

Instructions and Helpful Tips for Preparation of Emergency Action Plans

Maryland Department of the Environment

Dam Safety Division

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Adapted from 2007 NRCS Publication and FEMA 64 “Emergency Action Planning for Dams”

Introduction

Dam failures occur every year in this country. Dams may fail on first filling, after a heavy storm, during maintenance efforts, or suddenly after 100 years of “safe” operation. In an event that may stress your dam (hurricane, heavy rain, earthquake, etc.), an effective and up-to-date Emergency Action Plan (EAP) is a critical tool for high and significant hazard dam owners, dam safety officials, and emergency response personnel. Should your dam fail and cause loss of life or property damage, implementing an EAP will demonstrate responsible and recommended actions consistent with standard level of care by a dam owner.

An effective EAP can save lives and protect property. A well prepared EAP will provide details regarding emergency triggers; mitigation methods; communication protocols; incident command duties; and perhaps most importantly, the information necessary to determine where the at-risk population downstream of the dam is located, and how to safely evacuate those persons.

While a dam owner may not be able to control personnel changes, downstream development, or other variables, it is critical that the dam owner is aware of such changes and maintains an accurate and current EAP to ensure effective communications and emergency response. Accordingly, the MDE Dam Safety Division recommends that by July 1 of each year, the following activities are completed by the dam owner:

- Review the content of the EAP with all personnel responsible for operation or maintenance of the dam.
- Check that contact information is correct for all individuals listed in the EAP.
- Update the EAP as necessary, and provide updated copies to all listed record-holders and the MDE Dam Safety Division. If after review no changes are found to be necessary, contact the MDE Dam Safety Division so that the review/update can be recorded.

A note on updating your Emergency Action Plan

- *Annual EAP review and updates are required by Maryland law for High and Significant hazard structures.*
- *It is recommended that the EAP is completely re-written using the latest template on an approximate 5 year cycle. This recommendation is intended to encourage the dam owner/operator to perform a deeper analysis of the document in preparation for recommended tabletop and functional exercises.*

Using MDE Dam Safety Template EAPs

The EAP templates available on the MDE Dam Safety Division website have recently been updated to benefit the dam owner and streamline the EAP generation process¹. While the template documents contain many pages, some of the pages do not require any additional information, and many require filling in only a few pieces of information. These pages may still contain very important information, but they are typically universally applied, rather than being specific to a dam.

The EAP template is available as Microsoft® Word documents at the following web address:

https://mde.maryland.gov/programs/Water/DamSafety/Pages/model_eap.aspx

The standard template, indicated as “Template EAP – 2021” provides highlighted yellow text wherever dam specific information is required. In many cases context is provided regarding what type of information is required. This feature has been added as a review of existing EAPs indicates that certain information is often left out of the document, or the placeholder template text is inadvertently left in place.

Tips:

- *The yellow highlighting in either template document can be removed by selecting all text (CTRL+A) and removing the highlight in the Microsoft® Word “Home” ribbon.*
- *Page references can be automatically updated once the document is complete by selecting all (CTRL+A), then pressing F9. A relic dialogue box from a former template version will appear, simply click “OK” twice to clear the box and update page numbers.*

A note on uniformity of Emergency Action Plans

EAP effectiveness can be enhanced by a uniform format that ensures that all critical aspects of emergency planning are covered in each plan. Uniform EAPs and advance coordination with emergency management authorities should facilitate a timely response to a developing or actual emergency.

That being said, each dam is unique. Some dams may warrant a fourth “High Flow” emergency level. Customize the EAP to suit your dam as needed.

Preparing or Updating an EAP

¹ The content of the EAP has not changed, thus existing EAPs do not require changes.

Step 1: Gather pertinent emergency response personnel information.

- a. Complete EAP Worksheet Number 1. Consider the state, county, and local agencies that may play a role in responding to an emergency. Also consider adding media contacts, and other important downstream property owners (for example, rail operators, school or hospital officials). Discuss the list of contacts you have developed with the County Emergency Manager, as they may have additional contacts to add. Contact each agency to determine a specific point of contact and obtain pertinent information (office and cell phone numbers, email address, office address). An emergency can happen at any hour of the day, so try to obtain phone numbers that are available 24/7.
- b. Determine the roles and responsibilities for each of the principals identified in the EAP:
 - o Identify the Incident Commander during the emergency. The Incident Commander is responsible for managing and directing persons and organizations during the emergency. Generally, the Sheriff or Emergency Management Coordinator is the Incident Commander, but you need to check with officials in your area to see who will be the local responsible official.
 - o Identify a person responsible for being the point of contact with the media (generally the Sheriff or Emergency Management Coordinator).
 - o Identify the primary contact for MDE Dam Safety Division.
- c. Review the list of responsibilities in the sample EAP, and revise as necessary.
- d. Complete EAP Worksheet Number 2. Determine locally available labor, equipment and material resources available for responding to an emergency. Contact local quarries, excavation companies, and other similar entities to establish a business relationship and get current contact information. Where possible, arranging a service agreement or contract terms in advance may reduce delay during an emergency.

Step 2: Gather pertinent dam information.

- a. Complete EAP Worksheet Number 3, which contains basic dam information (age, type of construction, size, etc.). If this information is not readily available, your MDE Dam Safety Division contact can provide this.
- b. Gather inundation maps and determine the downstream area and the people, businesses, and public infrastructure at risk if the dam should fail. Sometimes this can be determined with a quick analysis and field review if only isolated properties are involved downstream from the dam. Typically a qualified professional engineering firm will need to perform field surveys and a detailed breach inundation study. The study should be reviewed and accepted by MDE Dam Safety before it is published in the EAP. Consult with MDE Dam Safety regarding the format of inundation maps

and other pertinent data that should be included in the breach inundation study. Inundation maps should show the areas inundated in both the “sunny day” and design storm events. The maps should include cross section information for selected areas downstream of the dam. The following information should be included for the “sunny day” breach and design storm breach scenarios:

- Distance of cross section downstream from the dam.
- Travel times (in hours and minutes) of the leading edge and peak of the dam breach flood waves starting from when the dam fails
- Expected peak water surface elevations
- Incremental rises in water levels
- Peak discharges
- Estimated duration of inundation

The dam owner should try to prepare maps using terms understood by all emergency responders. For example, a local responder may prefer that the maps show the expected height of water over a road instead of peak water surface elevation. However, the NWS may need the incremental rise and water level to issue flood warnings.

- a. Prepare a list of impacted properties and the contact information for residents and/or businesses. County Emergency Management officials may be able to obtain contact information or assist with this task.
- b. Gather dam as-built construction drawings from your files, MDE Dam Safety, or from your selected engineering firm. Make copies of needed sheets from the as-built drawings. Locate or prepare maps showing the location of the dam in the state; the vicinity map showing the detailed location of the dam and how to access it; the project watershed map; plan view and profile of the dam and important appurtenances; and the reservoir elevation-area-volume-discharge data (aka stage/storage and stage/discharge curves). If possible, make an electronic scan of the drawings for insertion into the document.
- c. In coordination with your engineer and MDE Dam Safety determine appropriate emergency trigger levels based on the dam watershed, the dam outlet works, its response to rain events and the downstream hazards. Consider how quickly water levels rise, historic high water levels or stream flows, and other factors in conjunction with the dams performance during storm events.
- d. Complete EAP Worksheet Number 4, which provides directions to the dam and a list of potentially impacted downstream properties. Remember that the directions to the dam should consider which roads may be inundated during a failure. Direct responders to the dam using roads that remain “dry” where possible.

Step 3: Add information to the EAP template:

- a. Download the appropriate EAP template from the MDE Dam Safety Webpage at the link provided above. Save this document (suggested file name: “Dam Name, Dam No

____, Emergency Action Plan – MM-YYYY”).

- b. Input the data gathered in EAP Worksheets Number 1 through 4 into the EAP template by filling in the blanks.

Tips:

- *Any of the content of the sample EAP can be edited; however, the highlighted areas contain information that must be input for the site-specific EAP. The EAP templates are samples - your dam may require additional emergency trigger levels, points of contact, or other variables.*
- *Emergency Action Plans are only useful if the information provided is current, correct and easily understood. To that end, shrinking a large plan to fit onto a standard sheet of paper may render the information contained on the plan illegible. Inserting 11”x17” pages, or even full plan pages into your EAP is preferred if the information cannot be easily read on an 8.5” x 11” page.*

Step 4: Distribute the draft EAP for review and comments:

- a. Distribute the draft EAP to the emergency management officials and MDE Dam Safety Division and request their review and comments.
- b. Offer to coordinate an onsite review of the dam with all record holders of the EAP if they wish.
- c. Incorporate comments received.

Step 5: Obtain concurrence signatures:

- a. Obtain signatures of all officials with responsibilities with implementing the EAP. (Note, each individual can sign a separate page to expedite the process).
- b. The dam owner and a representative of the MDE Dam Safety Division should also sign the cover page.

Step 6: Assemble and distribute final copies of the EAP:

- a. It is preferable that all identified EAP record holders have both electronic and paper copies of the EAP.

Step 7: Set a calendar reminder to begin reviewing and updating your EAP on an annual basis!

Step 8: Tabletop Exercises

- a. Coordinate with all record holders and conduct an EAP “table-top” exercise. These simulated emergency events must be coordinated by the dam owner at least every five (5) years in accordance with Maryland law. During the event all emergency response personnel should gather and act out their responses to a hypothetical event. The Maryland Dam Safety Division can assist the dam owner with running the event.

EAP Maintenance

After the EAP has been developed, approved, and distributed, continual reviews and updates must be performed. Without periodic maintenance, the EAP will become outdated and ineffective.

The EAP should be updated promptly to address changes in personnel and contact information, significant changes to the dam, changes to the danger reach, or emergency procedures. The EAP should be reviewed at least annually for adequacy and updated as needed. Even if no revisions are necessary, the review should be documented.

Tips:

- *An EAP Review Checklist is included with this document. This checklist can be a useful starting point for beginning an annual update.*

The review should include an evaluation of any changes in flood inundation areas, downstream developments, or in the reservoir, and a determination of whether any revisions, including updates to inundation maps, are necessary.

Including the date of the EAP or the date of the current revision on each page will help to ensure that users have the most current version. It is recommended that the entire EAP be reprinted as necessary and distributed to all plan holders to ensure that all updates have been included in the documents.

EAP Worksheet Number 1

EAP Emergency Contact Information

Note: The following agencies are suggestions, tailor to your specific dam.

Agency / Organization	Principal Contact	Address	Office Telephone Number	Alternate Telephone Numbers
Dam Owner				
Dam Operator				
Dam Engineer				
MDE Dam Safety Contact				
County Emergency Management Office				
County Police Contact				
State Police Contact				
Local Fire/Rescue Agency				
Local News Media				
National Weather Service <i>(see contact sheet in this document)</i>				
County Department of Public Works				
Maryland State Highway Administration				
Downstream Property Owners				

EAP Worksheet Number 2

EAP Emergency Response Materials/Resources

Resources Available

Locally available equipment, labor, and materials:

Local DPW (or similar) has the following resources that can be utilized in the event of an emergency:

- Equipment 1
- Equipment 2
- Equipment 3
- Equipment 4
- Materials 1
- Materials 2
- Materials 3

Contact the **Local DPW (or similar)**—see *Emer. Services Contacts* tab.

Other locally available resources include:

Heavy equipment service and rental	Sand and gravel supply	Ready-mix concrete supply
Company Name Address City, State 410-555-XXXX	Company Name Address City, State 410-555-XXXX	Company Name Address City, State 410-555-XXXX
<i>or</i>	<i>or</i>	<i>or</i>
Company Name Address City, State 410-555-XXXX	Company Name Address City, State 410-555-XXXX	Company Name Address City, State 410-555-XXXX
Pumps	Diving contractor	Sand bags
Company Name Address City, State 410-555-XXXX	Company Name Address City, State 410-555-XXXX	Company Name Address City, State 410-555-XXXX

EAP Worksheet Number 3
National Inventory of Dams (NID)
Data

Dam name: **Dam Name**

State: **MD**

NID ID: **MD00###**

Longitude: **##.####**

Latitude: **##.####**

County: **County Name**

Stream: **Stream Name**

Nearest town: **Nearest Town**

Distance to nearest town: **## mi**

Operator: **Operator Name**

Year constructed: **YYYY**

Max. Discharge: **#### ft³/s**

Max. Storage: **### acre-ft**

Normal storage: **## acre-ft**

Surface area: **## acre**

Design hazard potential: **High/Significant/Low**

Current hazard year: **YYYY**

Hazard Classification: **High/Significant/Low**

Sediment storage: **### acre-ft**

Flood storage: **### acre-ft**

Principal spillway type: **Material and Type**

Principal spillway conduit diameter: **## in**

Auxiliary spillway type: **Type and ground cover**

Auxiliary spillway width: **## ft**

Drainage area: **## mi²**

Inspection frequency: **# yr**

State regulated?: **Yes/No**

State Regulating Agency: **MDE- Dam Safety Div**

Purpose of Dam: **Flood Control/Water Supply/etc.**

Service life: **## yrs**

O&M insp. resp.: **Entity Name**

O&M insp. current?: **Yes/No**

Population at risk: **###**

Dam height: **## ft**

Dam length: **### ft**

Dam volume: **#### yd³**

EAP Worksheet Number 4

Site-specific EAP Information

Dam Name: _____

Directions to Dam: *(Start at a spot like an intersection in town or two major roads and give, in miles, directions from that point to the dam):*

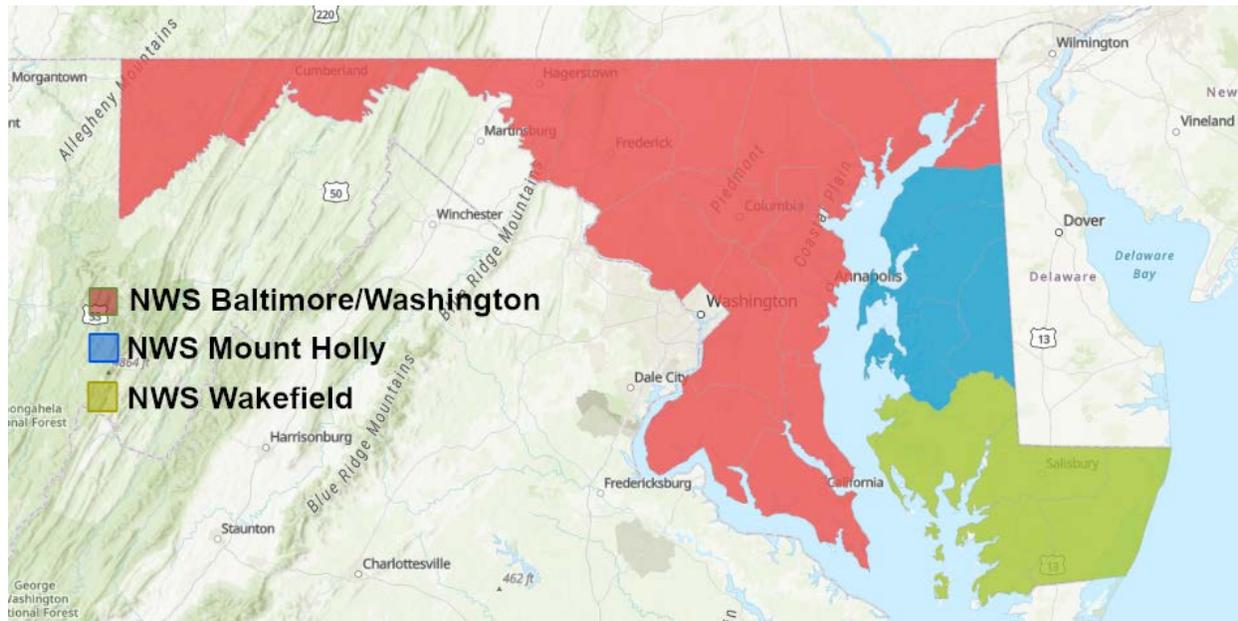
If the main road to the dam could be flooded if the dam failed, provide an alternate route:

An alternate route to the dam is:

Houses, businesses, highways, other structures in the downstream area that will be impacted by a dam failure:

House/ business no.*	Resident/business	Address	Phone no.	Distance downstream from dam (ft)	Travel time** (hr)	Max water depth above first floor (ft)
#	Resident Name(s)	Address, City, State	410-555-XXXX	####	##	##
B-#	Business Name	Address, City, State	410-555-XXXX	####	##	##
#	Resident Name(s)	Address, City, State	410-555-XXXX	####	##	##
	Highway Name			####	##	##
	Highway Name			####	##	##

Name, address, and phone number of landowner where dam is located:



National Weather Service Baltimore/Washington (Central and Western Counties)	Decision Support Meteorologist nws-sterling- wxsupport@noaa.gov	43858 Weather Service Road Sterling, Virginia 20166	1-800-253-7091 (24/7)	1-571-888-3501 (Business Hours)
National Weather Service Mount Holly (Kent, Queen Anne's, Talbot, Caroline)	Decision Support Meteorologist Or Raymond Krzdlo	732 Woodlane Rd, Mt Holly, NJ 08060	609-261-6602	609-261-6600
National Weather Service Wakefield Wicomico, Somerset, Dorchester, Worcester)	Decision Support Meteorologist Or Eric Seymour Eric.Seymour@noaa.gov	10009 General Mahone Hwy, Wakefield, VA 23888	747-899-5730	757-899-2415

EAP Review Checklist

(Source: FEMA 64 “Emergency Action Planning for Dams”)

General Document Items

- Is the name of the dam and other relevant identifiers, such as NID, State, and Federal ID numbers, clearly labeled in large letters in the EAP?
- Is the document a controlled document (i.e., each distributed plan is individually numbered and contains a statement that the plan is not to be copied or distributed by anyone other than the dam owner)?
- Is there a table of contents?
- Are the roles and responsibilities of key emergency personnel clearly documented, preferably at the beginning of the document?
- Is there an up-to-date revision sheet provided near the beginning of the document?
- Are revision numbers and revision dates provided as footers on each page of the document?

Detection Items

- Are detection and/or early warning systems at the dam clearly described, including dam operators’ observations, instrumentation systems, and observations by the general public?

Decision Making Items

- Are the emergency levels clearly described?
- Are there clear guidelines and decision criteria to help the dam owner determine the appropriate level for potential unusual and emergency conditions that could occur at the dam?

Notification and Communication Items

- Are primary and backup communication systems among the dam owner, local emergency responders, and other key stakeholders described in the document?
- Are the notification flowcharts complete and logical?
- Are phone numbers, after-hours phone numbers, and backup personnel listed on the notification flowcharts and emergency contact lists?
- Do the notification flowcharts include contacts to provide timely engineering support?
- Do the notification flowcharts include contacts for timely notification of local

emergency management organizations for more serious emergency levels?

- Do the notification flowcharts minimize the number of calls that dam operators are required to make, so that they can focus on implementing preventative actions? (Optimally, one or two calls per entity is best with no more than four calls)

Pre-planned Action Items

- Are there descriptions of recommended preplanned actions for potential unusual and emergency conditions at the dam?
- Is there a list of locally available engineering, labor, materials, and equipment resources that can be referenced in an emergency?
- Has the contact information for the locally available resources been recently updated or verified?

Termination and Follow-up Items

- Is the person with the authority to terminate emergency operations identified?
- Are the procedures for terminating emergency operations clearly described?
- Is there guidance on follow-up responsibilities after the emergency is terminated?

Inundation Mapping

- Does the inundation map include a north arrow and bar scale?
- Are the inundation areas clearly delineated and labeled? This is especially important if there are “sunny day” failure and “Design Storm plus Breach” inundation limits shown on the inundation maps.
- Does the inundation map include a qualification stating that the inundation limits for an actual dam failure may vary in some ways from what is shown on the inundation map?
- Are local roads, drainages, and other landmarks clearly labeled on the base map?
- Is the downstream limit of the inundation mapping logical (e.g., at a major reservoir, river, other water course)?
- Were channel cross sections taken at critical downstream locations, such as at major road crossings, schools, major population centers, etc.?
- Is the following flood inundation information provided at important downstream cross sections:
 - Peak flood stage
 - Floodwave arrival time
 - Time to peak discharge

- Maximum water surface elevation
- Peak discharge

Other Items

- Are clear procedures for testing and updating the document provided?
- Is the frequency of testing and updating the document clearly described?
- Is the person or position responsible for updating the document indicated along with current contact information for that person?
- Are the processes for training personnel in how to use the document and the frequency and responsibility for this training clearly described?
- Are key hydrologic/hydraulic data, such as spillway and outlet discharge curves and reservoir area capacity curves, provided?
- Does the document include a general location map that shows where the dam is located relative to other key local roads, drainages, and population centers?