EAST LAKE DAM FAILURE SCENARIO

Unit 2: ICS Fundamentals Review

Student Version

Objective:

To apply key Unified Command principles.

Instructions:

Ask the students to work in groups to complete the following activity:

1. Review the following:
   - Scenario
   - Maps
   - Spillway Profile: Conditions and Critical Issues
   - Current Resources
   - Guidance for Determining the Emergency Level Associated with Dam Failure Staffing
2. Complete the following steps:
   a. Who has a stake in the incident?
   b. Who are the assisting and cooperating agencies?
   c. Is this a Single or Unified Command managed incident?
   d. If Single Command, who is the Incident Commander and why?
   e. If Unified Command, who are the members and why?
3. Draw an Organization Chart for your Incident Command or Unified Command.
4. Identify challenges and safety issues.
5. Record your results on chart paper that can be seen by the entire class.
6. Select a spokesperson and be prepared to present in 30 minutes.
7. Emphasize that the spokesperson should be able to explain the rationale for the group's decisions.

Scenario:

East Lake Dam is located 10 miles northeast of Central City in Liberty County. East Lake Dam provides water to Gold Mine, Blue Water, and the Mineral County Communities of Sumpter, Danton, and Bradley. Along with water supply, East Lake Dam provides hydropower, flood control, and water quality benefits to the surrounding communities.

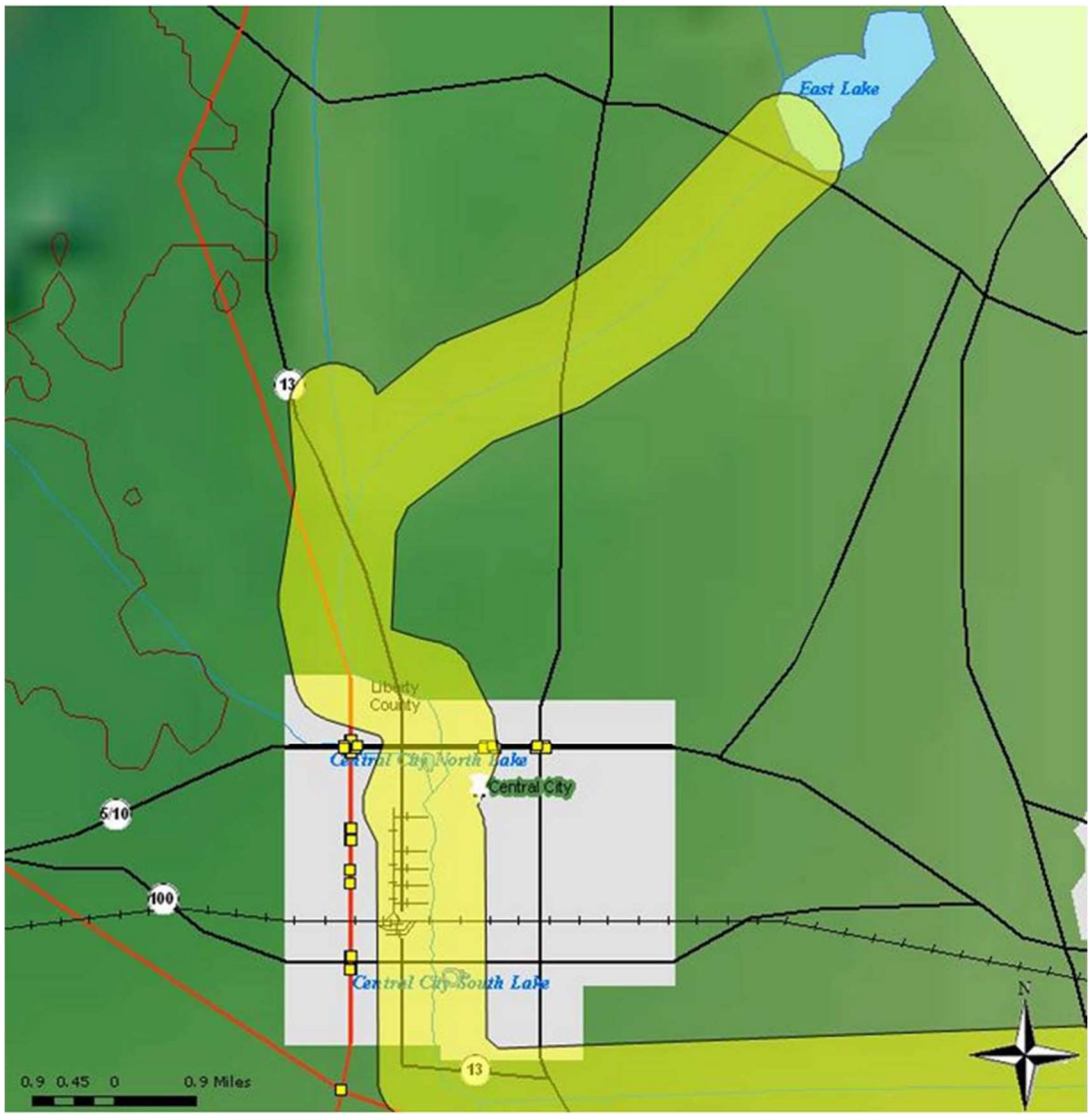
East Lake Dam

East Lake Dam was designed and constructed by the Columbia Valley Authority (CVA) between 1938 and 1952 and extends 3,979 feet and has a maximum height of 94 feet. The East Lake Dam consists of an earthen embankment and a concrete section that controls outflow to the power plant and water level control. This dam was built to control flooding, provide hydroelectric power, enhance recreational opportunities, and provide quality potable water to area communities. It impounds the Roaring River and is approximately one mile across. It is capable of producing 140,400 kW. At maximum elevation, the dam impounds 162,000 acre-feet of water.

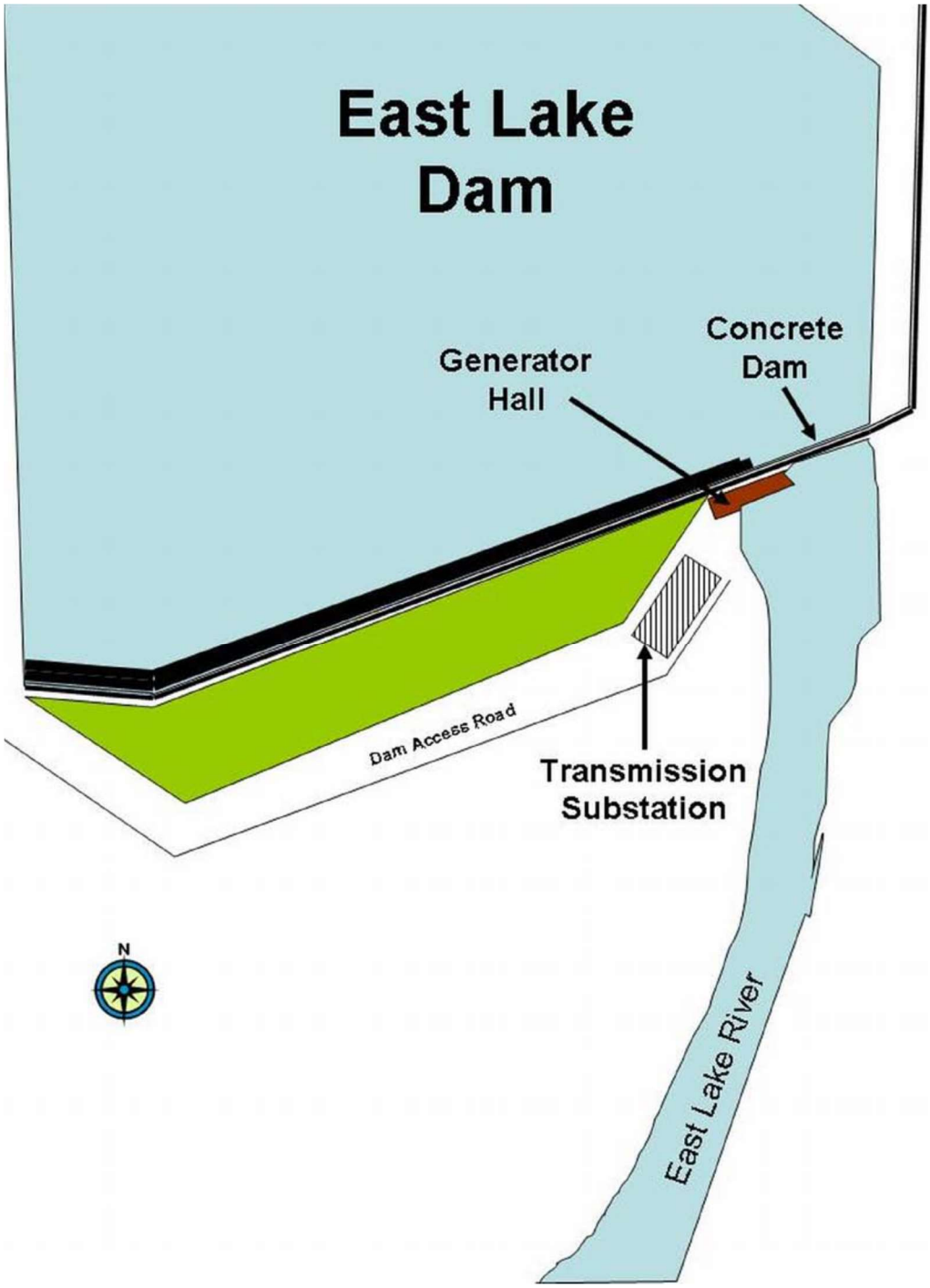
Fifteen years after completion, a study of muddy flows and two sinkholes at the toe of the dam revealed the karst topography of the supporting bedrock was causing significant seepage problems in the dam's foundation, threatening its structural integrity. Ten years after the discovery of the seepage, a concrete diaphragm wall was constructed, which runs through the earthen embankment down to the bedrock. While this solution provided temporary relief from the dam's erosion, instrumentation embedded throughout the dam has highlighted areas where seepage was not entirely blocked and has found new paths around the diaphragm. This continued degrading of the dam's condition convinced the United States Army Corp of Engineers (USACE) to designate the East Lake Dam as "high risk" for failure. A sudden catastrophic failure of the East Lake Dam would cause a significant loss of life and cause serious economic losses. The loss estimates for Central City, the community most at risk below East Lake Dam, are loss of life of up to 5,000 individuals and a financial impact of five billion dollars.

The inundation map shows the extent of flooding that would occur if the East Lake Dam should experience a catastrophic failure. The Turtle River, south of Central City, would

also be impacted all the way to the coast. Currently, remediation approaches are plans for a larger diaphragm using newer technologies along with a grout curtain and a lowering of the lake level by a fifth of its normal height. Warning sirens have been installed to provide early warning to the populace in the event of the dam's failure.



Inundation Diagram of Flooding Caused by a Catastrophic Failure of East Lake Dam



East Lake Dam Layout Diagram

The Columbia Valley Authority (CVA) is managed by a commissioner and assistant commissioner who employ four (4) full-time and five (5) part-time Dam Technicians. The Dam Technicians are responsible for the monitoring and maintenance of the water control structures located within the watershed district. The CVA has one (1) large portable pump; three (3) dump trucks; one (1) backhoe; and five (5) pickup trucks.

Central City has a population of approximately 149,000. The police department employs 183 personnel dedicated to public safety and service. The fire department is comprised of 300 firefighters operating from 12 fire stations. Level 3 Minimum Staffing is 66 personnel on duty, with ten (10) Type 1 engines; two (2) Squirts; four (4) Type 1 aerials; two (2) brush trucks; four (1) water tender; and four (4) quick response vehicle.

Dam break flooding from East Lake Dam could threaten areas that have not historically had flooding problems. Catastrophic failure of East Lake Dam could impact Liberty County and Central City. Floods from the East Lake River, Roaring River, Swatera Creek, and Turtle River could impact the communities along their banks following the failure of the East Lake Dam. If the failure occurs during a period of heavy rains, all four waterways could be impacted and flooding could occur along their banks. The following three maps show the flood zones in Liberty County and in Central City.

During the month of March, Central City and other surrounding areas in the Liberty County have experienced unusually heavy rainfall. Approximately 2 weeks ago, rainfall and associated watershed runoff caused excessive auxiliary spillway flow at East Lake. Since construction of the dam, this was the first time that water had flowed through the auxiliary spillway. CVA personnel noticed late on Sunday afternoon that water was starting to seep through an area in the right side of the dam at approximately five (5) GPM and was mostly clear in appearance. Attempts to operate the slide gate on the principal spillway to initiate a water release failed. The CVA Commissioner immediately provided a situation report to the District Conservationist and Liberty County Emergency Manager.

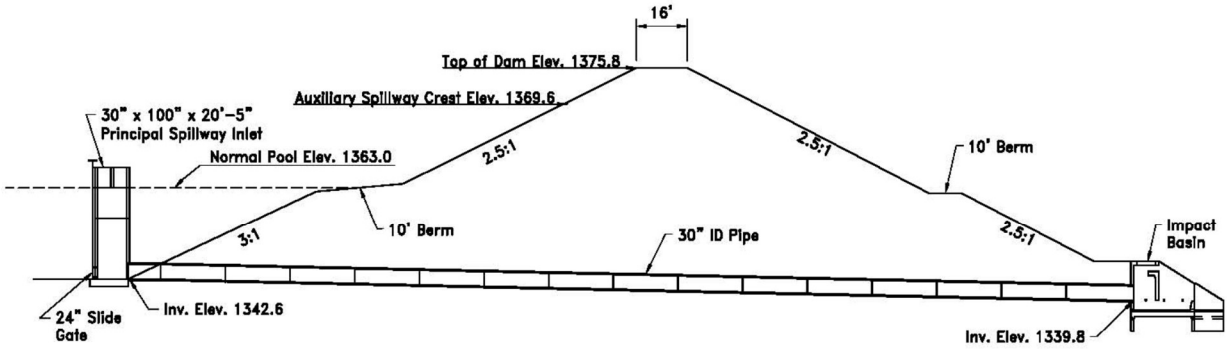
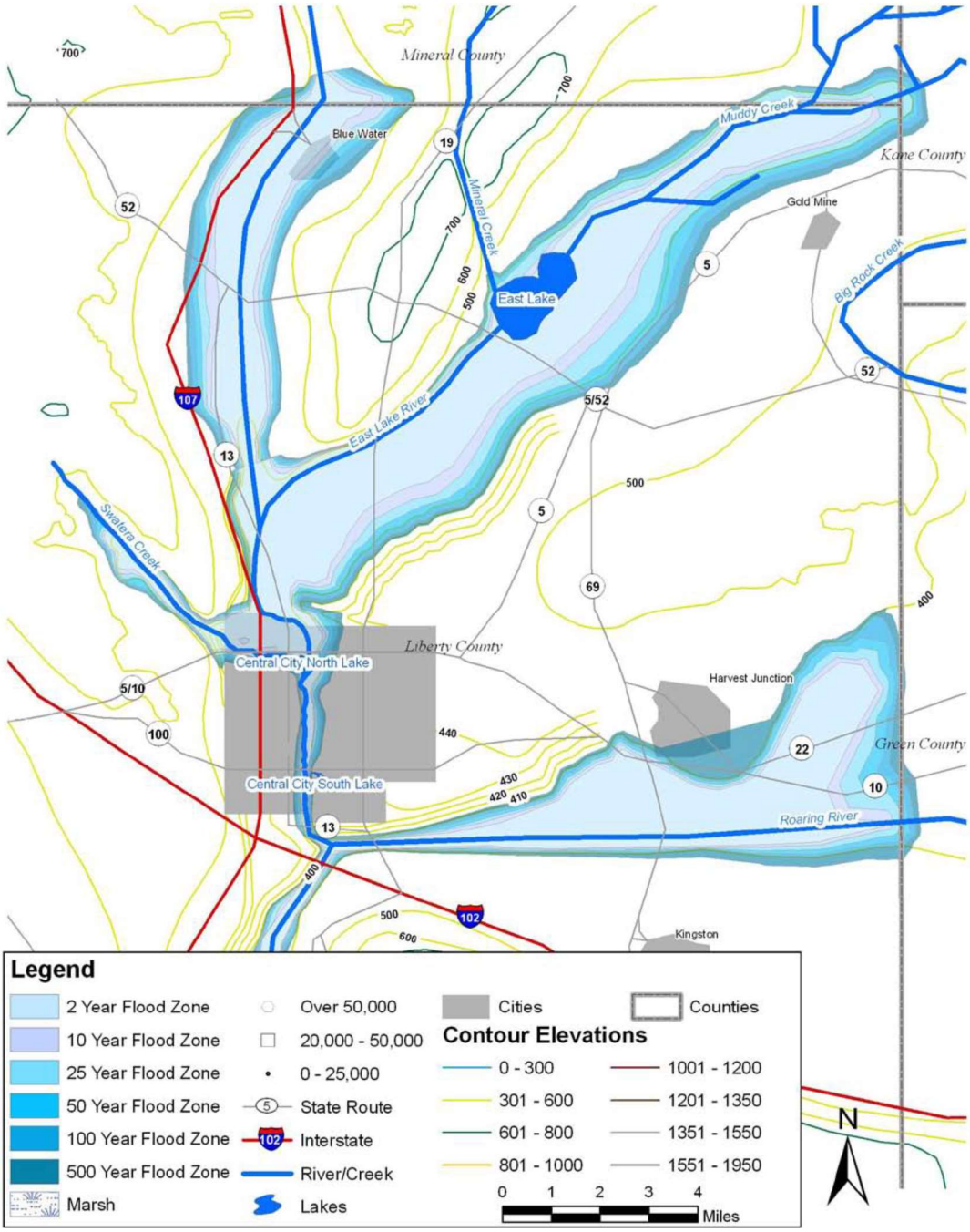


Figure F.2 – Profile of Principal Spillway

Flood Inundation Maps of Liberty County show elevation contours and the 2, 10, 25, 50, 100, and 500 year flood zones for Central City and northern and southern Liberty County.

Also shown on the South Liberty County Map are the areas of expected flooding during a hurricane.

North Liberty County Flood Map:



Spillway Profile:

Conditions:

- The Liberty County Emergency Manager has requested the East Lake Dam Safety Incident Management Team.
- Additional CVA personnel have been requested to work on repairing the slide gate on the principal spillway, which will not function.
- Local law enforcement and fire department resources have been notified of the situation.
- At this time, no evacuations of residences or businesses directly below the dam have been requested.
- Liberty County's Emergency Operation Center's Public Information Officer is seeking permission to release a press statement about the incident.
- Current weather conditions are sunny to partly cloudy with no precipitation and temperatures in the low fifties.

Critical Issues:

- Implement required safety measures to protect responding personnel and the public.
- Immediately make a determination of what measures can be taken to release water from East Lake to reduce pressure on the earthen dam.

Current Resources:

Columbia Valley Authority (CVA):

Supervisory Personnel	(1) Dam Assistant Commissioner
Dam Maintenance Labor	(2) FTE Dam Technicians 2 person crews
	(2) PTE Dam Technicians 2 person crews
Portable Pump	(1) Large
Backhoes	(1) wheeled backhoe/front loader
Dump Trucks	(3) single axle dump trucks
Pickup Trucks	(5) F150

Liberty County:

County Personnel	(1) District Conservationist
	(1) Soil Conservation Technician
Area Personnel	(1) Area Engineer

Law Enforcement:

Liberty County Sheriff Department	(2) patrol units with 2 deputies
Central City Police Department	(2) patrol unit with 1 officer

Fire Department:

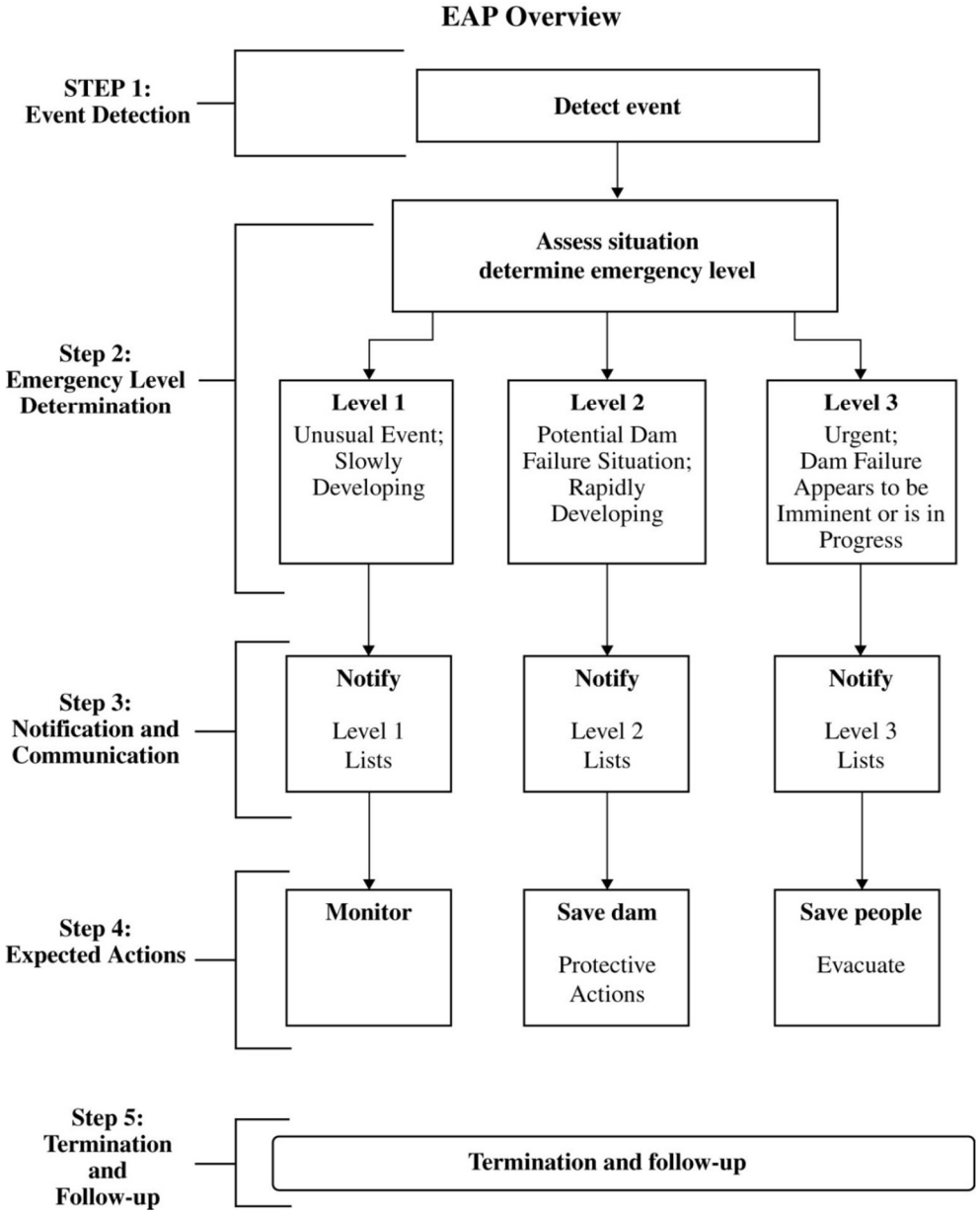
Central City Fire Department	(2) Type 1 engines and 6 firefighter/EMTs

Public Works:

Liberty County	(4) dump trucks
	(2) backhoe/front loaders
	(2) road graders

Guidance for Determining the Emergency Level Associated With Dam Failure:

Step 1: Event Detection



This step describes the detection of an unusual or emergency event and provides information to assist the dam operator in determining the appropriate emergency level. 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.
- Evaluation of instrumentation data.
- Earthquakes felt or reported in the vicinity of the dam.
- Forewarning of conditions that may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast).

Step 2: Emergency Level Determination

After an unusual or emergency event is detected or reported, the event is classified into one of the following three emergency levels:

Emergency Level 1 - Non-emergency, unusual event, slowly developing:
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. Columbia Valley Authority (CVA) technical representatives or State Dam Safety Officials should be contacted to investigate the situation and recommend actions to take. 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 Liberty County Emergency Management Director 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 Liberty County Emergency Management Director should be notified of this emergency situation and placed on alert. The dam operator should closely monitor the condition of the dam and periodically report the status of the situation to the Liberty County Emergency Management Director. If the dam condition worsens and failure becomes imminent, the Liberty County Emergency Management Director must be notified immediately of the change in the emergency level to evacuate the people at risk downstream. If time permits, Columbia Valley Authority (CVA) and State Dam Safety Officials should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The Dam Operator should initiate remedial repairs. Time available to employ remedial actions may be hours or days.

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

Emergency Level 3 - Urgent; dam failure appears imminent or is 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 earth spillway is causing downstream flooding of people and roads. The Liberty County Emergency Management Director should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed.

EVENT	SITUATION	EMERGENCY LEVEL*
Earth Spillway Flow	Reservoir water surface elevation at auxiliary spillway crest or 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 head cut that is threatening the control section	**3**
	Spillway flow that is flooding people downstream	**3**
Embankment Overtopping	Reservoir level is 1 foot below the top of the dam	**2**
	Water from the reservoir is flowing over the top of the dam	**3**
Seepage	New seepage areas in or near the dam	**1**
	New seepage areas with cloudy discharge or increasing flow rate	**2**
	Seepage with discharge greater than 10 gallons per minute	**3**
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	**2**
	Rapidly enlarging sinkhole	**3**
Embankment Cracking	New cracks in the embankment greater than ¼-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 proceeding slides of the embankment slopes	**3**
Instruments	Instrumentation readings beyond predetermined values	**1**
Earthquake	Measurable earthquake felt or reported on or within 50 miles of	**1**

	the dam	
	Earthquake resulting in visible damage to the dam or appurtenances	**2**
	Earthquake resulting in uncontrolled release of water from the dam	**3**
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	**3**
Sabotage/ Vandalism	Damage to dam or appurtenance 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	**3**

* **Emergency Level 1:** Non-emergency unusual event, slowly developing
Emergency Level 2: Potential dam failure situation, rapidly developing
Emergency Level 3: Urgent; dam failure appears imminent or is in progress