

# EMERGENCY ACTION PLAN

for

## Foster's Pond Dam

Andover, Essex County, Massachusetts

National I.D. Number: MA00153

State ID Number: 5-5-9-10

Dam Location: 42.61361° N / 71.14146° W



### Dam Owner:

Foster's Pond Corporation  
c/o Stephen Cotton, President  
19 Pomeroy Road, Andover, MA 01810  
Owner Daytime Phone: 978-475-5679  
Owner Emergency Phone: 978-475-5679

### Dam Caretaker:

David Brown  
31 Glenwood Road, Andover, MA 01810  
Caretaker Daytime Phone: 978-470-0454  
Caretaker Emergency Phone: 978-470-0454

Plan Developed September 2019  
Revision Number     Date September 2019

**Foster's Pond Dam**

**EMERGENCY ACTION PLAN  
TABLE OF CONTENTS**

<b><u>CHAPTER</u></b>	<b><u>PAGE</u></b>
PREAMBLE	ii
EAP Notification Flowchart	iii
1.0 NOTIFICATION PROCEDURES	1-1
1.1 Notification Flowchart .....	1-1
1.2 Emergency Notification Template .....	1-1
1.3 Impact Summary / Road Closures .....	1-2
1.4 General Response Flowchart .....	1-3
2.0 PROJECT DESCRIPTION	2-1
3.0 GENERAL RESPONSIBILITIES	3-1
3.1 Summary of Responsibilities .....	3-1
3.2 Emergency Response Coordination .....	3-2
4.0 INUNDATION MAPS	4-1
4.1 Inundation Map Development .....	4-1
4.2 Impacted Area Summary .....	4-2
INUNDATION MAPPING	4-3

**FIGURES**

Figure 1	Foster's Pond Dam Inundation Boundary
Figure 2	Site Location Map
Figure 3	Aerial Photograph
Figure 4	Dam Site Plan Sketch

**APPENDICES**

Appendix A	Preparedness
Appendix B	Emergency Detection, Evaluation, & Classification
Appendix C	Termination & Recovery
Appendix D	Materials & Equipment
Appendix E	Sign Off Sheets
Appendix F	Common Dam Safety Definitions

**REFERENCES**

## **PREAMBLE**

This Emergency Action Plan was prepared for the Owner of the Foster's Pond Dam in accordance with the Commonwealth of Massachusetts General Laws, M.G.L. 253, Section 44, Chapter 302 C.M.R. 10.00, "Dam Safety, dated February 10, 2017" to establish a basic plan of action if conditions at the dam indicate the potential for dam failure or if any individual observes and reports that a dangerous condition is developing at the dam. The development of this EAP has been primarily based on the Federal Emergency Management Agency (FEMA) "Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners," dated October 1998, the Federal Energy Regulatory Commission (FERC) "Emergency Action Plan Guidelines," dated November 1998, 2006 NRCS recommendations for developing EAPs, and other publically available EAP templates from state dam safety programs.

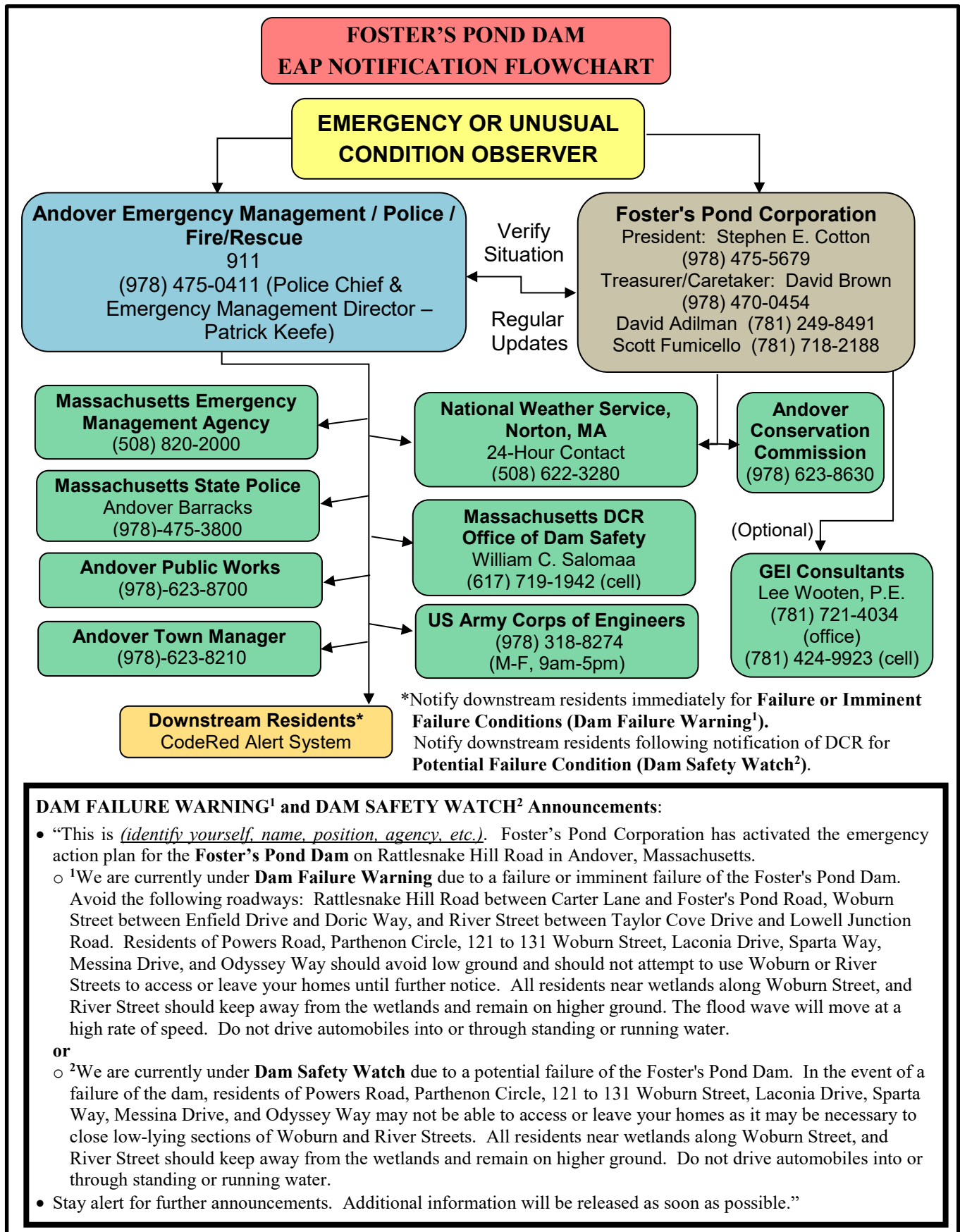
The purpose of this plan is to define responsibilities and provide procedures for identifying unusual and unlikely conditions, which may endanger the Foster's Pond Dam and infrastructure downstream of the dam, in time to take mitigated action and to notify the appropriate emergency management officials of possible, impending, or actual failure of the dam in order to minimize property damage and loss of life.

This Emergency Action Plan should not be viewed as a substitute for implementing standard dam maintenance, inspections, and repairs in accordance with good dam operations.

It is important to note that the condition of the dam depends on numerous and constantly changing internal conditions and is evolutionary in nature. It would be incorrect to assume that the condition of the dam will remain the same over time. Only through continued care and inspection can there be any chance of detecting unsafe conditions before they result in an emergency condition.

The EAP is housed in a three ring binder to easily facilitate updates to the plan. The EAP should be updated and exercised annually to ensure that the information is current. Most importantly, the names and telephone numbers of emergency response personnel listed in the Notification Flowchart must be checked periodically and updated whenever changes occur. The chain of communication to be followed in the event of an Emergency is as shown on the following page:

## Emergency Action Plan, Foster's Pond Dam





## 1.0 NOTIFICATION PROCEDURES

### 1.1 Notification Flowchart

The Notification Flowchart (located at the front of this report) indicates the chain of communication to be followed in the event of an Emergency. The Notification Flowchart indicates a Dam Failure Warning or Dam Safety Watch type of notification to be implemented depending on the emergency condition (see below) as determined necessary based upon the judgment of the personnel monitoring the emergency condition at the dam (see Section 4 for additional descriptions).

- **Dam Safety Watch: “Potential failure is developing”:** This is a situation where a failure may eventually occur if left unattended. This situation will require a Dam Safety Watch response with continuous monitoring of the situation.
- **Dam Failure Warning: “Failure is Imminent or has occurred”:** This is a situation where a failure either has occurred, is occurring, or is just about to occur. This situation will require Dam Failure Warning responses that will proceed with evacuation procedures.

It is not anticipated that a failure of Foster's Pond Dam will result in flooding that would threaten downstream residential structures. However, residents abutting the estimated inundation area should be warned about flooding and to stay away from low-lying areas.

If pre-existing flood levels are close to residences prior to a potential dam failure, those residences should be evacuated. During the highest emergency level (Dam Failure Warning), procedures are to evacuate such downstream residents using a combination of the telephone, augmented by police cruising the area broadcasting the evacuation message and going door to door to homes that cannot be reached by telephone. To ease this burden somewhat, the National Weather Service can be alerted at (508) 622-3280 and they will make a general broadcast about the evacuation over the airways. ***The National Weather Service will call the Fire Department to verify the emergency. Therefore, the Fire Department should be called before the National Weather Service is contacted. MEMA can also be contacted to activate the Emergency Alert Service.***

The flowchart should be updated yearly to account for local or state personnel changes. Any new personnel should be informed and trained to perform their responsibilities under this plan.

### 1.2 Emergency Notification Template

Once the emergency condition has been identified, and the appropriate response level has been determined, the following template can be used as a guide for notification announcements:

- “This is (identify yourself, name, position, agency, etc.). The Foster's Pond Corporation has activated the emergency action plan for the Foster's Pond Dam in Andover, Massachusetts.”

## Emergency Action Plan, Foster's Pond Dam

For **Dam Failure Warning** conditions:

- “We are currently under **Dam Failure Warning** due to a failure or imminent failure of the Foster's Pond Dam. Avoid the following roadways:
  - Rattlesnake Hill Road between Carter Lane and Foster's Pond Road,
  - Woburn Street between Enfield Drive and Doric Way,
  - River Street between Taylor Cover Drive and Lowell Junction Road.Residents of Powers Road, Parthenon Circle, 121 to 131 Woburn Street, Laconia Drive, Sparta Way, Messina Drive, and Odyssey Way should avoid low ground and should not attempt to use Woburn or River Streets to access or leave your homes until further notice. All residents near wetlands along Woburn Street and River Street should keep away from the wetlands and remain on higher ground. The flood wave will move at a high rate of speed. Do not drive automobiles into or through standing or running water.”

Or, for **Dam Safety Watch** conditions:

- We are currently under **Dam Safety Watch** due to a potential failure of the Foster's Pond Dam. In the event of a failure of the dam, residents of Powers Road, Parthenon Circle, 121 to 131 Woburn Street, Laconia Drive, Sparta Way, Messina Drive, and Odyssey Way may not be able to access or leave your homes as it may be necessary to close low-lying sections of Woburn and River Streets. All residents near wetlands along Woburn Street and River Street should keep away from the wetlands and remain on higher ground. Do not drive automobiles into or through standing or running water.”

And, for both Warning and Watch notifications:

- “Stay alert for further announcements. Additional information will be released as soon as possible.”

### 1.3 Impact Summary / Road Closures

A failure of Foster's Pond Dam is unlikely to flood downstream residences but will result in flooding across the following local roads in the order listed, with approximate distances from the dam listed in parentheses:

- Rattlesnake Hill Road immediately below the dam between 108 and 118 Rattlesnake Hill Road (30 ft downstream)
- Woburn Street between 131 and 146 Woburn Street (1,500 ft downstream)
- Woburn Street between 116 and 121 Woburn Street (3,500 ft downstream)
- River Street between 83 and 98 River Street (4,700 ft downstream)

At Rattlesnake Hill Road the depth of flooding from a dam breach could be in excess of 2 to 3 ft and, more importantly, the velocity of flow over the road could be significant because of the grade between the dam and the road, and the proximity of the dam. A breach flood could wash out this section of Rattlesnake Hill Road.

At the other downstream crossings on Woburn and River Streets, we expect that the depth of flooding from a dam breach would be less than about 2 ft and that velocities would be low

## Emergency Action Plan, Foster's Pond Dam

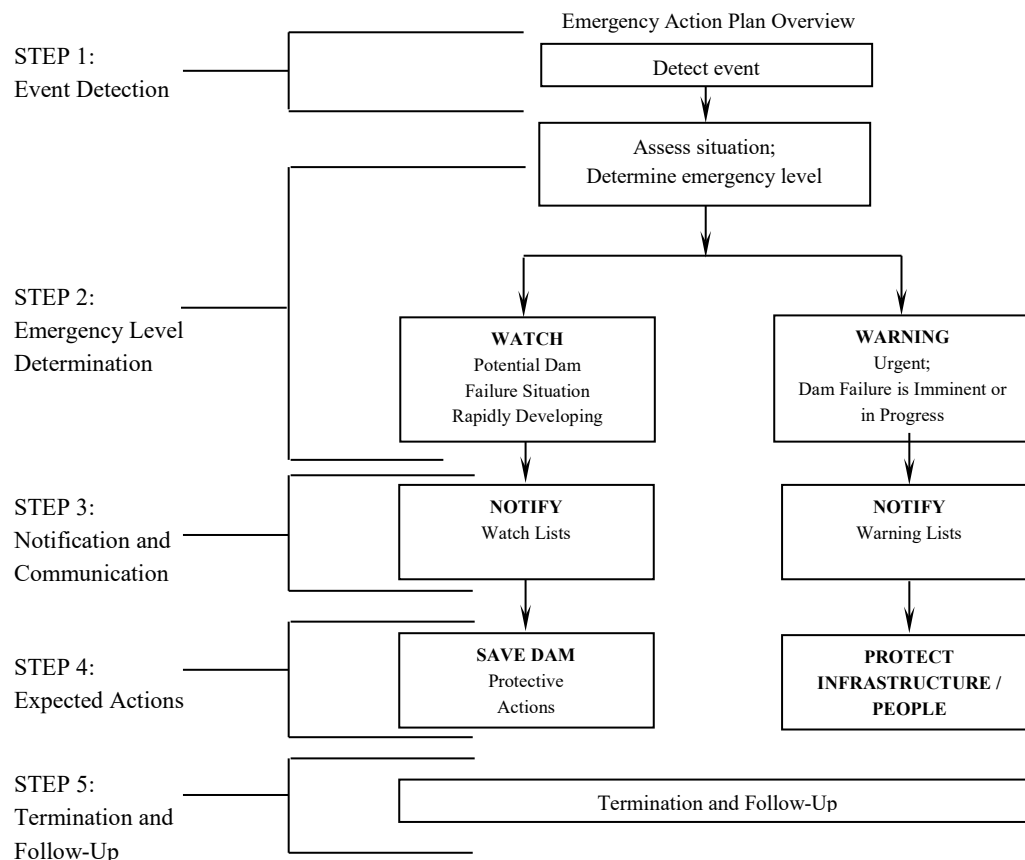
because each street crossing is downstream of a broad, flat wetland area that will mitigate flood flows and velocities.

In a Dam Safety Watch condition, Rattlesnake Hill Road below the dam and Woburn Street between 131 and 146 Woburn Street should be closed, and police should be prepared to close the two other crossings. We note that closing Woburn Street between 116 and 121 Woburn Street and between 131 and 146 Woburn Street cuts off all roads to one residential section of Andover (121 to 131 Woburn Street, Parthenon Circle, and Powers Road), and result in some residents being trapped in their homes temporarily. Closing River Street between 83 and 98 River Street cuts off access to Laconia Drive and three streets off Laconia Drive (Sparta Way, Messina Drive, and Odyssey Way), potentially trapping residents in their homes temporarily.

In a Dam Failure Warning condition, all four road crossing should be closed until the extent of flooding is confirmed to be minor or the emergency has been terminated.

### 1.4 General Response Flowchart

The flowchart below lays out the steps in a response to an emergency event that involves either a potential dam failure (Dam Safety Watch) or a failure/imminent failure (•Dam Failure Warning).



## 2.0 PROJECT DESCRIPTION

Dam Name: Foster's Pond Dam

Hazard Classification: Significant

STATE-ID #: 5-5-9-10

Federal ID (NID): MA00153

City/Town: Andover

County: Essex

Size Classification: Intermediate

### Location & Access:

Foster's Pond Dam is located off Rattlesnake Hill Road within Essex County in the Town of Andover, Massachusetts (see EAP cover and Figs. 2 and 3 for maps). The dam impounds water that flows into wetlands immediately downstream of the dam and eventually into the Shawsheen River above the Ballardvale Dam and into an urban area. The structure and the impoundment are shown on the Google Earth© website at 42.61361°N latitude and 71.14146°W longitude. The dam can be reached from I-93 in Wilmington via:

- Exit 41 – Route 125 East to
- Andover Street, north (left) to
- Woburn Street, north (straight), to
- Rattlesnake Hill Road, north (right).

Lot No: 122-1 and 101-63

Block No: Not available

Latitude: 42.61361°N

Longitude: 71.14146°W

River/Stream/River Basin: Shawsheen

Quad Sheet: Reading

Nearest City/Town: Andover

Hydraulic/Structural Height (ft): ~10.1

Normal Surface Area (ac): 120

Embankment Length (ft): 150

Normal Storage (ac-ft): ~538

Dam Type: Earthfill w/ downstream stone masonry

Maximum Storage (ac-ft): ~867

Spillway Type: Broad-crested weir

Spillway Capacity (cfs): ~194

Type Dike: NA

Drainage Area (sq. mi.): 1.58

Outlet Types (other than spillway): Sluiceway on left side of spillway and a grass-covered swale emergency spillway

Year Built: 1850s

Last Rehabilitation: 2010 & 2015

### Purpose/Operation of Dam:

The purpose of Foster's Pond Dam today is to provide a recreational impoundment (Foster's Pond). The dam is operated and maintained by Foster's Pond Corporation, a community-based non-profit organization. Foster's Pond Corporation was formed in 1939 to maintain, repair and operate the dam and to regulate the flow of water from Foster's Pond. The water level control at

## Emergency Action Plan, Foster's Pond Dam

the dam is maintained at approximately 2 inches below the bottom of the dam's primary spillway between the months of April and November. A winter drawdown to create reserve capacity for the dam commences in November. Removal of the three stoplogs from the sluiceway, one at a time, reduces the water level gradually to no more than 18 inches below the spillway level, the maximum allowed by the Andover Conservation Commission and DEP Superseding Order of Conditions. An Operations and Maintenance Manual has been prepared for this structure.

Instrumentation (if any): None

Upstream Dams: None

Downstream Dams: Ballardvale Dam (on Shawsheen River, 1.7 miles downstream); next dam at 4.3 miles downstream; all downstream dams estimated to be beyond significant effect (2 ft rise) from failure of Foster's Pond Dam

Description of Inundation Area and Downstream Hazards: The inundation area from a failure of Foster's Pond Dam could include up to four road crossings (see EAP Section 1.3) and a large area of flat wetlands that flow to the Shawsheen River. The attached inundation map (Fig. 1) provides a conservative estimate of the potential extent of flooding from a failure of the dam.

Method of Emergency Drawdown: The small (2 ft wide x 2.5 ft deep) sluiceway on the left side of the spillway provides a limited means of drawing down the reservoir. Flow through the sluiceway is controlled by stoplogs, which are placed and removed manually. Drawdown of the pond by more than about 1.5 to 2 ft would require the use of a large pump or siphon.

Dam Site Sketch Plan: See Fig. 4.



### 3.0 GENERAL RESPONSIBILITIES

#### 3.1 Summary of Responsibilities

Entity	Responsibilities
<b>Dam Owner:</b> Foster's Pond Corporation Stephen E. Cotton (978) 475-5679	1. Notify local authorities. Upon receiving report of an incident, contact the Emergency Management Director (EMD) and identify the report. 2. Evaluate the extent/nature/severity of the incident. Update the EMD as to the need to implement the EAP. 3. Monitor the situation at the dam for the duration of the emergency. Update the EMD and other local and state authorities of developing conditions at the dam for the duration of the emergency situation.
<b>Local Emergency Management:</b> Patrick Keefe Andover Police Chief & Emergency Management Director (978) 475-0411	1. Contact and warn population in area of potential impacts; Coordinate efforts with other parties involved in the EAP as necessary. 2. The EMD/Incident Commander will serve as the contact point for disseminating all updates concerning the condition of the emergency.
<b>Local Police Department:</b> Andover Police (978) 475-0411 or 9-1-1	1. Assist in securing the site and implementing evacuation if necessary (i.e. coordinating barricades, street closures, traffic flow). 2. Utilize appropriate and/or necessary evacuation procedures, which may include but are not limited to, multilingual broadcasts, slow-speed broadcasts, and coordinated efforts with other emergency responders.
<b>Local Fire Department</b> Andover Fire/Rescue (978) 475-1281 or 9-1-1	1. Assist in the evacuation of special needs and/or elderly citizens. 2. Provide additional evacuation support as needed. 3. Assist EMD as needed.
<b>Massachusetts Emergency Management Agency (MEMA)</b> 24 hrs: (508) 820-2000	1. Coordinate broadcast notification as <u>requested</u> by the local Fire/Police/EMD. 2. Mobilize necessary equipment as <u>requested</u> by the local Police/Fire/EMD.
<b>Massachusetts State Police Andover Barracks</b> 24 hrs: (978)-475-3800	1. Assist in securing the site, implementing evacuation, and controlling traffic flow in and out of the impacted area as <u>requested</u> by the local Police Department.
<b>National Weather Service, Norton, MA</b> 24 hrs: (508) 622-3280	1. Assist with information about dam and downstream dams. 2. Assist with evaluation of dam safety condition and responses. 3. Assist with determination of emergency termination and follow-up actions.
<b>Massachusetts DCR Office of Dam Safety</b> William C. Salomaa (617) 719-1942 (cell)	1. Assist with information about dam and downstream dams. 2. Assist with evaluation of dam safety condition and responses. 3. Assist with determination of emergency termination and follow-up actions.
<b>Andover Public Works</b> (978) 623-8700	1. Assist with equipment needed for road closures. 2. Assist with emergency construction equipment & supplies.
<b>Andover Town Manager</b> (978) 623-8210	1. Assist Emergency Management with public information. 2. Assist with management of affected town services.
<b>Andover Conservation Comm.</b> Robert Douglas, Cons. Director (978) 623-8630	1. Review, advise, authorize emergency work in the buffer zone per Wetlands Protection Act and Town wetlands by-law.

## Emergency Action Plan, Foster's Pond Dam

Entity	Responsibilities
<b>GEI Consultants, Inc.</b> Lee Wooten, P.E. 24 hrs: (781) 424-9923 (cell)	1. Assist with evaluation of dam safety condition and responses. 2. Assist with follow-up actions.

### 3.2 Emergency Response Coordination

During an emergency situation, the Emergency Management Director will be responsible for the proper organization and operation of the Emergency Action Plan. He/she will coordinate all activities with state and local authorities.

## 4.0 INUNDATION MAPS

### 4.1 Inundation Map Development

The attached inundation map (Fig. 1) was developed using engineering judgement to provide a conservative estimate of the area of potential flooding should Foster's Pond Dam breach. The following characteristics of the dam, the pond, and the downstream area factored into the estimate of the inundation area:

- Rattlesnake Hill Road is located about 30 ft downstream of the dam with a low point about 6 ft below the dam crest.
- Between the dam and Rattlesnake Hill Road is a stilling basin with a downstream masonry wall with a tapered height of about 0 to 2.5 ft that would mitigate breach flows if a breach occurred at the middle part of the dam.
- A grassed swale on the right side of the dam will act as an emergency spillway and the initial location of overtopping flows. The swale flows onto Rattlesnake Hill Road and will be an indicator that should alert the community before the entire dam is overtopped.
- The lake branch that abuts the dam is shallow, with a depth of about 5 ft and will restrict flow in the event of a dam breach. In addition, the main part of the pond is about 3,000 ft from the dam with a narrow, shallow connector that will both limit flow and prevent the loss of the original natural pond storage if the dam were to fail.
- The area downstream of Rattlesnake Hill Road consists of broad, flat wetlands. Residential development is on higher ground surrounding the wetlands. Three road crossings fall in these wetland areas:
  - Woburn Street between 131 and 146 Woburn Street (1,500 ft downstream)
  - Woburn Street between 116 and 121 Woburn Street (3,500 ft downstream)
  - River Street between 83 and 98 River Street (4,700 ft downstream)
- A flood from a failure of Foster's Pond Dam would eventually flow into a broad, low-gradient section of the Shawsheen River about 5,300 ft downstream from the dam.

We used the following approximations to delineate a conservative delineation of the area of potential flooding should Foster's Pond Dam breach:

- Dam to first Woburn Street crossing (between 131 and 146 Woburn Street): We used the topographic contour that is 2 meters above this wetland area. This contour is slightly more than 1 meter below the dam crest.
- First Woburn Street crossing to Shawsheen River: We used the topographic contour that is 1 meter above the wetland areas for the inundation area downstream of the first Woburn Street Crossing. This contour is slightly more than 2 meters below the dam crest.

Fig. 1 shows the resulting map of this inundation area estimate.

## **4.2 Impacted Area Summary**

As described in Section 1.3, a failure of Foster's Pond Dam is unlikely to flood downstream residences but will result in flooding across the following local roads in the order listed, with approximate distances from the dam listed in parentheses:

- Rattlesnake Hill Road immediately below the dam between 108 and 118 Rattlesnake Hill Road (30 ft downstream)
- Woburn Street between 131 and 146 Woburn Street (1,500 ft downstream)
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At Rattlesnake Hill Road the depth of flooding from a dam breach could be in excess of 2 to 3 ft and, more importantly, the velocity of flow over the road could be significant because of the grade between the dam and the road and proximity of the dam. A breach flood could wash out this section of Rattlesnake Hill Road.



At the other downstream crossings on Woburn and River Streets, we expect that the depth of flooding from a dam breach would be less than about 2 ft and that velocities would be low because of each street crossing is downstream of a broad, flat wetland area that will mitigate flood flows and velocities.

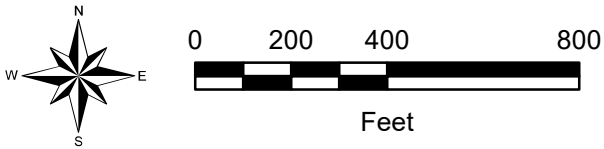
## FIGURES






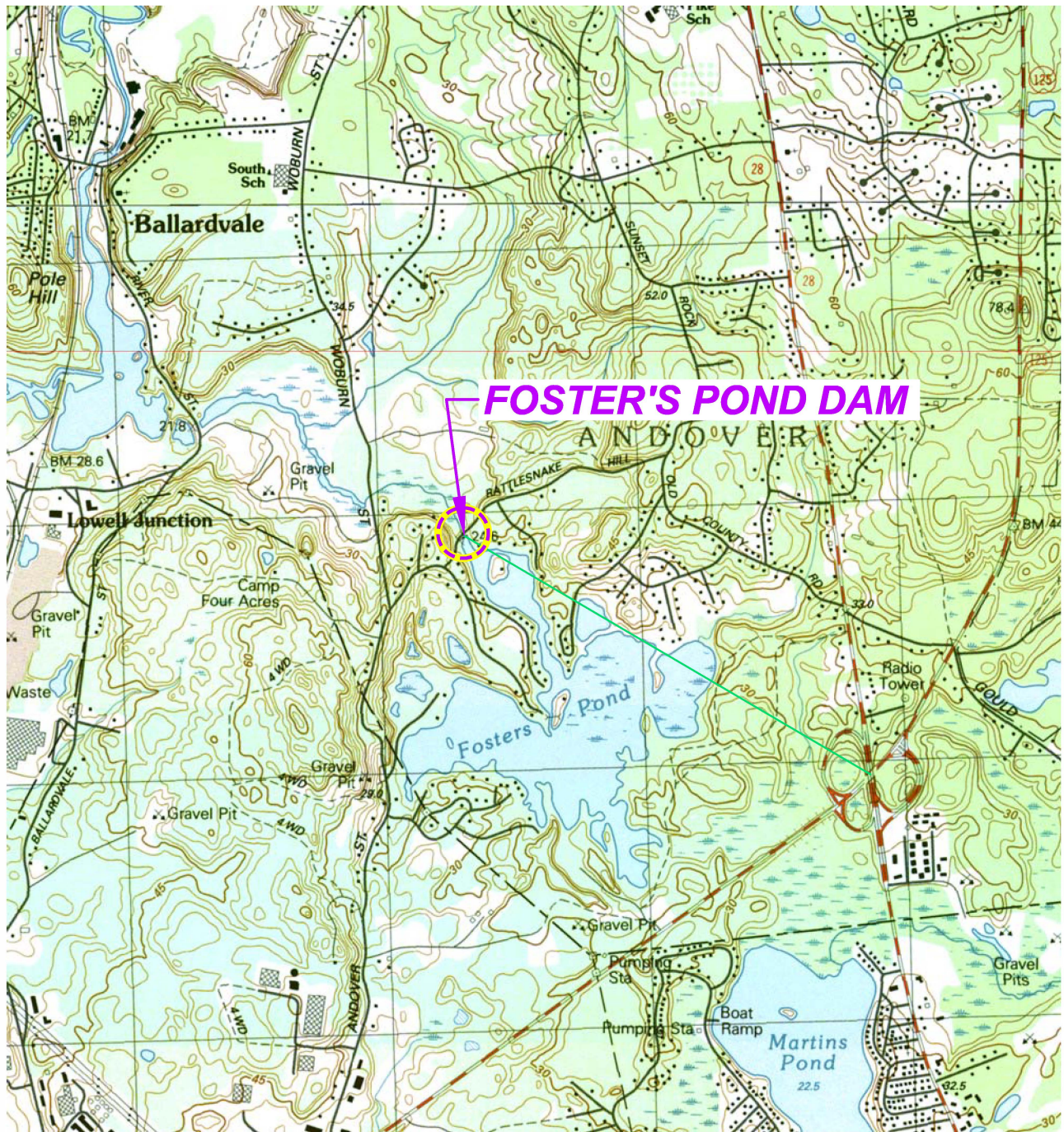
**LEGEND:**

-  Inundation
-  Inundated roads



Emergency Action Plan Foster's Pond Dam Andover, Massachusetts	 GEI Consultants	FOSTER'S POND DAM INUNDATION BOUNDARY	
Foster's Pond Corporation Andover, Massachusetts		September 2019	Fig. 1





APPROXIMATE SCALE, FEET

FOSTER'S POND DAM  
 NID ID# MA00153  
 ANDOVER, MA  
 READING & LAWRENCE, MA QUADRANGLES  
 SOURCE: MassGIS  
 LATITUDE: 42.61361°N  
 LONGITUDE: 71.14146°W



MASSACHUSETTS  
 QUADRANGLE LOCATION

Foster's Pond Dam  
 Andover, Massachusetts

Foster's Pond Corporation  
 Andover, Massachusetts



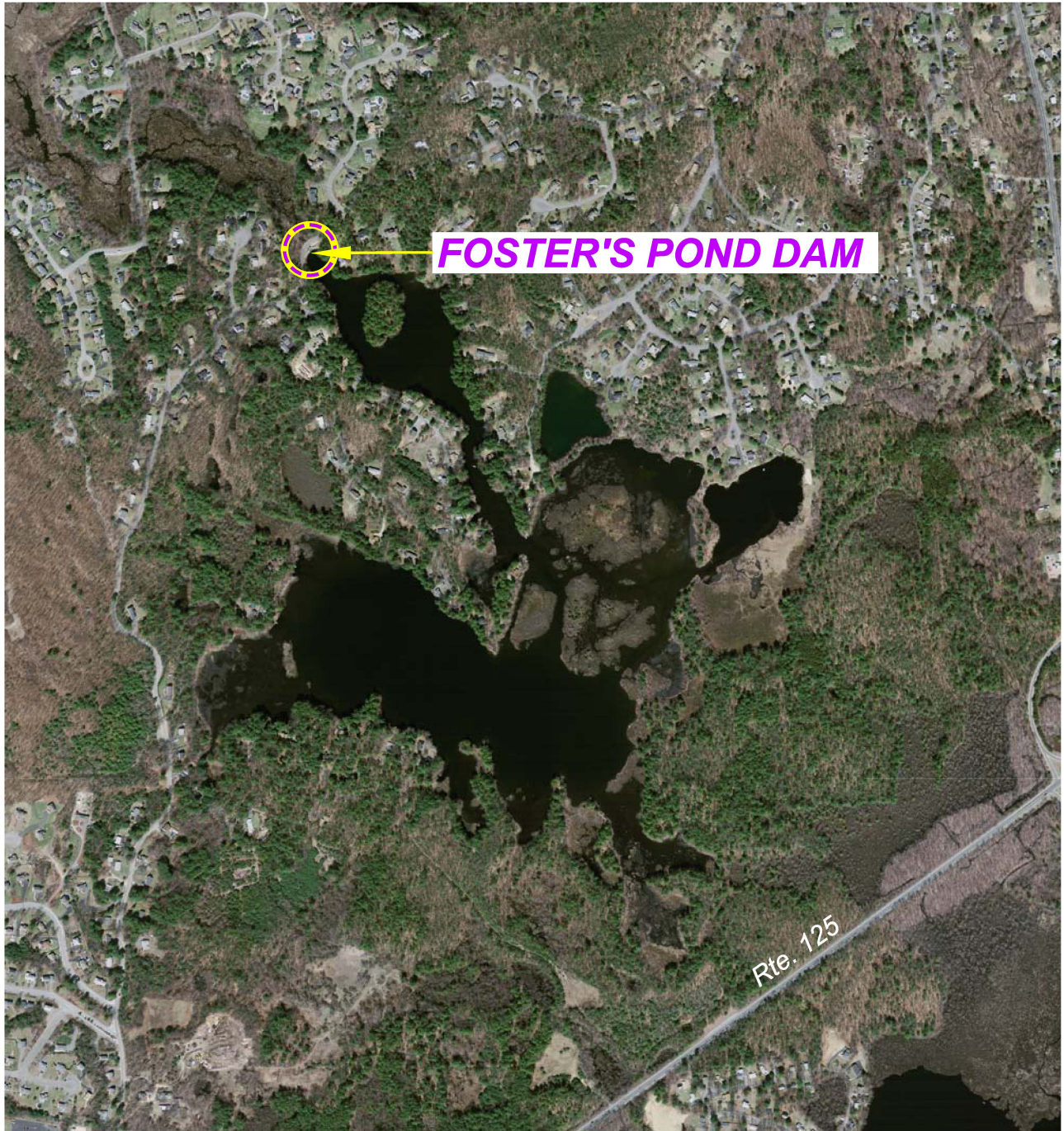
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SITE LOCATION MAP

September 2019

Fig. 2





APPROXIMATE SCALE, FEET

FOSTER'S POND DAM  
 NID ID# MA00153  
 ANDOVER, MA  
 READING & LAWRENCE, MA QUADRANGLES  
 SOURCE: MassGIS  
 LATITUDE: 42.61361°N  
 LONGITUDE: 71.14146°W



MASSACHUSETTS  
 QUADRANGLE LOCATION

Foster's Pond Dam  
 Andover, Massachusetts

Foster's Pond Corporation  
 Andover, Massachusetts



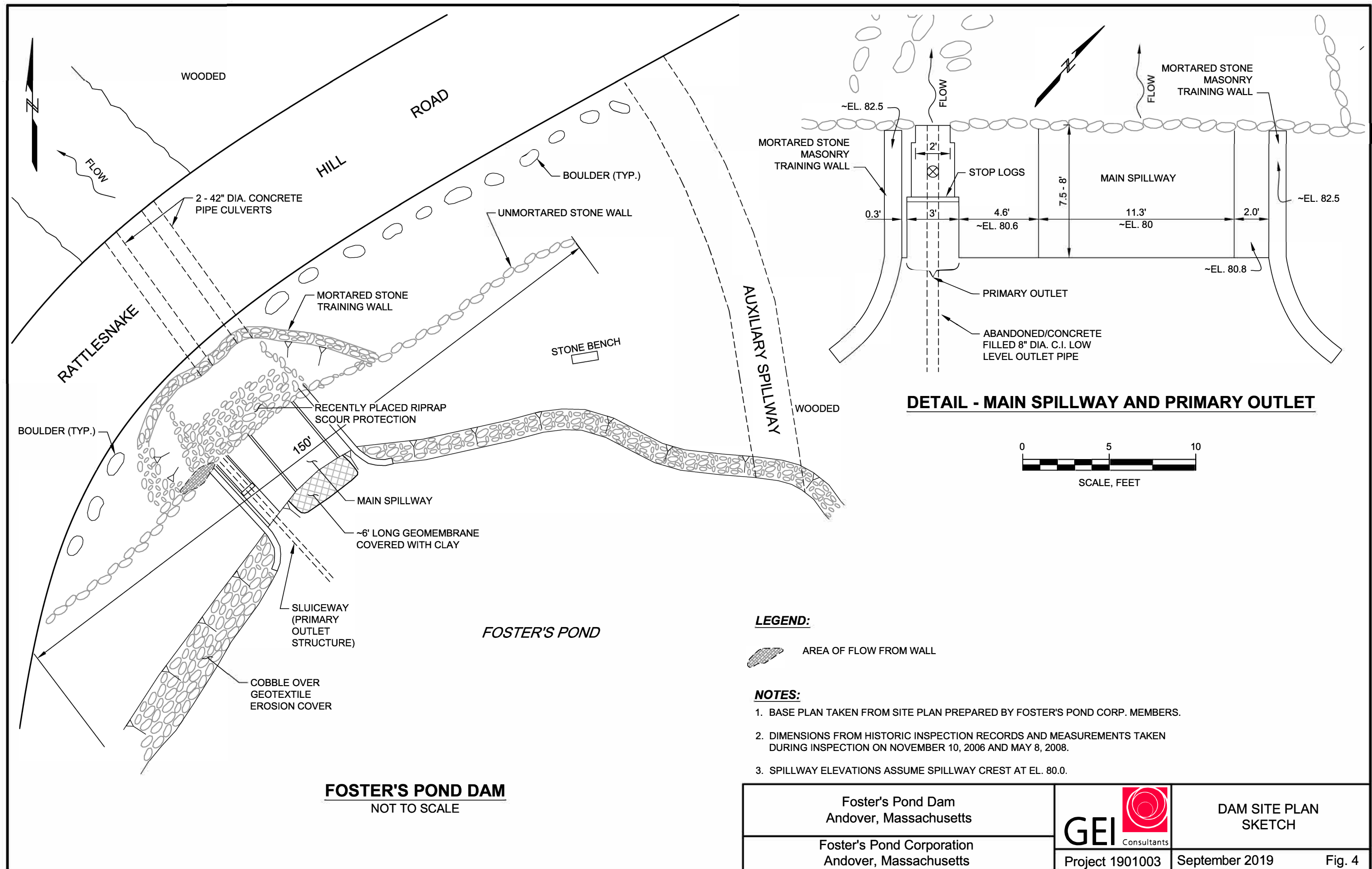
Project 1901003

AERIAL  
 PHOTOGRAPH

September 2019

Fig. 3





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## **Appendix A**

### **Preparedness**



## **PREPAREDNESS**

Preparedness actions are taken to prevent an emergency situation from developing or to minimize the extent of damage caused from a developed emergency situation. The preparedness actions may be by providing response procedures to emergency situations and/or arranging for equipment, labor, and materials for use in emergency situations.

### **A-1 Surveillance**

The identification of a problem and the initiation of notifications described in Section 1 are the most important aspects of an emergency response. Problem identification will be much easier if knowledgeable personnel regularly monitor the dam closely.

The dam owner must continue to monitor the dam on a regular basis. This is especially important during high rainfall events and during spring runoff conditions when large amounts of snow melting occur. Appendix B identifies some potential hazards that could lead to dam failure.

It is impossible to predict when an emergency situation will develop, therefore it is important that emergency contact information be posted at the site so that a casual observer can contact emergency personnel if they observe an unusual condition. It is recommended that the Dam Owner and the Emergency Management Director collaborate on the appropriate contact information to be posted at the site.

### **A-2 Access to Site**

Foster's Pond Dam is located off Rattlesnake Hill Road within Essex County in the Town of Andover, Massachusetts (see EAP cover for maps). The dam impounds water that flows into wetlands immediately downstream of the dam and eventually into the Shawsheen River above the Ballardvale Dam and into an urban area. The structure and the impoundment are shown on the Google Earth© website at 42.61361°N latitude and 71.14146°W longitude. The dam can be reached from I-93 in Wilmington via:

- Exit 41 – Route 125 East to
- Andover Street, north (left) to
- Woburn Street, north (straight), to
- Rattlesnake Hill Road, north (right).

### **A-3 Operations and Maintenance**

The dam is operated and maintained by Foster's Pond Corporation (FPC), a community-based non-profit organization. FPC was formed in 1939 to maintain, repair and operate the dam and to regulate the flow of water from Foster's Pond. The water level control at the dam is maintained at approximately 2 inches below the bottom of the dam's primary spillway between the months of April and November. A winter drawdown to create reserve capacity for the dam commences in November. Removal of the three stoplogs from the sluiceway, one at a time, reduces the water level gradually to no more than 18 inches below the spillway level, the maximum allowed by the

Andover Conservation Commission and DEP Superseding Order of Conditions. An Operations and Maintenance Manual has been prepared for this structure and can be obtained from the FPC.

#### **A-4 Response during Periods of Darkness**

The proximity of the dam to Rattlesnake Hill Road and the presence of a street light at the dam allow for relatively easy monitoring of the dam at night. Officers of the FPC live in close proximity to the dam and can respond quickly when notified.

#### **A-5 Response during Evenings, Weekends, and Holidays**

Again, the proximity of the dam to Rattlesnake Hill Road and the regularity of traffic on the road provide for a reasonably frequent observation for unusual conditions like water flow across the road. Officers of the FPC and members who might be active during an emergency live in close proximity to the dam and can respond quickly when notified.

#### **A-6 Response during Periods of Adverse Weather**

Adverse weather will hinder access to the dam in only very unusual circumstances. Like most New England towns, Andover regularly plows streets following heavy snows. Heavy rains should not prevent access to the dam unless the pond level has exceeded the level of the emergency spillway, which should result in a Dam Safety Watch. Officers of the FPC and members who might be active during an emergency live in close proximity to the dam and can respond quickly when notified.

#### **A-7 Training and Testing**

Training and testing of the EAP is generally the responsibility of the dam owner. However, the involvement of FPC in the EAP actions is relatively minor, and the primary EAP activities (road closures and notifications) fall to the Andover EMD. Consequently, the FPC will confer with the Andover EMD to coordinate training and testing. Training seminars should be held for all FPC personnel who may assist with the EAP and for Andover emergency response personnel (i.e., police and fire) responsible for the primary EAP activities.

It is recommended that the EAP or components of the plan be tested periodically. The testing should be conducted through the use of drills and exercises. Testing should include operators, attendants, police, fire, and other personnel responsible for the implementation of the plan. Downstream residents shall not be included in the test.

Below is a list of suggested training exercises, the frequencies at which they should be conducted, and the topics they should cover:

#### Seminars with Emergency Personnel

- Frequency: As needed
- Topics:
  - New officers of the FPC and FPC members who volunteer to participate in emergency responses should be briefed on their duties for an emergency response.
  - At a minimum a read-through of the EAP and a brief assessment should be conducted.

#### Emergency Management Workshop

- Frequency: Annually or as determined by the Andover EMD
- Attendees: FPC representative and emergency responders (police, fire/rescue), Andover Public Works representative, Town Manager's office representative
- Topics:
  - Authorities responsible for executing the EAP should gather to discuss the EAP.
  - Review and updating of the Notification Flowchart, Emergency Contacts, and Emergency Warning Systems (i.e., CodeRED) should be conducted at this time.
  - Parties should discuss the response effort, specifically the Notification Flowchart, communications, and road closures.
  - Lines of communication should be streamlined such that a developing condition at the dam can be assessed and handled.

#### Public Meetings

- Frequency: Optional, at the discretion of Andover EMD (no residences affected)
- Topics:
  - The public may be educated on the EAP at the discretion of the Emergency Management Director and how they can facilitate the rapid and safe execution of the EAP during an emergency.
  - Closed roads and avoiding low areas should be discussed.
  - Emergency Warning Systems (i.e., CodeRED) should be discussed and updated.
  - Preparation and situational awareness techniques during an emergency situation. (i.e., avoiding the affected roadways and low-lying wetlands areas)

#### Table Top Exercise

- Frequency: Optional, at the discretion of Andover EMD
- Topics:
  - Emergency management personnel should gather and discuss different emergency scenarios to assess plans, policies, and procedures.

#### Functional Exercise

- Frequency: Optional, at the discretion of Andover EMD
- Topics:
  - A functional exercise is conducted to test and validate the coordination, command, and control between all agencies involved with carrying out the EAP.
  - This type of exercise does not include any "boots on the ground."

After each of the tests mentioned above, a "lessons learned" discussion and evaluation should be conducted. The discussions should highlight procedures that work well and those that did not; as

well as inaccurate information (within the flowchart, inundation maps, resident contacts, assigned responsibilities, equipment, etc.). Results should be written down and distributed to the associated parties and any corrections and updates should be made.

The training and testing activities should be fully documented.

### **A-8 Updating and Posting**

All aspects of the EAP should be reviewed and updated once per year in accordance with the applicable guidelines. During the review, a determination of any new developments or other changes downstream or elsewhere should be made to determine whether any revisions to the current EAP are necessary. It is imperative that all other holders of the EAP receive updates to the EAP immediately upon becoming aware of necessary changes to keep the EAP workable. This includes revisions when phone numbers and/or names change for notification flow chart personnel and downstream residents.

An up-to-date copy of the flowchart and notification list should be kept in prominent locations in the offices of the personnel responsible for the EAP implementation.

A copy of the complete up-to-date EAP should also be available to all operators and personnel responsible for the implementation of the EAP. At a minimum, a full copy of the EAP should be located at the following locations:

- Owner: Foster's Pond Corporation, Stephen E. Cotton – President, 19 Pomeroy Road, Andover, MA
- Local Emergency Management Agency: Andover Police / Emergency Management, 32 N. Main Street, Andover, MA
- Massachusetts Emergency Management Agency (MEMA); 400 Worcester Road (Route 9 East), Framingham, MA
- Massachusetts Department of Conservation and Recreation, Office of Dam Safety: William Salomaa, Director, 251 Causeway Street, Boston, MA 02114

### **A-9 Emergency Response Coordination**

During an emergency situation, the Andover Emergency Management Director (Andover Police Chief) will be responsible for the proper organization and operation of the Emergency Action Plan. He/she will coordinate all activities with state and local authorities.

### **A-10 Contact Lists**

Contact lists should be maintained for facilities, structures, and other properties that may be impacted by a flood wave. Dependent upon the nature of the inundated area, the contact lists may include residents to be evacuated due to shallow flooding, facilities requiring special considerations, and other facilities. Contact lists should also consider special needs in the impacted area such as multilingual communications.

Appropriate communications should be made to ensure that potentially affected residents can be reached with the CodeRED system.

Hard copies of the list should be kept at the EOC and within each EAP binder. At a minimum, annual reviews and updating of the contact list should be completed to keep the list current.

#### **A-11 Alternative Systems of Communication**

If there is an interruption in telephone service during an emergency condition, emergency response personnel should broadcast over their radio communications system and cellular phones as necessary. Cell phone/telephone numbers for the emergency responders should be maintained and updated in the notification flowchart on a regular basis.

#### **A-12 Emergency Labor, Supplies, and Equipment**

Once an emergency condition has been identified, mobilization of the appropriate equipment is key to addressing the situation. The following lists provide partial equipment lists for the conditions described above. This list should be modified as required to address actual conditions at the time of the emergency. Additional equipment, not listed below may be necessary. Actual condition and estimated response time versus the rate of deterioration of the dam may preclude the repair of the structure and necessitate full evacuation. The primary goal is to protect human life and minimize property damage.

- Barriers, barricades for road closures
- Emergency lights and generators for monitoring dam and for safety at road closures

During flood emergencies, generally the safest course of action will be to not attempt to make repairs to the dam and to have no one work or walk on the dam. One possible exception would be to allow access from the abutment over to the sluice outlet to remove the outlet stop logs. This action should not be attempted if access is unsafe. A flood from a failure of the dam is unlikely to result in death or major property damage and would be preferable to taking unnecessary risks at the dam.

An emergency condition may arise for which remedial measures or equipment access at the dam may be appropriate and safe (e.g., not associated with high pond levels). Any work on the dam should be well planned and appropriate for the emergency condition as determined by an experienced dam engineer. Remedial measures on a dam typically involve earthwork and/or concrete/masonry construction and most likely would be performed by a local contractor.

If responders determine that equipment access to the dam is safe and an appropriate course of action for the conditions, such access for much of the dam will require that the guard rails along the upstream side of Rattlesnake Hill Road be removed, most likely by Andover Public Works. Operators of large equipment should be made aware of overhead power lines in the vicinity of the dam.



The Foster's Pond Corporation has established accounts and/or been provided with emergency telephone numbers for contractors and suppliers who are prepared to respond in the event of an emergency.

**A-12.1. Contractors**

The Foster's Pond Corporation has discussed emergency procedures with and been provided with emergency contact information for the qualified general contractor (T Ford Company) listed in Appendix D. This contractor may purchase materials and undertake emergency work with the approval of an authorized representative of the FPC. An additional potential contractor is also listed in Appendix D.

**A-12.2. Potential Nearby Borrow Areas or Material Sources**

The Foster's Pond Corporation has established accounts with two of the nearest providers of sand and gravel (Lynch Materials and Benevento Companies, both on Route 62 in Wilmington). Emergency contact information for these companies is provided in Appendix D. Additional potential material sources are also listed in Appendix D.

## **APPENDIX B**

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### **Emergency Detection, Evaluation, & Classification**

## EMERGENCY DETECTION, EVALUATION & CLASSIFICATION

The detection, evaluation and classification of a potential emergency situation are crucial in determining the level of response and notification required in order to minimize the response time.

The following emergency classification system is proposed for this site:

- **Dam Safety WATCH: “Potential failure is developing”**: This is a situation where a failure may eventually occur if left unattended. This situation will require a Dam Safety Watch response with continuous monitoring of the situation.
- **Dam Failure WARNING: “Failure is Imminent or has occurred”**: This is a situation where a failure either has occurred, is occurring, or is just about to occur. This situation will require a Dam Failure Warning response that will proceed with evacuation procedures.

Examples of the preplanned procedures and notification that should be followed based on the various conditions observed during either storm or fair weather conditions are outlined below. These are examples and are not intended to describe all possible conditions, nor are they intended to limit the actions taken during a given event.

### B.1 Dam Safety WATCH Examples

*Notify: Dam Owner, Local Emergency Management Director, Engineer, and MADCR ODS*

- Any seismic event regardless of how slight
- Other situations that may lead to damage at the structure
  - Evidence of vandalism
  - Bomb threat
  - A civil disorder near the reservoir
  - Any aircraft accident near the reservoir
- Water level of the impoundment is at an unsafe level and is rising threatening to overtop the dam
- Discharges resulting in significant erosion and/or scour
- Any developing erosion, settlement, or upheaval occurring on the downstream slope or at the toe of the dam that is considered to be controllable
- Any undocumented leakage through any dam structure considered to be controllable

### B.2 Dam Safety WARNING Examples

*Notify: ALL PARTIES LISTED ON THE NOTIFICATION FLOWCHART*

- Water has overtopped or will overtop the dam
- Any uncontrollable erosion, settlement, or upheaval occurring on the downstream slope or at the toe of the dam
- Any uncontrollable leakage through any dam structure resulting in degradation to the structural integrity of the dam
- A dislocation or failure of any structure which allows for an expanding, uncontrollable discharge of water through the spillway or dam indicating a breach is occurring
- Dam is failing, is about to fail, or has failed

An Emergency Condition Watch may be declared initially with gradual transition into a Dam Failure Warning or a Dam Failure Warning may be declared immediately, depending on the actual conditions.

While these actions attempt to generalize responses to the observed conditions, the judgment of the primary observer and/or knowledgeable person(s) must be utilized. While some conditions such as breaching, overtopping, and severe piping can dictate an immediate evacuation; others will require the observer to determine the extent of the concern and the probability of the concern being addressed within a timely fashion.

### B.3 Additional Guidance for Determining the Emergency Level<sup>1</sup>

**TABLE B.1: Possible Failure Modes**

Event	Situation	Emergency Level
Structural Cracking	New cracking along the concrete structure with radial, transverse, or vertical displacement	--
	New cracks in the concrete with seepage	Watch
	New cracks/old cracks with actively progressing displacements	Warning
Foundation Weakness	New cracks at the abutment greater than 1/4-inch wide without seepage	Watch
	Cracks in the abutment with seepage	Watch
	Visual movement/slippage of the embankment slope	Warning
Construction Joint Cracking	Cracking at the construction joint	--
	Cracked construction joint with displacement and seepage	Watch
Sinkholes	Rapidly enlarging sinkhole	Warning
Embankment Cracking	New cracks in the embankment greater than 1/4-inch wide without seepage	--
	Cracks in the embankment with seepage	Watch / Warning
Earthquake	Earthquake resulting in visible damage to the dam or appurtenances	Watch
	Earthquake resulting in uncontrolled release of water from the dam	Warning
Security Threat	Verified bomb threat that, if carried out, could result in damage to the dam	Warning
	Detonated bomb that has resulted in damage to the dam or appurtenances	Warning
Sabotage/Vandalism	Damage to dam or appurtenances with no impacts to the functioning of the dam	--
	Damage to dam or appurtenances that has resulted in seepage flow	Watch
	Damage to dam or appurtenances that has resulted in uncontrolled water release	Warning

<sup>1</sup> Based upon the NRCS Recommendations for Developing EAPs, 2006.

#### **B.4 Potential Hazards That Can Lead to Dam Failure**

The purpose of the section is to educate the user of the EAP as to some of the common causes of dam instability and possible failure. A short definition of each hazard is listed along with typical causes. This is not intended to be an exhaustive list of all failure mechanisms as each dam has a unique set of conditions that will influence the development of conditions and concerns.

1. Flow Erosion

- Wash out of spillways, embankment sections
- Causes: poor compaction of silt backfill; lack of riprap or concrete protection at interface between soil embankment and concrete structure; erosion by flow over embankment, spillway, or through outlet.

2. Embankment Leakage, Piping

- Excessive seepage resulting in internal erosion followed by formation of a "pipe" through the embankment that, once formed, causes rapid flow erosion and wash-out of the embankment.
- Causes: poor compaction of soil along interface with concrete structures; lack of seepage control collars around pipe; root and rodent holes; inadequate or nonexistent filters between fine and coarse soils; cracks or voids within the concrete structure.

3. Foundation Leakage, Piping

- Wash-out of foundation material below dam causing undermining.
- Causes: poor interface with bedrock and concrete structures; excessive seepage at dam toe carrying soil with it.

4. Sliding

- Serious movement in foundation or concrete structure, which either result in dam failure or significantly weaken the dam structure.
- Causes: Foundation material weak; excessive water pressure in structure or foundation

5. Deformation

- Gross deformation of dam or outlet structures resulting in immediate failure or cracking of the dam, and subsequent wash-outs.
- Causes: excessive settlement in foundation, ice jacking (pressure exerted by expending/contracting ice structures).

6. Blowing Down Trees on or near Embankment

- Blowing down trees on and near the embankment would result in substantial cracks and scour of the embankment and subsequent wash-out of the embankments.

- Causes: Heavy rain associated with gusty winds and natural aging and poor root system of the trees on and near the embankments.

7. Reduction of Crest Elevation

- Deterioration or wash-out of Dam crest
- Causes: Poor concrete condition; heavy rain runoff; vehicle or foot traffic rutting

8. Dam Overtopping

- Water flows over the crest of the dam causing erosion and subsequent reduced dam height with time. If overtopping continues for any length of time it may lead to a total failure of the dam.
- Causes: Heavy rain; blocked or inadequately sized spillway.

9. Cracking

- Longitudinal cracking can be due to movements and/or settlements of the dam and can allow water to infiltrate the concrete.
- Transverse cracking can be due to horizontal and/or vertical movement and can result in a flow path across the concrete structure.
- Thin cracks can be very deep and intersect the phreatic surface.

## **APPENDIX C**

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### **Termination & Recovery**

## **APPENDIX C**

### **TERMINATION & RECOVERY**

If the EAP has been placed into action and the event has been deemed to not be an emergency, or the threat has been mitigated, termination of the emergency response under the EAP will be the sole responsibility of the Emergency Management Director. Termination process should include, but not be limited to, the following steps:

- Notify all agencies and parties contacted during the response of the situation termination
- Issue public notification
- Complete post-situation dam inspection

Implement post-situation recovery including restoring impacted areas such that they are safe for public use and repairing or otherwise addressing damaged infrastructure.



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**APPENDIX D**  
**Materials & Equipment**

## APPENDIX D

### AVAILABLE MATERIALS & EQUIPMENT

<p>Andover Public Works 978-623-8700</p> <p>The Public Works Department may have temporary traffic control devices (barriers, warning signs) that emergency responders may need. Also, access to sand or other fill materials from the Andover Public Works Department may be possible in an emergency. Typically, however, such materials will not be available to the FPC for repair of the dam.</p>	
<p><u>Aggregate Vendors with Foster's Pond Corp. emergency accounts</u></p>	
<p>Lynch Materials <b>Emergency Contact:</b> <b>Sal Dambauskas: 978-420-7727</b> <b>Main #: (978) 658-3602 (forwarded to cell phones or voice mail which is monitored every two hours when yard is closed)</b> 800 Salem Street (Route 62) Wilmington, MA 01887 <a href="http://lynchmaterials.com/materials.html">http://lynchmaterials.com/materials.html</a> Lynch Materials is an aggregate retailer whose products include sand, washed pea stone, and bank-run gravel.</p>	<p>Benevento Companies <b>Emergency Contact:</b> <b>Tim Allard, Quarry Mgr: (c) 978-337-4473</b> <b>(o) 978-658-5300 x 137</b> 900 Salem Street (Route 62) Wilmington MA. 01887 <a href="https://www.beneventocompanies.com/products-services/">https://www.beneventocompanies.com/products-services/</a> Benevento Companies sell a variety of sand and aggregate products as well as concrete and asphalt.</p>
<p><u>Additional potential aggregate vendors</u></p>	
<p>M. O'Mahoney Company 978-686-6149 175 Market Street Lawrence, MA <a href="http://www.momahoney.com/">http://www.momahoney.com/</a> M. O'Mahoney Company is a retailer of "Natural Stone, Pavers and Masonry Products," including various aggregate products (process gravel, 3/8" peastone, 3/4" stone, peastone mix, fine sand, coarse sand).</p>	<p>Torromeo Industries, Inc. &amp; Divisions 800-235-8649 Corporate Office 33 Old Ferry Road Methuen, MA 01844 <a href="https://www.torromeo.com/">https://www.torromeo.com/</a> Torromeo Industries sells concrete and aggregate products (ready-mix concrete, flowable fill, 3" through 3/8" stone, processed gravel, concrete sand, gravel borrow, sand &amp; stone mix, rip rap)</p>
<p>Agretech Corporation (978) 458-6502 50 Jackson Street Dracut, MA 01826 <a href="https://agretechcorp.com/">https://agretechcorp.com/</a> Agretech Corporation sells "a wide variety of quality recycled and natural aggregate materials," (crushed stone, screened aggregates, washed concrete and masonry sand).</p>	

<u>Contractors (Dam Repair Capabilities)</u>	
<p>T Ford Company, Inc.  <b>Emergency 24-hour contacts:</b>  <b>Jack Enos, President: (508) 726-1231</b>  <b>Dan Galante, VP: (508) 726-4086</b>  Non-emergency: 978-352-5606  124 Tenney Street, Georgetown, MA 01833  <a href="http://www.tford.com/">http://www.tford.com/</a>  “Ford Company, Inc. (TFCI) is a Massachusetts based general contractor with specific expertise in civil construction; specifically, environmental remediation, solar and battery installations, dam replacement/removal, site work, utilities, concrete foundations, and industrial buildings.”</p>	<p>SumCo Eco-Contracting  (978) 744-1515  2 Centennial Drive, Suite 4D  Peabody, MA 01960  <a href="https://sumcoeco.com/">https://sumcoeco.com/</a>  SumCo Eco-Contracting “offer[s] additional site, civil and environmental construction experience supporting redevelopment, remediation, coastal, and linear infrastructure projects,” and “has completed dozens of dam removals, dam rehabilitations, fish passage, and associated river restoration projects.”</p>

## **APPENDIX E**

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### **Signoff Sheets**

**APPENDIX E**  
**SIGNOFF SHEETS**

Use the following tracking sheet(s) to document and track revisions and updates to the EAP as well as to document and track regular review, exercise, and training for the EAP. Responsible personnel/parties include the FPC Officers and the local Emergency Management Director.

## Record of Revisions, Updates, Reviews, Exercises, & Training

[illegible]

## **APPENDIX F**

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### **Common Dam Safety Definitions**

## **APPENDIX F**

### **COMMON DAM SAFETY DEFINITIONS**

For a comprehensive list of dam engineering terminology and definitions refer to 302 CMR10.00 Dam Safety, or other reference published by FERC, Dept. of the Interior Bureau of Reclamation, or FEMA. Please note: should discrepancies between definitions exist, those definitions included within 302 CMR 10.00 govern for dams located within the Commonwealth of Massachusetts.

#### **Orientation**

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

#### **Dam Components**

Dam – Shall mean any artificial barrier, including appurtenant works, which impounds or diverts water.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate therefrom, including but not limited to, spillways; reservoirs and their rims; low-level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

#### **Size Classification**

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

Large – structure with a height greater than 40 feet or a storage capacity greater than 1,000 acre-feet.

Intermediate – structure with a height between 15 and 40 feet or a storage capacity of 50 to 1,000 acre-feet.

Small – structure with a height between 6 and 15 feet and a storage capacity of 15 to 50 acre-feet.

Non-Jurisdictional – structure less than 6 feet in height or having a storage capacity of less than 15 acre-feet.



### **Hazard Classification**

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

High Hazard (Class I) – Shall mean dams located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

Significant Hazard (Class II) – Shall mean dams located where failure may cause loss of life and damage to home(s), industrial or commercial facilities, secondary highway(s) or railroad(s), or cause the interruption of the use or service of relatively important facilities.

Low Hazard (Class III) – Dams located where failure may cause minimal property damage to others. Loss of life is not expected.

### **General**

EAP – Emergency Action Plan - Shall mean a predetermined plan of action to be taken to reduce the potential for property damage and/or loss of life in an area affected by an impending dam break.

O&M Manual – Operations and Maintenance Manual; Document identifying routine maintenance and operational procedures under normal and storm conditions.

Normal Pool – Shall mean the elevation of the impoundment during normal operating conditions.

Acre-foot – Shall mean a unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet. One million U.S. gallons = 3.068 acre-feet

Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

Spillway Design Flood (SDF) – Shall mean the flood used in the design of a dam and its appurtenant works particularly for sizing the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

### **Condition Rating**

Unsafe - Major structural, operational, and maintenance deficiencies exist under normal operating conditions.

Poor - Significant structural, operation and maintenance deficiencies are clearly recognized for normal loading conditions.

Fair - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.

Satisfactory - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.

Good - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF.

## REFERENCES

## REFERENCES

The following references were utilized during the preparation of this report and the development of the recommendations presented herein:

1. "Foster's Pond Dam, Phase I Inspection/Evaluation Report," GEI Consultants, Inc., December 6, 2016.
2. "Foster's Pond Corporation," website: <https://www.fosterspond.org/>, 2019.
3. "Design of Small Dams," United States Department of the Interior Bureau of Reclamation, 1987
4. "ER 110-2-106 - Recommended Guidelines for Safety Inspection of Dams," Department of the Army, September 26, 1979.
5. "Guidelines for Reporting the Performance of Dams," National Performance of Dams Program, August 1994.
6. Commonwealth of Massachusetts General Laws, M.G.L. 253, Section 44, Chapter 302 CMR 10.00, Dam Safety, February 10, 2017.