Ohio Dam Safety Program & Emergency Action Plans (EAPs)

Ohio Emergency Management
2018 Spring Conference
April 18, 2018

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Ohio Department of Natural Resources
Division of Water Resources
Dam Safety Program
What is a dam?

- A "Dam" is:
  - Artificial barrier together with any appurtenant works,
  - Does or may impound water (or other liquefied material).
  - Upground reservoirs and lagoons are considered to be dams.
  - Fill or **structure** intended solely for highway or railroad -not considered a dam.
  - OAC 1501:21-3-01 (f)

https://www.usbr.gov/lc/hooverdam/
What Kind of Dams in Ohio?

- Concrete Gravity Dams
- Earthen with Concrete Spillway
- Upground Reservoirs
- Low-head Dam/Channel Dams
- Earthen Dams
- Industrial Waste
Miami Conservancy District – Earthen Dam with Concrete Spillway - Flood Control
John R. Doutt Upground Reservoir
Pumped Storage - Water Supply
Low-Head Dam, Channel Dam, Run-of-the-River Dam
Industrial Waste Pond Dam
Earthen Dam – Recreation, Flood Control, Sediment Control
Ohio Dam Safety Program’s Core Purpose:

To ensure human life, health & property are protected from dam failures
Ohio Dam Safety Responsibilities

Per Ohio’s statutes – dam safety is a shared responsibility between the dam owner & Division of Water Resources (DWR) – Dam Safety Program (DSP).
Owner Responsibilities

- Per ORC 1521.062 (E), Dam Owner **shall:**
  - Monitor, maintain, & operate the dam safely.
Maintenance & Monitoring Are Critical
You Need To Be Able To See All Parts Of The Dam To Inspect & Monitor Properly
Owner Responsibilities

- Per ORC 1521.062 (E), Dam Owner **shall:**
  - Monitor, maintain, & operate the dam safely.
  - Notify DSP & other authorities of incidents threatening the safety of the dam.
  - Take action to safeguard life, health, & property.
  - Notify Chief of DWR in writing of a change in ownership.
DWR Responsibilities

- Periodic safety inspections
  - 5-year periodic inspections
  - Evaluate condition, downstream hazard, & owner’s safety program
- Repairs and modifications
  - Review and oversight of repairs and modifications
- Construction permits
  - Issue permits for new dams and enlargements
- Enforcement
  - Authority to compel corrective action through the courts
- Emergency response
  - Authority to require and to take immediate action
Dam Classification

- Dam Safety Program Classifies Dams based on:
  - Height
  - Storage
  - Downstream Hazard

- Not all dams in Ohio are regulated by the Dam Safety Program
Dams Exempt from ODNR Regulation Based on Size

Volume of Water at Highest Level

<table>
<thead>
<tr>
<th>Height</th>
<th>Volume</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 6 ft.</td>
<td>Unlimited</td>
<td>-</td>
</tr>
<tr>
<td>6 to 10 ft.</td>
<td>50 acre-feet</td>
<td>10-ft in height, 10-acre lake</td>
</tr>
<tr>
<td>Unlimited</td>
<td>15 acre-feet</td>
<td>15-ft in height, 2.5-acre lake</td>
</tr>
</tbody>
</table>
Dam Classification

**Class I**
- > 60 feet high
- > 5,000 acre-feet storage
- Probable loss of life
Dam Classification

**Class II**

- 40-60 feet high
- 500-5000 acre-feet storage
- Loss of High-Value Property
  - Damage to:
    - Businesses
    - Class I, II, & III dams
    - Homes
    - State & Interstate Roads
    - Water/Wastewater/Industrial Impoundments
Dam Classification

Class III

- 25-40 feet high
- 50-500 acre-feet storage
- Loss of Property:
  - Agricultural structures
  - Garages
  - Exempt dams
  - County, Township, & City Roads
Dam Classification

Class IV

- Dam & lake larger than an exempt dam
- 10-25 feet high
- 15-50 acre-feet storage
- No downstream hazard impact to structures
How Many Dams in Ohio?

Class I Dams - 361
Class II Dams - 549
Class III Dams - 568
Dams can and do fail...

Wayne County – Early 1980s
South Fork Dam Failure
Johnstown, PA (1889)
Killed 2209 people
Downstream Development & Hazard

Alum Creek Lake Dam
Importance of EAPs

"RUN FOR IT! IS NOT AN ADEQUATE EMERGENCY ACTION PLAN."
Emergency Action Plan (EAP)

Ohio Administrative Code Rule 1501:21-21-04

- The owner of a dam shall be responsible for the continued safe operation and use of the dam so that it is not a hazard to life, health, or property.

Ohio Administrative Code Rule 1501:21-15-07

- An emergency action plan is required for all Class I, II, and III dams.
- The plan for all Class I dams shall include an inundation map.
DWR - Fillable EAP

- Designed for Class III and some Class II dams
- Includes most sections of standard EAP, but simplified
- Must still be tailored for each individual dam
ICODS FORMAT

I. Notification Flowchart
II. Statement of Purpose
III. Project Description
IV. Emergency Detection, Evaluation, and Classification
V. General Responsibilities
   A. Dam Owner
   B. Notification
   C. Evacuation
   D. Termination and follow-up
   E. EAP coordination
VI. Preparedness
VII. Inundation Maps
VIII. Appendices
      Appendix A: Investigation and Analyses of Dam Break Floods
      Appendix B: Plans for Training, Exercising, Updating, and Posting EAP
      Appendix C: Site-Specific Concerns
      Appendix D: Approval of the EAP
Section I - Notification Flowchart

- One of the most important parts of the plan
- List of “Who” to notify in the event of a dam emergency
- Contains phone numbers and alternative contacts
  - ODNR
  - County EMA
  - National Weather Service
I. Notification Flowchart

<table>
<thead>
<tr>
<th>Dam Owner Representative #1</th>
<th>Dam Owner Representative #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name: John Damowner</td>
<td>Name: Jane Damowner</td>
</tr>
<tr>
<td>Phone number: 111-111-1111</td>
<td>Phone number: 111-111-1111</td>
</tr>
<tr>
<td>Cell phone number: 111-111-1112</td>
<td>Cell phone number: 111-111-1113</td>
</tr>
</tbody>
</table>

The dam owner representatives will determine the alert level at the dam according to Section IV of this EAP and notify 911, ODNR, and the owner’s engineer.

For a Watch Alert Level, notify the parties below that there is a potential dam failure situation developing.

For a Warning Alert Level, notify the parties below that a dam failure is in progress or is imminent. Evacuations and/or road closures are needed.

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911

The Example County 911 Dispatch will contact the entities listed below.

The EMA will assist with coordinating emergency response.

Example Co. EMA – 987-372-1111
Example Vol. Fire Dept. - 987-372-1222
Example Co. Engineer – 987-372-1333
Example Co. Sheriff – 987-372-1444
ODOT District 5 – 987-372-1555
National Weather Service – 800-455-9012

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ODNR, Dam Safety Engineering Program
24 hour emergency #: 614-799-9538
During business hours 8-5, Monday – Friday
614-265-6731

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Owner Engineer
Joe Engineer, P.E.
222-222-2222
1. NOTIFICATION FLOWCHART

DETECTION, EVALUATION & CLASSIFICATION

(See Table 4.1 & 4.2 and Figure 4.1)

If the severity of the problem is uncertain, maintain continuous observation and notify the ODNR, 24-hour Communication Center promptly. If the failure of Dams & appears to be imminent, notification for evaluation should be made.

**MONITOR**

This is an event or developing condition that is not normally encountered in the routine operation of the structures, or necessitates a variation from the operating procedures. The event may be a slowly developing situation that may endanger the structural integrity of the structure. The situation should be closely monitored. There is no need to contact other organizations.

**WATCH**

This is an emergency event that is developing and could lead to failure of the structure and flooding downstream. Emergency responders should be notified (see prescribed message) and make preparations to manage downstream of the structures.

Prescribed Message:

"This is the City notifying you that a Watch alert has been issued for the Dams. We are performing constant surveillance according to the Emergency Action Plan. We will inform you if a decision to evacuate or to cancel the Watch alert has been made.

**WARNING**

The failure of the Dams or flooding downstream of the Dams is imminent. Emergency responders should immediately evacuate downstream of the Dams and the area (see prescribed message).

Prescribed Message:

"This is the City notifying you that a Warning alert has been issued for the Dams. Please evacuate people downstream of the structures according to the County Emergency Operations Plan."

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**Figure 1.1 Notification Flowchart for and Dams &**
## ICODS FORMAT

### Dam Emergency Action Plan

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
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<tbody>
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<td>I.</td>
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<td>E. EAP coordination</td>
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<td>Inundation Maps</td>
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<td>VIII.</td>
<td>Appendices</td>
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Section IV - Emergency Detection, Evaluation, and Classification

- Section I & IV Notification relates to the alert levels

Typically 3 ALERT LEVELS

1. Non-failure (unusual) condition noted – “Monitoring”
2. Potential failure situation developing – “Watch”
3. Failure is imminent or has occurred – “WARNING”
Non-Failure Condition “Monitoring”

- Flood conditions with no threat to the integrity of the dam
- Example...Large spillway releases
Potential Failure Situation Developing

“Watch”

- Failure could occur, but pre-planned actions may prevent or mitigate failure...still time to do something.
- Assess situation & alert agencies
  - Provide periodic updates
  - Agencies decide their course of action
- Example...large earth slide on the external slope
Failure is imminent or has occurred

“Warning”

- Issued when no time is available to attempt corrective measures

- Dam is FAILING or is very likely to FAIL

- Responsible agencies will evacuate downstream

- Example... overtopping
Section VII. Inundation Maps

- Typically Class III Dams only require a downstream hazard map.

- Some Class II Dams require inundation maps & study, others merely a downstream hazard map.

- Class I Dams must have inundation maps & study.
Section VII. Inundation Maps

• Identifies area impacted by dam failure
  • endangered buildings & roads
  • evacuation routes
  • alternative routes to dam site
EAP Parts/Sections (cont.)

Section VII. Inundation Maps

- How high will water get?
- How long will it take water to arrive?
- Keep maps simple (while still being effective)!
- Summarize water height/arrival time at key cross sections.
- Include brief statement about inundation parameters.
### Dam Breach Inundation Map

**Legend**
- Sunny Day Breach
- 25% PMF Breach
- PMF Breach
- Cross Section Location
- Stream Centerline

**Source:** Base map orthophotography obtained from Ohio and Pennsylvania statewide imagery programs. Road names obtained from ODOT and county GIS departments. Map compiled and printed in Ohio State Plane Coordinate System with units of feet and horizontal datum of NAD83. The flood elevations are referenced to the NAVD88 vertical datum. Time of arrival and time to peak are calculated from the beginning of dam breach formation.

Flooded areas were determined using the HEC-RAS computer model for the probable maximum flood (PMF) dam failure hydrograph. 25% of the probable maximum flood (25% PMF) dam failure hydrograph, and a "Sunny Day" dam failure hydrograph. The failure of a dam is a complex hydraulic occurrence which can result in unexpectedly high depths of flow. Debris and the effect of encroachments can raise the water surface significantly. These local effects were not modeled in detail. When computing the flooded areas shown on the inundation maps, because of the limitations of the methods and procedures used to develop the flooded areas, the user of this map is advised that the limits of flooding shown are approximate and should be used solely as guidelines for the establishment of evacuation zones.

**Information:** The information contained in this map is prepared for use in notification of potential flood events.

**Table:**

<table>
<thead>
<tr>
<th>Failure Scenario</th>
<th>Time of Arrival (hrs)</th>
<th>Time of Peak (hrs)</th>
<th>Max WSEL (ft NAVD88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunny Day</td>
<td>0.4</td>
<td>2.8</td>
<td>871.47</td>
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<td>25% PMF</td>
<td>0.2</td>
<td>11.9</td>
<td>875.96</td>
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<tr>
<td>PMF</td>
<td>0.2</td>
<td>16.2</td>
<td>880.63</td>
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</table>

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<th>Time of Peak (hrs)</th>
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</thead>
<tbody>
<tr>
<td>Sunny Day</td>
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<td>2.3</td>
<td>875.22</td>
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<tr>
<td>25% PMF</td>
<td>0.2</td>
<td>2.2</td>
<td>883.04</td>
</tr>
<tr>
<td>PMF</td>
<td>0.1</td>
<td>1.8</td>
<td>887.85</td>
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</tbody>
</table>

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<th>Time of Peak (hrs)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Sunny Day</td>
<td>0.3</td>
<td>2.3</td>
<td>875.32</td>
</tr>
<tr>
<td>25% PMF</td>
<td>0.2</td>
<td>2.2</td>
<td>883.08</td>
</tr>
<tr>
<td>PMF</td>
<td>0.2</td>
<td>1.8</td>
<td>887.89</td>
</tr>
</tbody>
</table>
### Section VII. Downstream Hazard Maps (Fillable Form)

<table>
<thead>
<tr>
<th>Hazard Class:</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>—</th>
<th>Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Hazard</td>
<td>Loss of public water supply or wastewater treatment facility</td>
<td>Flooding of structure or high-value property</td>
<td>Damage to major road</td>
<td>Loss of local road</td>
<td>No hazard assessment, further investigation needed</td>
<td>Vertical velocity to base of affected structure</td>
</tr>
<tr>
<td></td>
<td>Damage to local road or public utility</td>
<td>Damage to major road, not otherwise high-value or critical facility area</td>
<td>Damage to Class IV dam or levee</td>
<td>No hazard assessment, further investigation needed</td>
<td>Vertical velocity to base of affected structure</td>
<td>Horizontal velocity to area of flood damage</td>
</tr>
<tr>
<td>Cam Lejnir Lake Dam</td>
<td>A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Girl Scouts Lake Dam (1511-007)</td>
<td>B</td>
<td>1800</td>
<td>4</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

![Downstream Hazard Maps](image)
Dam Safety Resources

- Ohio Dam Safety Program Webpage
  - http://water.ohiodnr.gov/safety/dam-safety#ABO
- Dam Locator
In the near future...

- ODNR Dam Safety Program will be reaching out with a survey to County EMAs

- Questions regarding:
  - How can the Dam Safety Program Improve the EAP distribution process?
  - Would an update yearly on approved EAPs in your county assist you?
  - Preference on Digital vs. Paper EAPs?
Questions?

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mia.kannik@dnr.state.oh.us

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EAP Coordinator
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What does a fish say when it swims into a concrete wall?

*WHAM!*  
DAM!