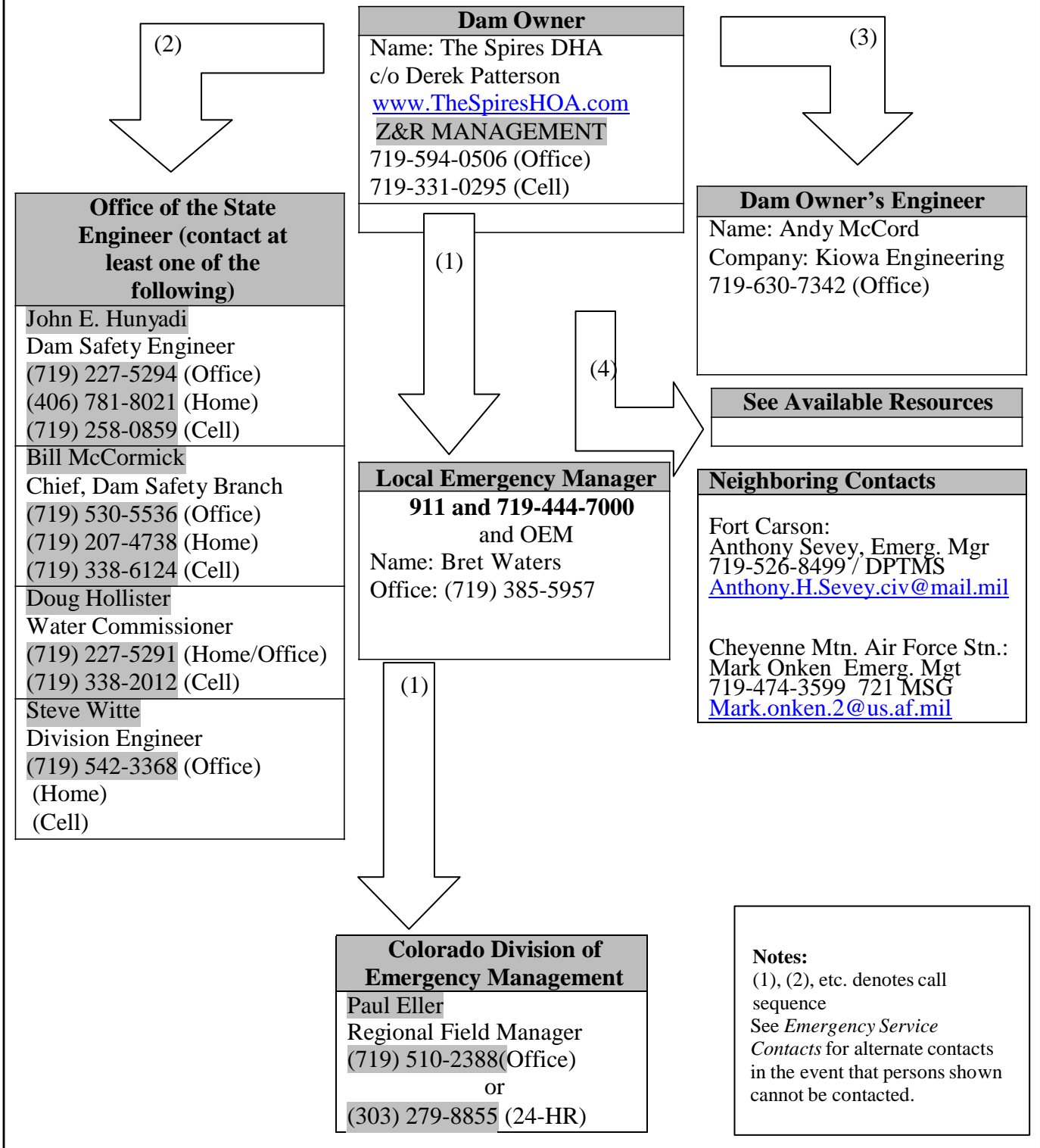
Dam Owner's Engineer
Name: Andy McCord Company: Kiowa Engineering 719-630-7342 (Office)

Office of the State Engineer (contact at least one of the following)
John E. Hunyadi Dam Safety Engineer (719) 227-5294 (Office) (406) 781-8021 (Home) (719) 258-0859 (Cell)
Bill McCormick Chief, Dam Safety Branch (719) 530-5536 (Office) (719) 207-4738 (Home) (719) 338-6124 (Cell)
Doug Hollister Water Commissioner (719) 227-5291 (Home/Office) (719) 338-2012 (Cell)
Steve Witte Division Engineer (719) 542-3368 (Office)

<p>Notes: (1), (2), etc. denotes call sequence See <i>Emergency Service Contacts</i> for alternate contacts in the event that persons shown cannot be contacted.</p>

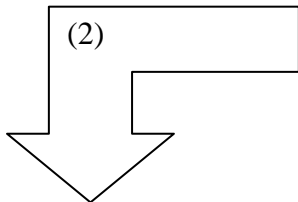
EMERGENCY LEVEL 2 NOTIFICATIONS

**Potential dam failure situation;
Rapidly developing**



EMERGENCY LEVEL 1 NOTIFICATIONS

**Urgent;
dam failure imminent or in progress**

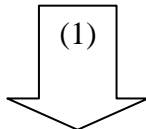


Dam Owner
Name: The Spires DHA Organization: c/o Derek Patterson Z&R MANAGEMENT 719-594-0506 (Office) 719-331-0295 (Cell)

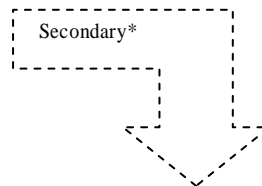
Notes:
 (1), (2), etc. denotes call sequence
 See *Emergency Service Contacts* for alternates in the event person shown cannot be contacted.
 *Additional secondary calls should be made by the Local Emergency Manager according to the Local Emergency Operations Plan

Office of the State Engineer (contact at least one of the following)

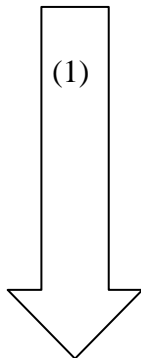
- | |
|--|
| John E. Hunyadi
Dam Safety Engineer
(719) 227-5294 (Office)
(406) 781-8021 (Home)
(719) 258-0859 (Cell) |
| Bill McCormick
Chief, Dam Safety Branch
(719) 530-5536 (Office)
(719) 207-4738 (Home)
(719) 338-6124 (Cell) |
| Doug Hollister
Water Commissioner
(719) 227-5291 (Home/Office)
(719) 338-2012 (Cell) |
| Steve Witte
Division Engineer
(719) 542-3368 (Office)
(Home)
(Cell) |



Local Emergency Manager
911 and 719-444-7000 and Bret Waters Office: (719) 385-5957



National Weather Service
Name: Pueblo Phone: (719) 948-9429 Or (000) 000-0000



Colorado Division of Emergency Management
Paul Eller Regional Field Manager (719) 510-2388 (Office) or (303) 279-8855 (24-HR)

ESSENTIAL RESOURCES CONTACT INFORMATION

Emergency Service Contacts

Agency/Organization	Principal Contact / Title	Address	Office Telephone Number	Alternate Telephone Number(s)
Colorado Division of Emergency Management	Paul Eller	9195 E. Mineral Ave. Ste. 200 Centennial, CO 80112	Colorado Division of Emergency Management	Paul Eller
City of CO Springs Office of Emergency Management	Bret Waters	375 Printers Pkwy Colorado Springs, CO 80910	719-385-5957	
Fort Carson Emergency Manager	Anthony Sevey		719-526-8499	Anthony.H.Sevey.civ@mail.mil
Cheyenne Mtn. Air Force Station	Mark Onken	Mark.onken	719-474-3599	
Colorado Springs Utilities	Emergency Mgmt.		719-668-5321	embc@csu.org

Resources Available

Locally available equipment, labor, and materials:

Heavy equipment service and rental	Sand and gravel supply	Ready-mix concrete supply
Name: Rocky Mountain Materials (Rob Mangone) Address: 1910 Rand Avenue, Colorado Springs, CO 80906 Phone: 719-491-3103 Name: Tom Smith Address: Same Phone: 719-491-3116	Name: Rocky Mountain Materials (Rob Mangone) Address: 1910 Rand Avenue, Colorado Springs, CO 80906 Phone: 719-491-3103 Name: Tom Smith Address: Same Phone: 719-491-3116	Name: Transit Mix Address: 444 Costilla Street, Colorado Springs, CO 80903 Phone: 719-475-0700
Pumps	Diving Contractor	Sand Bags
Name: Bill's Tool Rental Address: 125 S. Chestnut St., Colorado Springs, CO 80905 Phone: 719-633-9747	Name: Clint Curtis, ASI Constructors Address: 1850 E. Platteville Blvd, Pueblo West, CO 81007 Phone: 719-248-1503 (cell)	Name: Home Depot Address: 2250 Southgate Road, Southgate Shopping Center, CO Springs Phone: 719-471-0054
Other:	Other:	Other:
Name: Address: Phone:	Name: Address: Phone:	Name: Address: Phone:

Other locally available resources:

Record Holders of This EAP

Copy Number	Organization Name and Address	Person(s) Receiving Copy
1	Local Emergency Manager	Lizabeth Jordan
2	Colorado Division of Homeland Security	Paul Eller
3	Office of the State Engineer, Chief of Dam Safety	Bill McCormick
4	Dam Safety Engineer, Office of the State Engineer	John E. Hunyadi
5	Z & R Management	Derek Patterson
6	Kiowa Engineering	Andy McCord
7		
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9		
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17		

INUNDATION MAPPING



DESIGNED: MAP	SPIRES BROADMOOR	COLORADO SPRINGS, CO	REVISIONS
DRAWN: WIDTH			PROJECT
CHECKED: PAC			DRAWING
PEER REVIEWED: PAC	FLOOD INUNDATION LIMITS AND CROSS-SECTION LOCATION MAP		F
PROJECT MANAGER: CLW			
DATE: JUNE/04			

WARNING: THIS BAR DOES NOT MEASURE THEN DRAWING IS NOT TO SCALE.

SCALE IN FEET: 0 200 400 600

URS
 URS Center
 8181 E. Tufts Avenue
 Denver, CO 80231-2637
 (303) 694-2770

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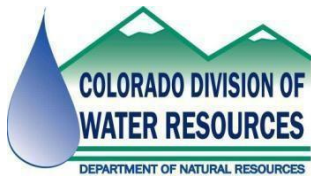
BY	DATE

STATE OF COLORADO DEPARTMENT OF
NATURAL RESOURCES DIVISION OF
WATER RESOURCES

OFFICE OF THE STATE ENGINEER
DAM SAFETY BRANCH

***ACTIVATION GUIDELINES FOR
EMERGENCY ACTION PLANS (EAP)***

*Effective Date:
January 24, 2013*



1313 Sherman Street Room
818 Centennial Building
Denver, Colorado



Telephone (303) 866-3581
Facsimile (303) 866-3589



Website:
<http://water.state.co.us>

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FIVE-STEP EAP PROCESS

Step 1 Event Detection

This step describes the detection of an unusual or emergency event. Information is provided herein to assist the dam owner in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by government personnel (local, state, or federal), landowners, visitors to the dam, or the public. All reports of an unusual or emergency event should be verified by the dam owner.
- Evaluation of instrumentation data
- Earthquakes felt or reported in the vicinity of the dam
- Forewarning of conditions which may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

See the *Guidance for Determining the Emergency Level* table and *Examples of Emergency Situations* in Step 2 for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

Step 2 Emergency Level Determination

After an unusual or emergency event is detected and verified, the Dam Owner is responsible for classifying the event into one of the following three emergency levels:

Emergency level 3 — Non-emergency incident; unusual event; slowly developing situation:

This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. The State Dam Safety Engineer and the Dam Owner's Engineer should be contacted to investigate the situation and recommend actions to be taken. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Local Emergency Manager should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency level 2 — Potential dam failure situation, rapidly developing:

This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The Local Emergency Manager should be notified of this emergency situation and placed on alert. The dam owner should closely monitor the condition of the dam and periodically report the status of the situation to the Local Emergency Manager and State Dam Safety Engineer. As time permits, remedial actions should be taken to delay, moderate, or prevent failure of the dam. If the dam condition worsens and failure becomes imminent, the Local Emergency Manager must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

The State Dam Safety Engineer should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam owner should initiate remedial repairs using local resources that may be available. Time available to employ remedial actions may be hours or days.

This emergency level may also be applicable when flow through the spillway has, or is expected to, result in flooding of downstream areas where people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 1 — Urgent; dam failure is imminent or in progress:

This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the spillway is causing downstream flooding of people and roads. The Local Emergency Manager should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see *Inundation Map* and *Summary of People/Structures at Greatest Risk* in the EAP).

See following pages for guidance in determining the proper emergency level for various situations.

Guidance for Determining the Emergency Level

Event	Situation	Emergency Level*
Spillway flow	Reservoir water surface elevation at emergency spillway crest or auxiliary spillway is flowing with no active erosion	1
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing headcut that is threatening the control section	1
Embankment overtopping	Overtopping flow not eroding the embankment slope; reservoir level expected to lower	2
	Overtopping flow not eroding the embankment slope; reservoir level expected to rise	1
	Overtopping flow eroding the embankment slope	1
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Rapid flow rate increase with cloudy discharge from existing seepage area(s)	1
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	1
	Rapidly enlarging sinkhole	2
Embankment cracking	New cracks in the embankment greater than 1/4-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly progressing slides of the embankment slopes	1
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	1
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	1
Sabotage/ vandalism	Damage to dam or appurtenances with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	1

*Emergency level 1: Urgent; dam failure is imminent or in progress.

*Emergency level 2: Potential dam failure situation; rapidly developing

*Emergency level 3: Non-emergency incident; unusual event; slowly developing situation

Examples of Emergency Situations

The following are typical examples of conditions that may occur at a dam that usually constitute an emergency situation. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the emergency spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency level condition and are provided as guidance only. Not all emergency conditions may be listed and the dam owner is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Emergency Spillway Flows

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or headcutting of the spillway is occurring but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the emergency spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Emergency Level 1—Urgent; dam failure is imminent or in progress:

1. Significant erosion or head cutting of the spillway is occurring at a rapid rate and a breach of the control section appears to be imminent.
2. Flow through the emergency spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level has reached the top of the dam and is projected to continue to lower.
2. Flow is occurring over the embankment, but it is not eroding the embankment slope and the reservoir is expected to continue to lower.

Emergency Level 1—Urgent; dam failure is imminent or in progress:

1. Flow is occurring over the embankment causing damage to the embankment slope.
2. The reservoir level has exceeded the top of the dam and is expected to continue to rise.

Seepage and Sinkholes

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or soon will be inundated by a rise in the reservoir:
 - a. Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
 - b. Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 1—Urgent; dam failure is imminent or in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Emergency Level 1—Urgent; dam failure is imminent or in progress:

1. Sudden or rapidly progressing slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Step 3 Notification and Communication

Notification:

After the emergency level has been determined, people on the following notification flowcharts (see *Notification and Communication Flowcharts* in the EAP) for the appropriate emergency level shall be notified immediately.

Communication:

Emergency Level 3— Non-emergency incident; unusual event; slowly developing situation:

The Dam Owner should contact State Dam Safety Engineer and the Dam Owner’s Engineer, describe the situation, and request technical assistance on the next steps that should be taken.

Emergency Level 2—Potential dam failure situation; rapidly developing:

The Dam Owner should contact Local Emergency Manager, State Dam Safety Engineer, and the Dam Owner’s Engineer, describe the situation, and request technical assistance on the next steps that should be taken. The following message may be used to help describe the emergency situation to the Local Emergency Manager:

“This is (Identify yourself; name, position, etc.). We have an emergency condition at (name of dam). We have activated the Emergency Action Plan for this dam and are currently under Emergency Level 2. We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure. Reference the Inundation Map in your copy of the Emergency Action Plan. We will advise you as soon as the situation is resolved or if the situation gets worse. I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____.”

Emergency Level 1—Urgent; dam failure is imminent or in progress:

The Local Emergency Manager should be contacted immediately and the potentially flooded area must be evacuated (see *Inundation Map* in the EAP). The following actions should be taken:

1. Call 911 and be sure to say, “This is an emergency”. The following message may be used to help describe the emergency situation to the Local Emergency Manager:

“This is an emergency. This is (identify yourself; name, position). (name of dam) is failing. The downstream area must be evacuated immediately. Repeat, (name of dam) is failing; evacuate the area along low-lying portions of (name of stream). We have activated the emergency action plan for this dam and are currently under Emergency Level 1. Reference the Inundation Map in your copy of the Emergency Action Plan. I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____.”

2. Do whatever is necessary to bring people in immediate danger to safety if directed by the Local Emergency Manager (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees). See *Summary of People/Structures at Greatest Risk* in the EAP.

3. Keep in frequent contact with the Local Emergency Manager to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.
4. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to reestablish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to reestablish contact with the Local Emergency Manager and emergency services.

The following pre-scripted message may be used as a guide for the Local Emergency Manager to communicate the status of the emergency with the public:

Attention: This is an emergency message from (the Local Emergency Manager). Listen carefully. Your life may depend on immediate action. (Name of dam) is failing. Repeat. (Name of dam) is failing. If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on (names of roads or highways) or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message

Step 4 Expected Actions

If the Local Emergency Manager receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Dam Owner. After the Dam Owner determines the emergency level, the State Dam Safety Engineer should be contacted for technical consultation and the following actions should be taken.

Emergency Level 3 – Non-emergency incident; unusual event; slowly developing situation:

- A. The Dam Owner should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the State Dam Safety Engineer; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.
- B. Record all contacts that were made on the *Contact Checklist*. Record all information, observations, and actions taken on the *Unusual or Emergency Event Log Form*. Note the time of changing conditions. Document the situation with photographs and video if possible.
- C. The Dam Owner should contact the State Dam Safety Engineer and Dam Owner's Engineer and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2 – Potential dam failure situation; rapidly developing:

- A. The Dam Owner should contact the Local Emergency Manager to inform him/her that the EAP has been activated and, if current conditions get worse, the emergency level may

- increase and the emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.
- B. The Dam Owner should report the situation to the State Dam Safety Engineer and the Dam Owner's Engineer and request investigation of the situation and recommend corrective actions.
 - C. Provide updates to the Local Emergency Manager to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.
 - D. If time permits, the Dam Owner should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the Local Emergency Manager and State Dam Safety Engineer. Refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.
 - E. Record all contacts that were made on the *Contact Checklist*. Record all information, observations, and actions taken on the *Unusual or Emergency Event Log Form*. Note the time of changing conditions. Document the situation with photographs and video, if possible.
 - F. If time permits, the following emergency remedial actions should be taken as appropriate.

Emergency Level 1—Potential dam failure situation; rapidly developing—continued:

Emergency remedial actions

If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with the State Dam Safety Engineer. See *Resources Available* in the EAP for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. Place sandbags along the low areas of the top of the dam to reduce the likelihood of overtopping and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open outlet(s) to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a nonerosive velocity. If the outlet is damaged, blocked, or of limited capacity, pumping or siphoning may be required. Continue lowering the water level until the seepage stops.
2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials, such as hay bales, bentonite, soil or rock fill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other

types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.

4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the outlet is damaged, blocked, or of limited capacity, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rock fill materials in the damaged area to restore freeboard.
3. Stabilize slides on the downstream slope by placing a soil or rock fill buttress against the toe area of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform field survey to determine if there has been any settlement and movement of the dam embankment, spillway and low level outlet works.
3. Drain reservoir if required.

Emergency Level 1—Urgent; dam failure is imminent or in progress:

- A. The Dam Owner shall immediately contact the Local Emergency Manager and others shown on the notification flow chart.
- B. The Local Emergency Manager shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see *Inundation Map* in the EAP).
- C. The Local Emergency Manager shall alert the general public and immediately evacuate at-risk people and close roads as necessary.
- D. The Dam Owner shall maintain continuous communication and provide the Local Emergency Manager with updates of the situation to assist him in making timely decisions concerning warnings and evacuations.
- E. Record all contacts that were made on the *Contact Checklist*. Record all information, observations, and actions taken on the *Unusual or Emergency Event Log Form*. Note the time of changing conditions. Document the situation with photographs and video, if possible.
- F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

Step 5 Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Local Emergency Manager is responsible for terminating EAP operations and relaying this decision to the Dam Owner. It is then the responsibility of each person to notify the same group of

contacts that he or she notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 1 or 2 event, the State Dam Safety Engineer will inspect the dam or require the inspection of the dam to determine if any hazardous conditions exist that could potentially result in loss of life, injury, or property damage. If it is determined that hazardous conditions no longer exist, the State Dam Safety Engineer will advise the Local Emergency Manager to terminate EAP operations as described above.

The Dam Owner shall assure that the *Dam Emergency Situation Report* is completed to document the emergency event and all actions that were taken. The Dam Owner shall distribute copies of the completed report.

ROLES AND RESPONSIBILITIES

Dam Owner

- Respond to observed or reported conditions, incidents, or unusual events to detect if an existing or potential emergency exists (see *Step 1 - Event Detection*).
- As soon as an emergency event is detected, immediately determine the emergency level (see *Step 2 - Emergency Level Determination*).
 - Level 3: Non-emergency incident; Unusual event; Slowly developing situation
 - Level 2: Potential dam failure situation; Rapidly developing
 - Level 1: Urgent; Dam failure is imminent or in progress
- Immediately notify the personnel in the order shown on the notification flow chart for the appropriate emergency level (see *Notification and Communication Flowcharts* in the EAP).
- Provide updates of the situation to the Local Emergency Manager to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.
- Facilitate exercise of the EAP as necessary to ensure the effectiveness of the EAP and emergency response.

Local Emergency Manager

- Typically City Police or Fire Department or County Sheriff Department personnel act as the Local Emergency Manager.
- Serve as the primary contact person responsible for coordination of all emergency actions.
- Maintain communication with media.
- When a Level 2 situation occurs:
 - Prepare emergency management personnel for possible evacuations that may be needed if a Level 1 situation occurs.
 - Alert public as appropriate.
- When a Level 1 situation occurs:
 - Initiate warnings and order evacuation of people at risk downstream of the dam.
 - Carry out the evacuation of people and close roads within the evacuation area (see *Inundation Map* in the EAP).

- Alert the general public of the emergency.
- Decide when to terminate the emergency.
- Participate in annual review and update of the EAP.

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- Respond to specific requests from the Local Emergency Manager to help minimize the impacts of an emergency event.

Dam Owner's Engineer

- Provide assistance and expertise with technical issues related to dam.

State Dam Safety Engineer (Office of the State Engineer)

- Advise dam owner on emergency level determination if time permits.
- Advise dam owner on remedial actions to take if a Level 2 event occurs and if time permits.
- Advise the Local and State Emergency Managers on technical issues related to the specific event and determine when conditions are safe to terminate the emergency.

MAINTENANCE – REVIEW, REVISION, AND EXERCISES

Emergency Action Plans should be considered “Living Documents”. This means that: (1) They will never be complete, (2) They should be reviewed not less than annually, (3) Reviews should include participation of the local emergency manager, (4) All updates should be made promptly. Additionally, emergency incidents at dams and/or dam failures are not common events. Therefore, training and exercises are necessary to maintain emergency response readiness, timeliness, and effectiveness.

The EAP therefore requires periodic maintenance to remain current and as useful and effective as possible. The three steps in Maintenance include:

Review

The EAP minimum annual review should include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current.
- Contacting the Local Emergency Manager to verify where the EAP is kept and if responsibilities as described in the EAP are understood.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.
- Review people and structures at risk information for changes in development within the dam failure flood inundation area downstream of the dam.

Revision

The EAP will be revised if any of the contacts, responsibilities, services or service providers, or people at risk information has changed. The Dam Owner is responsible for updating the EAP documents. The EAP document held by the Dam Owner is the master document. When revisions occur, the Dam Owner should provide the revised pages and a revised Revision Summary Page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

EAP Exercise

Periodic training and exercises are necessary to help ensure that all dam owner personnel are thoroughly familiar with the emergency action plan and their individual roles and responsibilities.

EAP exercising can include:

- Orientations
- Phone Drills
- Table Top Exercises
- Functional Exercises

As a minimum, owners of high and significant hazard dams should conduct an orientation and a phone drill yearly. The orientation can be a simple meeting where those individuals and entities with a stake in the EAP come together to review the roles and responsibilities described in the EAP. Orientations are especially useful for bringing new staff and/or leadership within any of the various organizations up to speed with regard to the components of the EAP.

Phone drills represent the next level of complexity with regard to EAP exercises. Phone drills can be part of the EAP review process to confirm contact information in the notification flow charts.

A comprehensive EAP exercise program should include provisions for table top and functional exercises. Tabletop and Functional exercises are typically more complex and are therefore conducted at lower frequencies, on the order of about every 6 years. Owners of high hazard dams should maintain a comprehensive exercise program which includes the components listed above. The program should be considered a normal part of the O&M program for the structure with the various exercises planned and executed as the owner would perform O&M on the physical components of the dam itself.

Key personnel from State dam safety and local emergency management agencies should be invited to participate in any orientation and exercises provided by the dam owner.

USEFUL FORMS

Contact Checklist

(to be completed during an emergency)

Dam Name: _____ DAMID: _____

County: _____ Date: _____

The following contacts should be made immediately after the emergency level is determined (see *Step 2 – Emergency Level Determination*) for guidance to determine the appropriate emergency level for a specific situation). The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the *Notification and Communication Flowcharts* and *Emergency Services Contacts* in the EAP for critical contact information.

Emergency Level 3	Person	Time	Contacted
	Contacted	Contacted	by
___ State Dam Safety Engineer	_____	_____	_____
___ Dam Owner’s Engineer	_____	_____	_____
___	_____	_____	_____
Emergency Level 1	Person	Time	Contacted
	Contacted	Contacted	by
___ Local Emergency Manager	_____	_____	_____
___ State Dam Safety Engineer	_____	_____	_____
___ Available Resources	_____	_____	_____
___	_____	_____	_____
Emergency Level 2	Person	Time	Contacted
	Contacted	Contacted	by
___ Local Emergency Manager	_____	_____	_____
___ State Dam Safety Engineer	_____	_____	_____
___	_____	_____	_____
___	_____	_____	_____

Dam Emergency Situation Report

(to be completed following the termination of the emergency)

Dam name: _____ State DAMID: _____

Dam location: _____ County _____
(City) (County) (Stream/River)

Date: _____ Time: _____

Weather conditions: _____

General description of emergency situation: _____

Area(s) of dam affected: _____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation: _____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

Other data and comments: _____

Observer's name and telephone number: _____

Report prepared by: _____ Date: _____

GLOSSARY OF TERMS

- Abutment** That part of the valley side against which the dam is constructed. The left and right abutments of dams are defined with the observer looking in the downstream direction from the dam.
- Acre-foot** A unit of volumetric measure that would cover one acre to a depth of one foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.
- Appurtenant Structures** Ancillary features of a dam such as outlets, spillways, power plants, tunnels, etc.
- Boil** A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.
- Breach** An opening through a dam that allows the uncontrolled draining of a reservoir. A controlled breach is a constructed opening. An uncontrolled breach is an unintentional opening caused by discharge from the reservoir. A breach is generally associated with the partial or total failure of the dam.
- Conduit** A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.
- Control section** A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.
- Dam** A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding water.
- Dam failure** The uncontrolled release of a dam's impounded water.
- Dam Owner** Any person, private or non-profit company, special district, federal, state, or local government agency, or any other entity in direct routine control of a dam and reservoir, and/or directly involved in the physical operation and maintenance of a dam, or proposes to construct a dam.
- Drain, blanket** A layer of pervious material placed to facilitate drainage of the foundation and/or embankment.
- Drain, chimney** A vertical or inclined layer of pervious material in an embankment to facilitate and control drainage of the embankment fill.

Drain, toe	A system of pipe and/or pervious material along the downstream toe of a dam used to collect seepage from the foundation and embankment and convey it to a free outlet.
Drainage area (watershed)	The area that drains to a particular point on a river or stream.
Drawdown	The difference between a water level and a lower water level in a reservoir within a particular time.
Emergency	A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.
Emergency Action Plan (EAP)	A written document prepared by the dam owner, describing a detailed plan of actions for response to emergency or unusual events, including alerting and warning emergency officials in the event of a potential or imminent dam failure or other emergency related to the safety of the dam and public.
Engineer	A Professional Engineer registered and licensed in Colorado in accordance with section 12-25-101, C.R.S. The Engineer must be sufficiently qualified and experienced in the design, construction, and safety evaluation of the type of dam under consideration.
Filter	One or more layers of granular material graded (either naturally or by selection) so as to allow seepage through or within the layers while preventing the migration of material from adjacent zones.
Freeboard	The vertical dimension between the crest (or invert) of the emergency spillway and the crest of the dam.
Groin	That area along the intersection of the face of a dam and the abutment.
Hazard Classification	The placement of a dam into one of four categories (High, Significant, Low, No Public Hazard) based on the hazard potential derived from an evaluation of the probable incremental adverse consequences due to failure or improper operation of the dam.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation Map	A map depicting the area downstream from a dam that would reasonably be expected to be flooded in the event of a failure of the dam.

Local Emergency Manager	Person(s) responsible for developing, organizing and exercising a community's emergency operations plan. Typically City Police or Fire Department or County Sheriff's Department personnel act as the Local Emergency Manager.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.
Outlet	A conduit (usually regulated by gates or valves) used for controlled or regulated releases of impounded water from the reservoir.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.
Reservoir	A body of water impounded by a dam.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway	An appurtenant structure that conducts overflows from a reservoir.
Spillway (Principal or Service)	The overflow structure designed to limit or control the operating level of a reservoir, and first to be activated in runoff conditions.
Spillway (Emergency)	The appurtenant structure designed to pass the Inflow Design Flood in conjunction with the routing capacity of the reservoir and any principal or service spillway(s).
Spillway crest	The elevation of the floor of a spillway, grade control structure, or ogee crest above which spillway flow begins.
State Dam Safety Engineer	For purposes of this EAP, Office of the State Engineer division or local field office engineer responsible for safety inspections and determining the safe reservoir storage level of assigned dams.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.