

Eagle Dam

Phase I Inspection / Evaluation Report

Wrentham, Massachusetts

Dam Name: **Eagle Dam**

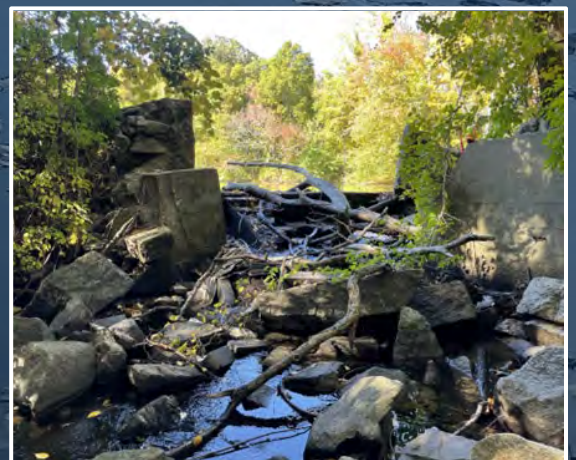
NID ID#: **MA02263**

Owner: **Town of Wrentham**

Town: **Wrentham**

Consultant: **Pare Corporation**

Date of Inspection: **October 11, 2022**



Dam Evaluation Summary Detail Sheet

1. NID ID: MA02263		4. Inspection Date: October 11, 2022	
2. Dam Name: Eagle Dam		5. Last Insp. Date: November 20, 2012	
3. Dam Location: Wrentham, MA		6. Next Inspection: October 11, 2032	
7. Inspector: David Caouette, PE			
8. Consultant: Pare Corporation			
9. Hazard Code: Low	9a. Is Hazard Code Change Requested?: No		
10. Insp. Frequency: 10 Years	11. Overall Physical Condition of Dam: UNSAFE		
12. Spillway Capacity (% SDF) >100% SDF w/ no actions by Caretaker			
E1. Design Methodology: 2		E7. Low-Level Discharge Capacity: 1	
E2. Level of Maintenance: 1		E8. Low-Level Outlet Physical Condition: 1	
E3. Emergency Action Plan: 1		E9. Spillway Design Flood Capacity: 5	
E4. Embankment Seepage: 4		E10. Overall Physical Condition of the Dam: 1	
E5. Embankment Condition: 1		E11. Estimated Repair Cost: \$1.28 M - \$2.38 M	
E6. Concrete Condition: 1			

Evaluation Description

E1: DESIGN METHODOLOGY

1. Unknown Design – no design records available
2. No design or post-design analyses
3. No analyses, but dam features appear suitable
4. Design or post design analysis show dam meets most criteria
5. State of the art design – design records available & dam meets all criteria

E2: LEVEL OF MAINTENANCE

1. Dam in disrepair, no evidence of maintenance, no O&M manual
2. Dam in poor level of upkeep, very little maintenance, no O&M manual
3. Dam in fair level of upkeep, some maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. Dam well maintained, detailed maintenance plan that is executed

E3: EMERGENCY ACTION PLAN

1. No plan or idea of what to do in the event of an emergency
2. Some idea but no written plan
3. No formal plan but well thought out
4. Available written plan that needs updating
5. Detailed, updated written plan available and filed with MADCR, annual training

E4: SEEPAGE (Embankments, Foundations, & Abutments)

1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but uncontrolled seepage
4. Minor seepage or high volumes of seepage with filtered collection
5. No seepage or minor seepage with filtered collection

E5: EMBANKMENT CONDITION (See Note 1)

1. Severe erosion and/or large trees
2. Significant erosion or significant woody vegetation
3. Brush and exposed embankment soils, or moderate erosion
4. Unmaintained grass, rodent activity and maintainable erosion
5. Well maintained healthy uniform grass cover

E6: CONCRETE CONDITION (See Note 2)

1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment but with potential for significant structural degradation
3. Significant longitudinal cracking and minor transverse cracking
4. Spalling and minor surface cracking
5. No apparent deficiencies

E7: LOW-LEVEL OUTLET DISCHARGE CAPACITY

1. No low level outlet, no provisions (e.g. pumps, siphons) for emptying pond
2. No operable outlet, plans for emptying pond, but no equipment
3. Outlet with insufficient drawdown capacity, pumping equipment available
4. Operable gate with sufficient drawdown capacity
5. Operable gate with capacity greater than necessary

E8: LOW-LEVEL OUTLET PHYSICAL CONDITION

1. Outlet inoperative needs replacement, non-existent or inaccessible
2. Outlet inoperative needs repair
3. Outlet operable but needs repair
4. Outlet operable but needs maintenance
5. Outlet and operator operable and well maintained

E9: SPILLWAY DESIGN FLOOD CAPACITY

1. 0 - 50% of the SDF or unknown
2. 50-90% of the SDF
3. 90 - 100% of the SDF
4. >100% of the SDF with actions required by caretaker (e.g. open outlet)
5. >100% of the SDF with no actions required by caretaker

E10: OVERALL PHYSICAL CONDITION OF DAM

1. UNSAFE – Major structural, operational, and maintenance deficiencies exist under normal operating conditions
2. POOR - Significant structural, operation and maintenance deficiencies are clearly recognized under normal loading conditions
3. 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
4. SATISFACTORY - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.
5. GOOD - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF

E11: ESTIMATED REPAIR COST

Estimation of the total cost to address all identified structural, operational, maintenance deficiencies. Cost shall be developed utilizing standard estimating guides and procedures

Changes/Deviations to Database Information since Last Inspection

Change in structure height from 8 feet to 11 feet.; Change in hydraulic height from 3 feet to 5.0 feet; Change normal pool surface area from 4.2 acres to 6 acres; change normal pool storage volume from 12 acre-feet to 23 acre-feet; change maximum surface area to 10.0 acres; Change maximum storage volume from 32 acre-feet to 72 acre-feet.

EXECUTIVE SUMMARY

This Phase I Inspection/Evaluation Report details the inspection and evaluation of the Eagle Dam located in Wrentham, Massachusetts. The inspection was conducted on October 11, 2022 by Pare Corporation (Pare) of Foxboro, Massachusetts. Eagle Dam is an approximately 200-foot long, 11-foot high earthen structure with a stone masonry spillway. The dam is currently classified as a **Small** size, **Low** (Class III) hazard potential dam.

No formal Operation and Maintenance (O&M) Manual is known to exist for this structure. An Emergency Action Plan (EAP) has not been prepared for this dam, nor is the preparation of one required by current state regulations for a low hazard potential dam.

In general, Eagle Dam was found to be in **Unsafe** condition with the following deficiencies noted:

1. Partial failure of the spillway
2. Severe erosion of the embankment left of the spillway
3. Vertical slopes along the downstream right channel right of the spillway
4. Overgrown trees and brush vegetation throughout the dam embankment
5. Cut and rotting stumps throughout the dam embankment
6. Areas of seepage at the downstream area left of the spillway
7. Additional maintenance deficiencies and potential dam safety concerns, as identified herein

More detailed descriptions, additional deficiencies, recommended repairs, and opinions of probable repair costs are provided within this report.

Based upon the size and hazard potential of this structure, the spillway design flood (SDF) for the dam is the 50-year storm event. An H&H model was prepared for the dam during the preparation of the Eagle Dam Removal Technical Feasibility Study in April 2021; the result indicated the dam can accommodate the SDF with 1.7 feet of freeboard.

Pare understands that the Town is assessing removal of the dam. If removal remains the preferred approach, Pare recommends that the Town implement measures in the interim to continue regular inspection and monitoring, minimize the level of the impoundment, and stabilize areas of apparent instability. However, if the dam is retained, Pare Corporation recommends the following actions be taken to address the deficiencies found at the dam during this inspection and evaluation:

1. Demolish and reconstruct the spillway.
2. Clear and grub the dam embankment and abutments within 10-feet of the dam of unwanted trees and vegetation from the embankment
3. Regrade the embankment to a more maintainable surface. Loam and seed the dam embankment after regrading
4. Armor the upstream slopes to protect the slope from wave induced erosion. Reconstruct the downstream channel walls to protect the embankment and abutments from erosion
5. Monitor areas of seepage and perform a formal analysis to assess and address the seepage
6. Perform a H&H analysis to assess the dam's ability to accommodate the SDF
7. Other studies, maintenance, and repairs as specified herein.

These repairs should be made in accordance with standard design practices, specifications, and construction methods. Design of the repairs, analyses to confirm the extent of the work, and observation to verify materials/methods used should be completed by a qualified engineer experienced in the design and rehabilitation of dams throughout the evaluation, design, and construction process.

Prior to undertaking recommended maintenance, repairs and remedial measures, the applicability of environmental permits needs to be determined for activities that may occur within resource areas under the jurisdiction of local conservation commissions, MADEP, or other regulatory agencies.



PREFACE

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this report.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection, along with data available to the inspection team. In cases where an impoundment is lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions, which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is critical to note that the condition of the dam is evolutionary in nature and depends on numerous and constantly changing internal and external conditions. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

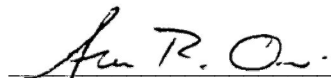

Allen R. Orsi, P.E., Senior Vice President
Pare Corporation
Massachusetts License No.: 46904
License Type: Civil



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SECTION 1

1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The Town of Wrentham, Massachusetts has retained Pare Corporation (Pare) to perform a visual inspection and develop a report of conditions for the Eagle Dam in Wrentham, Norfolk County, Massachusetts. This inspection and report were performed in accordance with MGL Chapter 253, Sections 44-50 of the Massachusetts General Laws.

1.1.2 Purpose of Work

The purpose of this investigation is to inspect and evaluate the present condition of the dam and appurtenant structures in accordance with 302 CMR10.04 to provide information that will assist in both prioritizing dam repair needs and planning/conducting maintenance and operation.

The investigation is divided into four parts: 1) obtain and review available reports, investigations, and data previously submitted to the owner pertaining to the dam and appurtenant structures; 2) perform a visual inspection of the site; 3) evaluate the status of and need for an emergency action plan for the site and; 4) prepare and submit a final report presenting the evaluation of the structure, including recommendations for remedial actions, and opinions of probable costs.

1.1.3 Definitions

To provide the reader with a better understanding of the report, definitions of commonly used terms associated with dams are provided in Appendix D. Many of these terms may be included in this report. The terms are presented under common categories associated with dams which include: 1) orientation; 2) dam components; 3) size classification; 4) hazard classification; 5) general; and, 6) condition rating.

1.2 Description of Project

1.2.1 General

Sections of this report are based upon available documentation, including previous inspection reports and other available information as identified in Appendix C. Other historical information obtained during the inspection, including information provided by the caretaker has also been incorporated into this report. This material is intended to provide general information. The accuracy of this referenced information was not verified as it was outside the scope of work for this inspection.

The completion of detailed hydrologic/hydraulic studies, stability analyses, subsurface investigations, and underwater investigations is beyond the scope of this evaluation.



1.2.2 Location

Eagle Dam is located within Norfolk County in the Town of Wrentham, Massachusetts. The dam is located downstream of the Red Dam and regulates flow along Eagle Brook. The structure and the impoundment are shown on the Wrentham, Massachusetts USGS quadrangle maps at coordinates 42.07251°N\71.34967°W. The dam is located at the northern end of the impoundment, as indicated on Figure 1: Locus Plan. Downstream of the dam, the spillway channel passes below Franklin Street (MA-140) and flows through a wooded area leading to an inventoried dam impounded water along Eagle Brook to create Mill Pond before travelling to Bush Pond, which is formed by Bush Pond #2 Dam.

To access the dam from Interstate-495 N, take Exit 38 (formerly Exit 15) to merge onto MA-1A N toward Wrentham. After 1.7 miles, turn left onto Creek Street and travel for 1.1 miles. Take a left onto Franklin Street (MA-140 N), the dam is approximately 0.3 miles on the left, immediately after Pendleton Road. The dam can be access through the woods from Franklin Street.

1.2.3 Owner/Operator

The dam is currently owned by the Town of Wrentham. Operations and Maintenance activities are the responsibility of the Town.

1.2.4 Purpose of the Dam

Available records¹ indicate that a dam was in place at this site since at least the early 1800's as part of a corn mill complex. Residents indicate that town historical references place a dam at this location as early as 1676. However, the industrial purpose of the dam has long since passed and the dam currently provides a recreation pool, although the current condition of the dam has resulted in a lower normal pool elevation.

1.2.5 Description of the Dam and Appurtenances

As shown in Figure 4, Eagle Dam is a non-linear earthen embankment dam approximately 200 feet long with a structural height of approximately 11 feet and a current hydraulic height of approximately 5 feet. The dam has two major components, the earthen embankment and the spillway.

Left of the spillway, the earthen embankment is made up of an unprotected upstream slope at approximately 1.5H to 2H:1V, a crest that varies from approximately 8 feet wide at the left abutment to a maximum width of 20 feet near midspan left of the spillway, and a partially grass covered downstream slope that varies from 2H to 3H:1V. Right of the spillway the upstream slope is 1H to 2H:1V, the crest is relatively flat and wide, blending with the natural topography, and the downstream slope is near vertical with concrete and stone masonry walls along the discharge channel for the primary spillway.

The primary spillway is located approximately 150 feet from the left abutment and is a sharp crested overflow weir constructed of stone masonry with concrete training walls. The spillway is approximately 15 feet wide and discharges to a boulder strewn stream channel that flows in a northerly direction.

¹ From a Wickedlocal.com article titled "Replace Eagle Dam, or remove it? Future of Wrentham structure is focus of upcoming virtual meeting (January 8, 2021)" referencing the Charles River Watershed Association feasibility assessment.



There are no other visible structures nor means to lower the impoundment visible at the site.

1.2.6 Operations and Maintenance

The dam is uncontrolled with no operations completed.

1.2.7 DCR Size Classification

Eagle Dam has a maximum dam height of approximately 11 feet and a maximum storage capacity of approximately 72 acre-feet. Therefore, in accordance with Department of Conservation and Recreation Office of Dam Safety classification, under Commonwealth of Massachusetts Dam Safety rules and regulations stated in 302 CMR 10.00, Eagle Dam is a **Small** size structure.

1.2.8 DCR Hazard Classification

Eagle Dam is located upstream of Franklin Street (MA-140) and an undeveloped wooded areas with an extensive floodplain and wetland complex surrounded by steep hills. It appears that a failure of the dam at maximum pool would pass below Route 140 and enter the wooded area with little impact to public or private structures and no anticipated loss of life. Therefore, in accordance with Department of Conservation and Recreation classification procedures, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10., Eagle Dam is currently classified as a **Low (Class III)** hazard potential structure.

The hazard potential classification recommendation is consistent with the hazard potential classification on record with the Office of Dam Safety for Eagle Dam.

1.3 Engineering Data

1.3.1 Drainage Area

As reported by the USGS StreamStats, the drainage area for Eagle Dam according to Massachusetts StreamStats is approximately 7.5 square miles and generally extends approximately 2 miles west of the dam through mixed use land towards Franklin center; approximately 1.85 miles east into Wrentham with light residential developments and some local roads present, and approximately 3.22 miles south to Sheldonville. The drainage area consists of 55.8% forest, 7.9% urban land, 12.8% impervious areas, and 1.9% waterbodies and wetlands¹.

The following control structures were identified within the watershed:

- MA00170 Red Dam (Significant Hazard)
- MA03142 Mill Pond Dam (Non-jurisdictional)
- MA03141 Trout Pond Dam (Non-jurisdictional).

¹ Percentages reported from Stream Stats for each land type are independent of the others and do not necessarily add up to 100% (for example: some of the impervious areas is likely located within urban land, etc.)



1.3.2 Reservoir

The following reservoir data was obtained from the H&H completed as part of the Eagle Dam Removal Feasibility Assessment.

Table 1-1 Reservoir Properties

	Elevation (ft)	Surface Area (acres)	Storage Volume (acre-feet)
Bottom of Pond	191	0.5	0
Normal Pool	196.5	6.0	23.0
Maximum Pool	202.5 ±	10.0	72.0

1.3.3 Discharges at the Dam Site

No discharge records were available during the preparation of this report.

1.3.4 General Elevations (feet)

Elevations are based upon a relative elevation survey completed by Pare personnel during the inspection referencing a temporary benchmark established at a paint mark on the upstream wall (assumed El. 100 ft) left of the spillway near mid length. This elevation was converted to NAVD88 using the top of the spillway (El. 196.5 ft, taken from the Eagle Dam Removal Feasibility Study) as a benchmark. Accuracy of the elevations should only be considered accurate to the level of methods used.

A. Top of Dam	201 ft± (current low high point) 202.9 ft (current high point)
B. Spillway Design Flood Pool ¹	200.8 ft ±
C. Normal Pool	196.5 ft ±
D. Downstream Toe Sta. 0+50	194.1 ft ±
E. Downstream Channel	191.5 ft ±

1.3.5 Primary Spillway

A. Type	Sharp Crested Overflow
B. Width	15.0 ft±
C. Spillway Crest Elevation	196.5 ft
D. Capacity	970 cfs±

1.3.6 Design and Construction Records

There were no construction records or information regarding the original construction of the structure available during the preparation of this report.

It appears that the masonry weir currently regulating the pond level has been added within the last several years to restore the pond level after a failure of the previous spillway. However, details or verification of this assumption was not available during the preparation of this report.

¹ From the 2021 dam removal feasibility study.



1.3.7 Operating Records

No records were made available during the preparation of this report or are known to exist.



1.4 Summary Data Table

Table 1-2 Summary Data Table

Required Phase I Report Data	Data Provided by Inspecting Engineer
National ID #	MA02263
Dam Name	Eagle Dam
Dam Name (Alternate)	N/A
River Name	Eagle Brook
Impoundment Name	Eagle Brook
Hazard Class	Low
Size Class	Small
Dam Type	Earthen Embankment
Dam Purpose	Recreation
Structural Height of Dam (feet)	11
Hydraulic Height of Dam (feet)	5
Drainage Area (sq. mi.)	7.5
Reservoir Surface Area (acres)	6
Normal Impoundment Volume (acre-feet)	23
Max Impoundment Volume ((top of dam) acre-feet)	72
SDF Impoundment Volume (acre-feet)	56
Spillway Type	Composite Concrete and grouted riprap weir
Spillway Length (feet)	36
Freeboard at Normal Pool (feet)	6
Principal Spillway Capacity (cfs)	970
Auxiliary Spillway Capacity (cfs)	N/A
Low-Level Outlet Capacity (cfs)	N/A
Spillway Design Flood (flow rate - cfs)	50 yr. / 470
Winter Drawdown (feet below normal pool)	Not Applicable
Drawdown Impoundment Vol. (acre-feet)	Not Applicable
Latitude	42.07251
Longitude	71.34967
City/Town	Wrentham
County Name	Norfolk
Public Road on Crest	No
Public Bridge over Spillway	No
EAP Date (if applicable)	None
Owner Name	Town of Wrentham
Owner Address	360 Taunton Street
Owner Town	Wrentham, MA 02093
Owner Phone	508-384-5477
Owner Emergency Phone	0
Owner Type	Municipality or Political subdivision
Caretaker Name	Brian Antonioli, Acting Director DPW
Caretaker Address	360 Taunton Street
Caretaker Town	Wrentham, MA 02093
Caretaker Phone	508-384-5477
Caretaker Emergency Phone	0
Date of Field Inspection	10/11/2022
Consultant Firm Name	Pare Corporation
Inspecting Engineer	David Caouette, PE
Engineer Phone Number	508.543.1755



SECTION 2

2.0 INSPECTION

2.1 Visual Inspection

The Eagle Dam was inspected on October 11, 2022. At the time of the inspection, temperatures were near 60°F with mostly clear skies. In the week prior to the inspection, approximately 1.3 inches of rain had fallen. Photographs to document conditions were taken during the inspection and are included in Appendix A. The level of the impoundment appeared to be near the current normal pool elevation. Underwater areas were not evaluated during this inspection. A copy of the inspection checklist is included in Appendix B.

For reference purposes, a baseline was established along the crest of the dam during the inspection with 0+00 at the left abutment of the dam and Station 1+50 left of the spillway; the right abutment is located near Station 2+00. Observations were made in relation to their location along the baseline as appropriate and as noted herein.

2.1.1 General Findings

In general, Eagle Dam was found to be in **Unsafe** condition. The specific concerns are identified in the sections below.

2.1.2 Dam

The following was noted along the embankment portion of the dam during the inspection.

Upstream Slope

Current Observations:	
➤ Dense vines, brush, and trees up to 24-inch diameter continues to develop on the embankment left of the spillway.	
Review of Previous Observations:	Comments from Current Inspection:
➤ Between Sta. 0+00 and Sta. 0+25: <ul style="list-style-type: none"> ○ The slope is irregular with near vertical scarps observed. The slope is overgrown with large trees and brush and a large rotting tree noted along the waterline at 0+10. ○ The upstream slope is steep, irregular, and overgrown with an irregular alignment which has been impacted by erosion. ○ The slope varies from 1.5H:1V to 2H:1V with a tree noted near the top of slope at STA 0+60. 	➤ Appeared in similar condition as previously noted with vegetation continuing to grow unchecked and erosion continuing to develop.
➤ Between Sta. 0+75 to Sta. 1+00: <ul style="list-style-type: none"> ○ The slope is overgrown and near vertical with some scarping noted about 1-foot above water. ○ The upstream slope is near vertical. A large tree was noted along the upstream side of the dam at Sta. 1+00. 	➤ Appeared in similar condition as previously noted with vegetation continuing to grow unchecked and erosion continuing to develop.



<ul style="list-style-type: none"> ➤ The upstream slope transitions to masonry wall from 1+30 to 1+50, with a worn path around the left end of the wall. The wall is in poor condition and has failed at the transition to the left training wall. 	<ul style="list-style-type: none"> ➤ The upstream wall continued to deteriorate; the worn path extended to the downstream channel. ➤ A 16-inch wide by 8-inch-deep void followed by a crack was noted approximately mid-wall.
<ul style="list-style-type: none"> ➤ Right of the spillway, the upstream slope is near vertical, with tree and brush coverage from the wall to the right abutment. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted with vegetation continuing to grow unchecked and erosion continuing to develop.

Crest

Current Observations:	
<ul style="list-style-type: none"> ➤ The crest is densely overgrown with vines and brush limiting the access for inspection. 	
Review of Previous Observations:	Comments from Current Inspection:
<ul style="list-style-type: none"> ➤ The crest is generally covered with vines and low brush and appears to pitch in the downstream direction. The crest narrows to 8'± at the left abutment and widens to 15'± near STA 0+25. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.
<ul style="list-style-type: none"> ➤ Between Sta 0+25 to 0+50, a fallen tree, resting on vines obscures the crest in this area. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.
<ul style="list-style-type: none"> ➤ Between Sta. 0+50 to 0+75, the crest is vegetated with small weeds and is approximately 20 feet wide with a downstream slope 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.
<ul style="list-style-type: none"> ➤ Between Sta. 0+75 to Sta. 1+00, minor brush is developing along the crest of the dam. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.
<ul style="list-style-type: none"> ➤ Between 1+00 to 1+25, the crest of the dam is approximately 10' wide, and brush covered in this area. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.
<ul style="list-style-type: none"> ➤ At 1+10 the dam crest approximately 6' to the eroded area that extends to the water edge. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.
<ul style="list-style-type: none"> ➤ Right of the spillway, the crest has an average width of 5'± at abutment with a large 24" tree located at upstream edge of crest. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.
<ul style="list-style-type: none"> ➤ The concrete and masonry downstream and upstream walls area 18" thick and approximately 20' long with a curved alignment. It was noted that the downstream side is fully eroded behind wall. 	<ul style="list-style-type: none"> ➤ The concrete and masonry wall continued to erode/degrade; vines and brush growth were noted behind the wall.

Downstream Slope

Current Observations:	
<ul style="list-style-type: none"> ➤ The downstream wall left of the spillway is in poor condition with cracks up to 5-in wide extend along the height of the wall at mid-section. 	
Review of Previous Observations:	Comments from Current Inspection:
<ul style="list-style-type: none"> ➤ The downstream slope is pitched at 3H:1V and is mostly grass covered leading from the dam crest to the water department access road. 	<ul style="list-style-type: none"> ➤ Appeared in similar condition as previously noted.



➤ Between Sta. 0+25 to Sta. 0+50, the downstream slope steepens to 2H:1V with increasing vegetation and a tree at the toe of the slope at STA 0+30±.	➤ Trees was noted throughout.
➤ Between Sta. 0+50 to 0+75, the downstream slope is steep and irregular (1H:1V) with vegetation consisting of brush and multiple 8" trees.	➤ Several tree stumps in various stages of rot were noted within this area.
➤ The downstream side of the dam is a path at STA 0+90 that is approximately 4' wide by 1' deep. The slope is overgrown with a mixture of large and small trees.	➤ The erosion path was approximately 1.5 feet deep.
➤ Between Sta. 1+00 to Sta. 1+25, the downstream side of the dam in this area is pitched 1H:V1, with 6-8" trees noted throughout.	➤ Appeared in similar condition as previously noted with trees continuing to increase in diameter.
➤ Right of the spillway, the short section of downstream slope is near vertical, and moss covered.	➤ Appeared in similar condition as previously noted.

2.1.3 Appurtenant Structures

The appurtenant structure at the dam is the primary spillway. The general condition of the primary spillway is detailed below.

Primary Spillway

Current Observations:	
<ul style="list-style-type: none"> ➤ Two areas of seepage were noted downstream of the spillway <ul style="list-style-type: none"> ○ Approximately 15 feet downstream, left of the channel, 0.2 GPM, no sign of sediment transport, stained iron oxide was observed. ○ Approximately 20 feet downstream, left of the channel, 1 GPM, no sign of sediment transport, stained iron oxide was observed. ➤ Leakage was noted between the stacked stones forming the spillway control section. ➤ Sticks, logs, and other debris is present within the downstream area approximately 20 to 30-feet downstream of the dam. This debris is creating a 2-foot tailwater within the discharge area. 	
Review of Previous Observations:	Comments from Current Inspection:
➤ The left and right training walls have failed.	➤ The left and right training wall continues to deteriorate with vertical cracks along the wall, spalls, missing section, and areas of scour.
➤ A concrete masonry, sharp crested weir has been constructed across the opening.	➤ The weir was reduced to a 2' high, single lined stack of 8" wide masonry concrete blocks and a mortared surface upstream. <ul style="list-style-type: none"> ○ On the right side of the spillway several blocks along the spillway crest have come loose resulting in increased discharge flow at this location.
➤ There was stones and masonry debris in channel, presumable from the previously failed structure.	➤ Appeared in similar condition as previously noted.
➤ Some floating debris was noted with the approach of the spillway.	<ul style="list-style-type: none"> ➤ Accumulated leaves were noted at the spillway approach. ➤ Logs were noted on the spillway crest and in the immediate discharge area.
➤ Significant erosion was noted behind the right training wall.	➤ Severe vertical erosion was noted behind the left and right training walls.



	<ul style="list-style-type: none"> ○ Erosion on the right side was up to 10-foot tall, vertical, and in direct contact with the discharge channel. ➤ Dense vines growth was noted at the right training wall.
--	---

2.1.4 Downstream Area

The channel downstream of the spillway is partially lined with concrete and masonry walls in various states of failure, and the channel contains concrete and stone debris from the failed spillway structure. Further downstream, the channel becomes an unlined channel that passes below Franklin Street (Route 140) via a double barrel concrete box culvert and enters an undeveloped wooded area that contains apparent wetlands and flood plain, Mill Pond, a cranberry bog, and Bush Pond.

2.1.5 Reservoir Area

The reservoir slopes are moderate to steep and are generally densely wooded. Four private residences are located at the top of the slope along the east and southern sides of the impoundment.

2.2 Caretaker Interview

Mr. Bradley Zinnack, Wrentham Highway Division Supervisor, was present at the beginning of the inspection and provided information about the dam. Information provided by Mr. Zinnack has been incorporated into the report.

2.3 Operation and Maintenance Procedures

2.3.1 Operational Procedures

A formal Operations and Maintenance (O&M) Manual has not been prepared for this structure. There are no operable components at the dam.

2.3.2 Maintenance of Dam

No maintenance procedures, formal or informal exist for this structure. The dam does not appear to be regularly maintained. There are cut stumps along the toe of the dam embankment left of the spillway, reportedly from trees that were dead/dying and had potential to fall onto MA-140,

2.4 Emergency Warning System

A detailed Emergency Action Plan has not been developed for this structure. As the dam is currently classified as a low hazard potential dam, preparation of an emergency action plan is not required by current state regulations.

2.5 Awareness of Potential Dam related Safety Hazards at, near, and on Dams

The following section identifies a list of potential dam related safety hazards which may be present in the vicinity of a dam. As part of the field inspection, the site was reviewed for the presence of these potential



hazards. This list may be incomplete, and it is the responsibility of the Dam Owner to ensure compliance with Local, State, and Federal Laws, inclusive of OSHA, ADA, MADPH, and other applicable safety regulators. It is the intent of this section to inform the Dam Owner of potential safety risks that may be present.

It should be noted that the scope of the safety assessment is limited to observations noted during the inspection. Pare recommends that the Owner consider completing a comprehensive site safety assessment by trained risk reduction and hazard assessment specialists.

Table 2-1 Potential Related Safety Hazards At, Near, and On Dams

Hazard Category Checked	Hazard Present?		Comments
	Yes	No	
Fall Hazard	X		Steep/vertical slopes right of the spillway. High fall height from embankment right of spillway onto the spillway and discharge area.
Submerged Inlet		X	None observed
Boater Safety	X		During period of high flow, draw over the spillway control section and through the discharge channel could lead to injury boat damage.
Roll Dam		X	Not Applicable
Sudden Releases		X	None Observed
Confined Space		X	None Observed
Ergonomic Safety		X	None Observed
Others		X	None Observed

Dam Safety Regulations 302 CMR Section 10.13: Liability (1), states “The owner shall be responsible and liable for damage to property of others or injury to persons, including but not limited to, loss of life resulting from the operation, failure of or mis-operation of a dam.” Implementation of any recommendations may require local, state, or federal permits as well as securing property rights if subject areas are not owned by the dam owner. Securing such permits and/or land rights is the sole responsibility of the dam owner.

2.6 Hydraulic/Hydrologic Data

The Eagle Dam is a **Small** size, **Class III** (low) hazard potential structure and in accordance with Massachusetts Law, the spillway design flood (SDF) for the site is the 50-year storm event.

Based upon available Hydraulic and Hydrologic (H&H) analysis completed as part of the Eagle Dam Removal Feasibility Assessment, the current dam can accommodate the SDF with 1.7 feet of freeboard (assumed average top of dam is El. 202.5 ft). A summary of the H&H data of the dam during the 50-year event is presented in the table below:

Table 2-2 H&H Data Summary During the 50-yr Event (7.51”)

	Top Elevation (feet)	Peak Elevation (feet)	Freeboard (feet)	SDF Inflow (cfs)	SDF Outflow (cfs)	Spillway Capacity (cfs)
Eagle Dam	202.5±	200.8	1.2	478	470	470



2.7 Structural and Seepage Stability

Formal stability and seepage evaluations were not completed for this structure during the preparation of this report. No records of the original design computations were available for review.

2.7.1 Embankment Structural Stability

Based on a visual inspection of the dam, no immediate concerns for the structural stability of the embankment were noted. However, the overgrown trees, brush, and vines growth along the embankment, the unprotected and scarping upstream slope, the severe eroded areas along the embankment are conditions that, if left unaddressed, could lead to potential structural instability.

2.7.2 Structural Stability of Non-Embankment Structures

The spillway stability is assumed to be marginal given the apparent failure and subsequent informal repair of the weir. Several blocks along the right side of the spillway have become dislodged resulting in uneven flow over the spillway.

2.7.3 Seepage Stability

Based on a visual assessment of the dam, while no signs of sediment transport were apparent, the seepage downstream of the spillway, is condition that may contribute to internal erosion and/or piping, which can lead to further deterioration of the structure including the development of sinkholes and voids within the embankment, or failure of the structure.



SECTION 3

3.0 ASSESSMENTS AND RECOMMENDATIONS

3.1 Assessments

In general, the overall condition of Eagle Dam is **Unsafe**. It should be noted that if the conditions at the dam are allowed to deteriorate further, unsafe conditions could develop. The following deficiencies identified:

Table 3-1 Deficiency Summary

<i>Deficiency Number</i>	<i>Description</i>
1.	Partial failure of the spillway
2.	Severe erosion of the embankment left of the spillway
3.	Vertical slopes along the downstream right channel right of the spillway
4.	Overgrown trees and brush vegetation throughout the dam embankment
5.	Cut and rotting stumps throughout the dam embankment
6.	Areas of seepage at the downstream area left of the spillway

The overall condition of the dam has been downgraded since the 2012 Phase I inspection which found the dam to be in Fair condition. The reasons for the downgraded to Unsafe is due to the continued development of dense vegetation and trees developing on the embankment and the seepage areas noted downstream of the spillway.

The following table provides a summary of the previously reported deficiencies or recommendations and the current conditions.

Table 3-2 Previously Reported Deficiencies & Current Status Summary

<i>Previously Noted Deficiency/ Recommendation</i>	<i>Resolution or Current Condition</i>
Structure Monitoring Program	No apparent change/ Same recommendation
Develop a formal O&M	No apparent change/ Same recommendation
Develop an EAP	No apparent change/ Same recommendation
H&H Analyses	Completed in April 2021 as part of the Dam Removal Feasibility Study.
Spillway Replacement	No apparent change/ Same recommendation
Embankment Reconstruction	No apparent change/ Same recommendation

The following recommendations and remedial measures generally describe the recommended approach to address current deficiencies at the dam. Prior to undertaking recommended maintenance, repairs and remedial measures, the applicability of environmental permits needs to be determined for activities that may occur within resource areas under the jurisdiction of local conservation commissions, MADEP, or other regulatory agencies.

3.2 Studies and Analyses

It is recommended that the owner of the dam arrange for the following investigations to be performed by a qualified registered professional engineer experienced with embankment dams and hydrology,



maintenance, and monitoring activities.

1. **Structure Monitoring Program:** Develop a program for continued monitoring of the structure until repairs or other measures are implemented to address ongoing concerns.
2. **Operations and Maintenance Manual:** Develop a formal Operations and Maintenance Manual (O&M) for this structure. The O&M should include periodic inspection schedules and operational and maintenance procedures required to ensure satisfactory operations and minimizing deterioration of the facility. **Due to the age of the structure and existing concerns, regular and frequent site visits and information inspections should be undertaken until repairs are implemented.**
3. **Emergency Responses:** Develop emergency response procedures to be implemented should conditions at the dam worsen. Although the dam is considered a low hazard potential structure, a plan of action should be developed to respond to a failure or potential failure of the structure. The Town may choose to adopt similar procedures to those in place at the upstream Red Dam.
4. **Site Safety Assessment:** Coordinate the completion of a site-specific risk and safety assessment to further evaluate, categorize, and determine the need for implementing a site safety improvement program.

3.3 Dam Removal

A Dam Removal Feasibility Study was completed for the dam in June 2021. The study includes the following analyses:

- Detailed Hydrologic/Hydraulic Analysis
- Eagle Dam Historic Information
- Sediment Assessment of the impoundment
- Conceptual Designs

The Town is currently working on selecting an alternative based on current study results. If removal remains the preferred approach, Pare recommends the following until the dam is breached/removed:

1. Continue regular inspection and monitoring to ensure that stability concerns do not progress.
2. Implement measures to maintain the impoundment below normal pool levels to reduce hazard associated with failure.
3. Stabilize areas of noted instability thru buttressing, repair, or replacement.

3.4 Yearly & Recurrent Maintenance Recommendations

The following recommendations should be performed on a regular schedule and allotted for within yearly operational budgets for the structure:

1. Perform regular monitoring and inspection of the dam and appurtenant structures, inclusive of the following:
 - a. Checking for accumulated debris within the approach and discharge areas of the spillway, areas of suspected soil movement (e.g., erosion, holes, depressions, bulges, slides, slough), and areas of seepage exiting the embankment. Monitor flow for changes in velocity, composition (i.e.,



- cloudy flow), or sediment transport. Monitoring should also provide a means by which to relate flow rates to impoundment and downstream channel water elevations.
- b. Complete routine inspections after significant rainfall events and formal inspections. Quarterly visual inspections of the dam should be performed with special attention paid to the deficiencies noted within this report in order to assess if any issues are progressing or accelerating.
 - c. Complete formal Phase I Inspections of the dam in accordance with current state regulations. As the dam is currently considered a Low hazard potential structure, a formal inspection is required every 10 years.
2. Complete regular maintenance activities at the site; inclusive of the following:
 - a. Routine removal of accumulated debris (e.g., fallen branches, logs, leaves) from the approach and discharge areas of the spillway.
 - b. Control vegetation at the dam and downstream area including hand clearing of woody vegetation within the upstream and downstream slopes and within 15 feet of the downstream toe.
 - c. Address dam safety issues identified during the regular monitoring and inspection activities.

3.5 Repair Recommendations

Given the extent of the erosion, and overgrowth, as well as the deterioration at the spillway, the damage has progressed beyond the repair stage. As such significant remedial measures are required to meet current criteria.

3.6 Remedial Modification Recommendations

The following remedial measures are recommended to meet current dam safety regulations and improve the integrity and safe operation of the dam.

1. **Replace the Spillway:** Replace the existing deteriorated spillway section with a new spillway control structure designed to accommodate the spillway design flood. Design of the spillway should account for additional capacity that may be realized by restoring the original top of dam elevation, as well as provide for low level discharge capacity. The spillway rehabilitation should also replace the spillway training walls with new walls designed to contain flows during all flow regimens without subjecting the downstream slope and toe to erosion.
2. **Reconstruct the embankment to current stability requirements.** This option includes implementing an extensive clearing and grubbing program to remove unwanted vegetation and the associated root systems from the dam; regrading the slopes and embankment to stable geometries; armoring the upstream slope to protect the dam from wave driven erosion along and below the waterline; installing seepage controls including toe and blanket drains; installing new retaining walls in areas of the dam where stable slopes cannot be installed; and loaming and seeding the dam to provide a uniform surface.

3.7 Alternatives

No alternative aside from removal or rehabilitation were considered for this site.



3.8 Opinion of Probable Costs

The following conceptual opinions of probable costs have been developed for the recommendations and remedial measures noted above. The costs shown herein are based on a limited investigation and are provided for general information only. This should not be considered an engineer's estimate, as actual costs may be somewhat less or considerably more than indicated.

Studies and Analyses

1. Structure Monitoring Program	\$	4,000	-	\$	8,000
2. O&M Manual	\$	6,000	-	\$	9,000
3. Emergency Response Procedures	\$	4,000	-	\$	8,000
4. Site Safety Assessment	\$	500	-	\$	1,000
Subtotal	\$	14,500	-	\$	26,000

Yearly Recommendations

1. Regular Inspection and Monitoring	\$	2,000	-	\$	4,000
2. Phase I Inspection (1/10yrs@\$5000/ea.)	\$	500	-	\$	2,000
3. Regular Maintenance	\$	5,000	-	\$	10,000
4. Follow up Inspection (6 month to 1 year)	\$	2,000	-	\$	2,500
Subtotal	\$	9,500	-	\$	18,500

Remedial Measures

1. Rehabilitate/Replace the Spillway	\$	300,000	-	\$	500,000
2. Reconstruct Embankment	\$	600,000	-	\$	1,200,000
Subtotal	\$	900,000	-	\$	1,700,000
Engineering & Design	\$	60,000	-	\$	90,000
Permitting	\$	25,000	-	\$	35,000
30% Contingency	\$	270,000	-	\$	510,000
Subtotal	\$	1,255,000	-	\$	2,335,000

RECOMMENDATIONS TOTAL \$ 1,279,000 - \$ 2,379,500

When comparing costs, the total cost including design, engineering, permitting, construction and long-term maintenance should be considered.

While most of these activities can be undertaken as maintenance activities under 302 CMR 10 Dam Safety and will only require that the Office of Dam Safety be notified of the activities, the applicability of other environmental permits (i.e., NOI, PGP, Water Quality Certificate, etc.) needs to be determined prior to undertaking maintenance activities that may occur within resource areas under the jurisdiction of MADEP, the local conservation commission or other regulatory agency.

3.9 Site Safety Considerations

Based upon the site safety screening completed as part of the inspection, Pare recommends that the owner

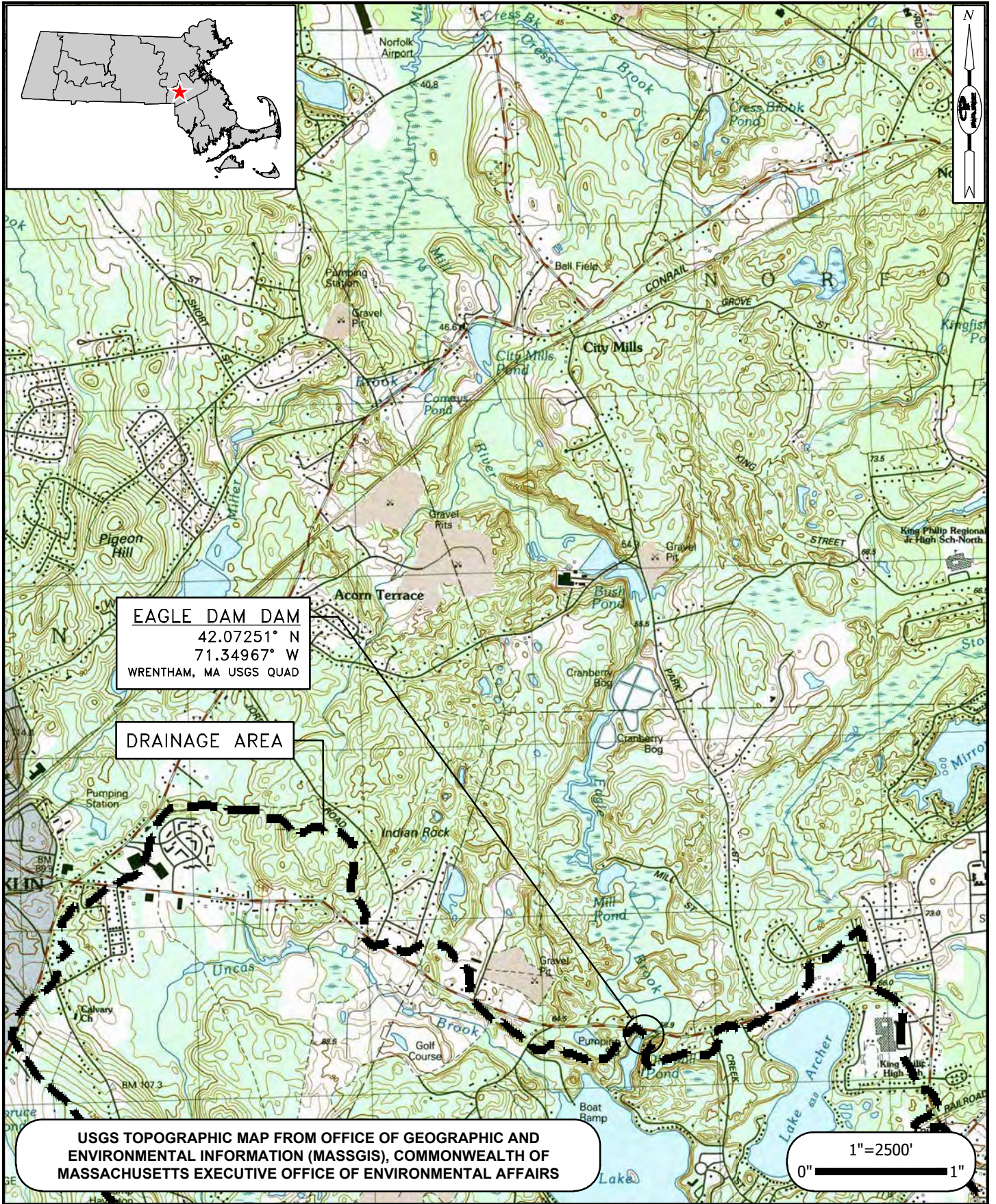


complete the recommended site safety assessments (See Section 3.2). The following presents a list of potential site safety improvements that should be considered. It should be noted that a detailed site safety assessment may find that some of these measures are not required and may identify additional hazards that are not identified herein.

- Provide railing or other fall protection along the tops of walls and the right side of the dam.
- Provide signage and/or barriers at the approach to the spillway to warn boaters of the presence of the spillway.



FIGURES
Eagle Dam
Wrentham, MA



EAGLE DAM
 MA02263 / 6-11-350-2
 WRENTHAM, MASSACHUSETTS

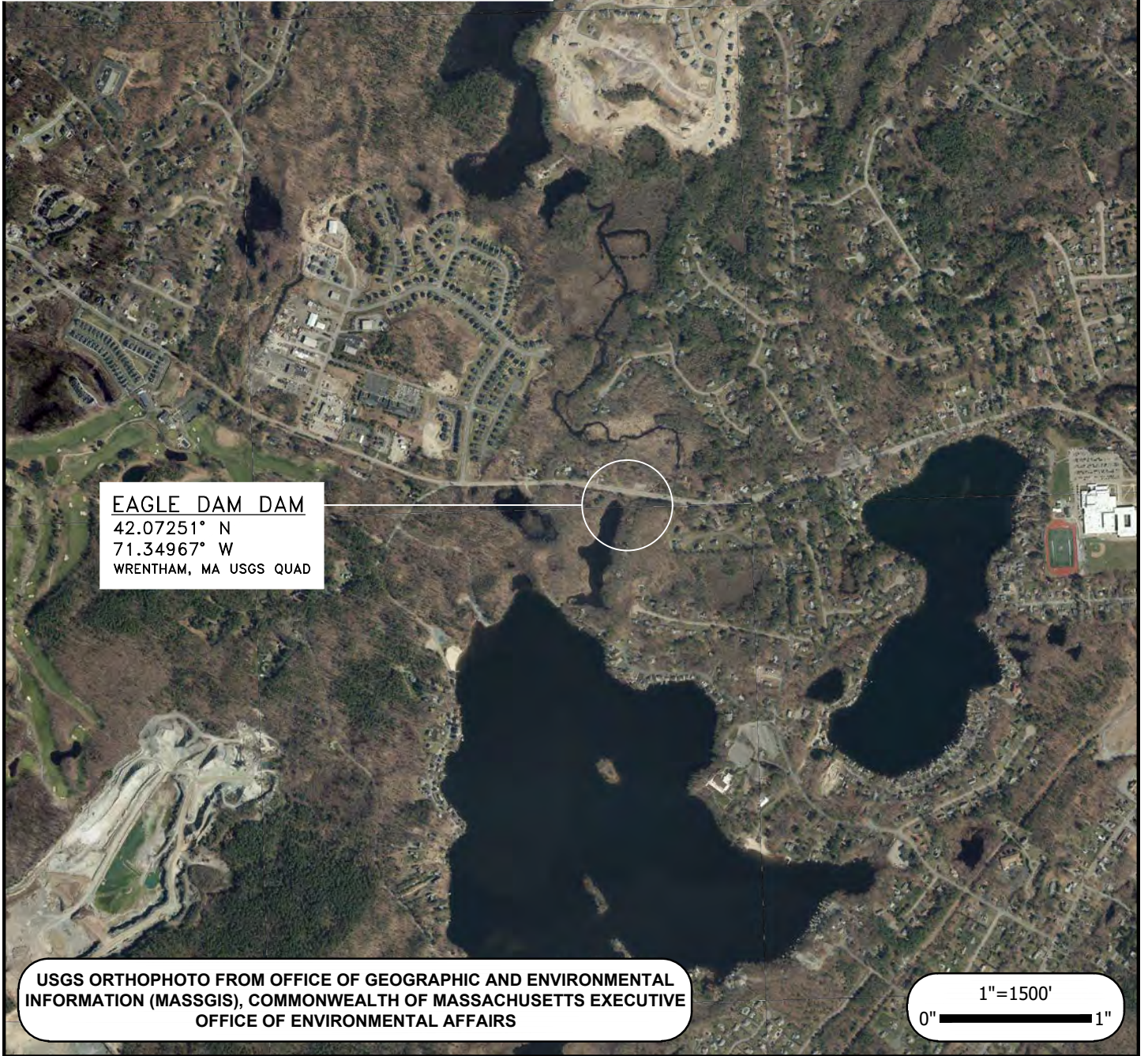
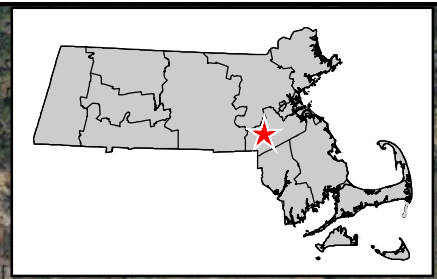
OWNER: TOWN OF WRENTHAM

LOCUS PLAN

OCTOBER 2022 FIGURE 1



SCALE: 1=150'



EAGLE DAM DAM
42.07251° N
71.34967° W
WRENTHAM, MA USGS QUAD

USGS ORTHOPHOTO FROM OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

1"=1500'
0" ————— 1"

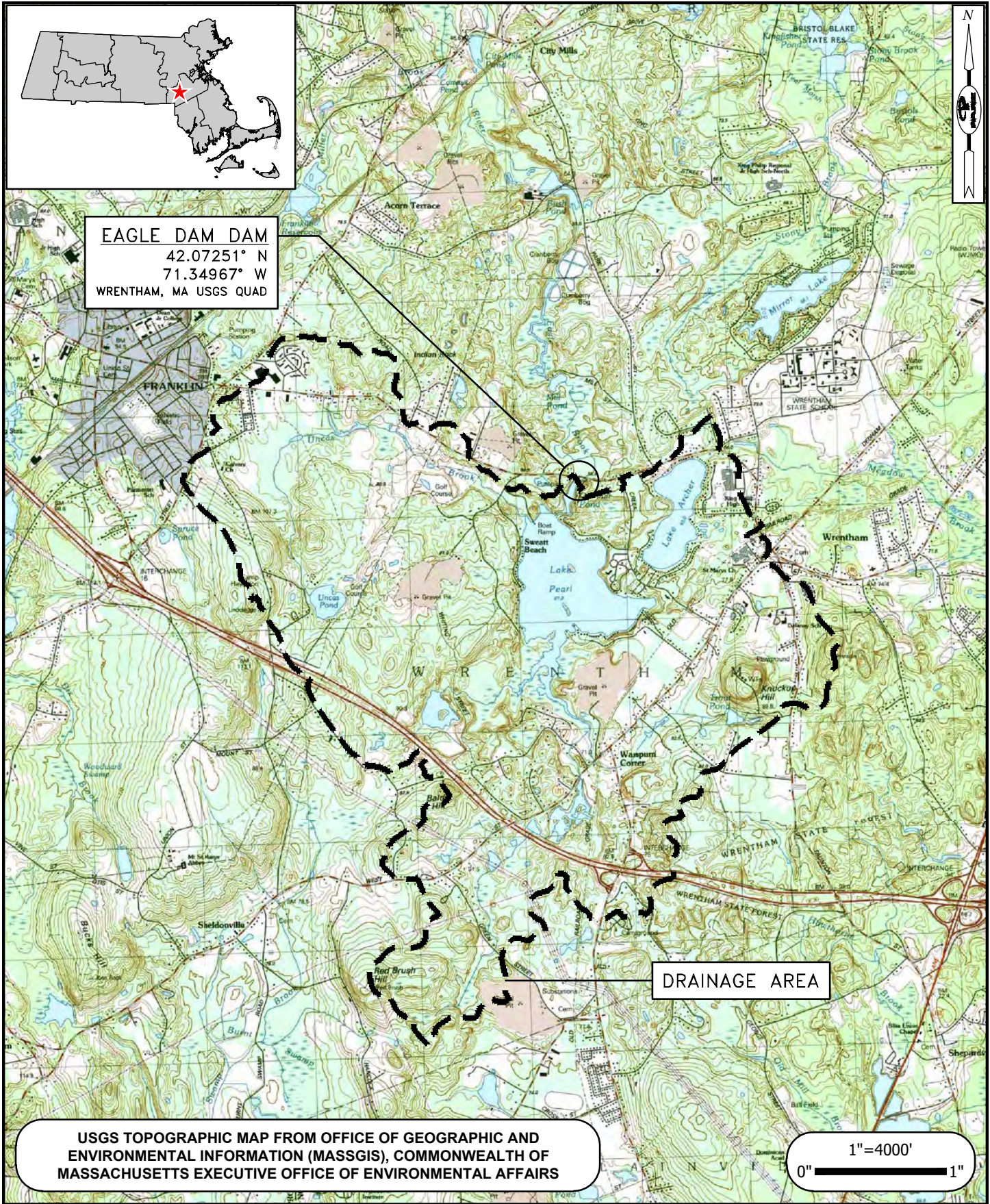


EAGLE DAM
MA02263 / 6-11-350-2
WRENTHAM, MASSACHUSETTS

OWNER: TOWN OF WRENTHAM

AERIAL PLAN

OCTOBER 2022 FIGURE 2



EAGLE DAM DAM
 42.07251° N
 71.34967° W
 WRENTHAM, MA USGS QUAD

DRAINAGE AREA

USGS TOPOGRAPHIC MAP FROM OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

1"=4000'
 0" ————— 1"



EAGLE DAM
 MA02263 / 6-11-350-2
 WRENTHAM, MASSACHUSETTS
 OWNER: TOWN OF WRENTHAM

DRAINAGE AREA
 MAP
 OCTOBER 2022 FIGURE 3

APPENDIX A
Photographs
Eagle Dam
Wrentham, MA



Photo No. 1.: Overview of the impoundment from near Sta. 1+50 looking upstream.



Photo No. 2.: Upstream slope of the dam from near the left abutment looking right.

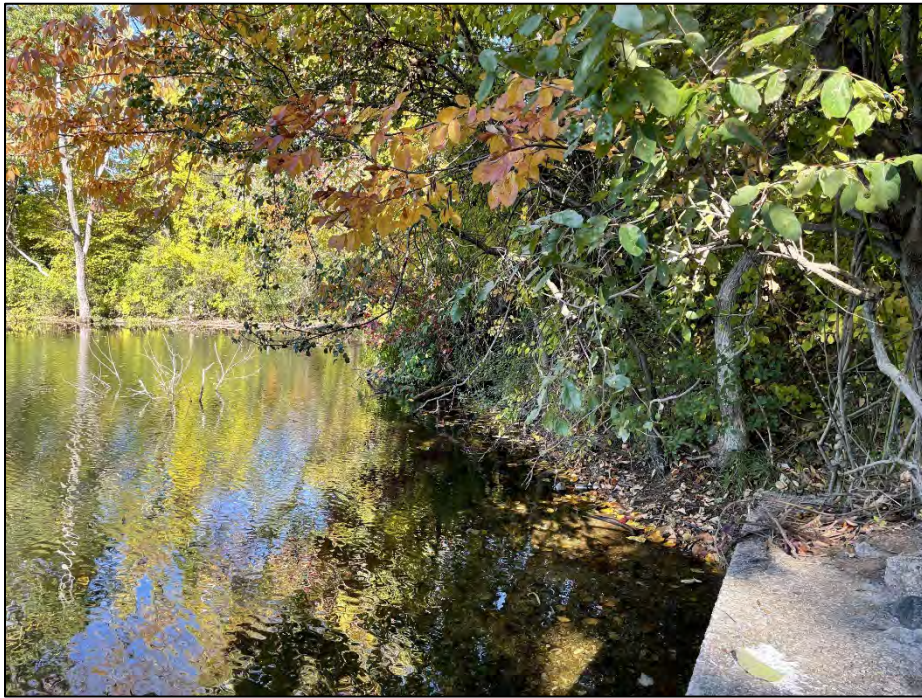


Photo No. 3.: Upstream slope from the left side of the spillway near Sta. 1+30 looking left.



Photo No. 4.: Upstream wall from near Sta. 1+30 looking right.



Photo No. 5.: Upstream slope of the dam right of the spillway.



Photo No. 6.: Crest from near Sta. 0+00 looking right.



Photo No. 7.: Crest from near Sta. 1+00 looking left.



Photo No. 8.: Crest from near Sta. 1+10 looking right. Note erosion of the crest behind the upstream wall left of the spillway (arrow).



Photo No. 9.: Erosion of the dam crest immediately behind the upstream wall left of the spillway.



Photo No. 10.: Crest of the dam right of the spillway.



Photo No. 11.: Downstream slope from near the left abutment looking left.



Photo No. 12.: Downstream slope from near Sta. 0+80 looking right.



Photo No. 13.: Erosion path from the crest to downstream toe near Sta. 1+00.



Photo No. 14.: Downstream slope from near Sta. 1+00 looking right.



Photo No. 15.: Downstream slope right of the spillway.



Photo No. 16.: Concrete wall left of the spillway. Note the 5-inch crack.



Photo No. 17.: Overview of the right upstream wall from the spillway channel looking right. Note the crack along the downstream section.



Photo No. 18.: Spillway channel from downstream channel looking upstream.



Photo No. 19.: Eroded area behind the right upstream wall.



Photo No. 20.: Observed seepages with iron oxide flocculant approximately 15 feet downstream of the downstream channel left wall.

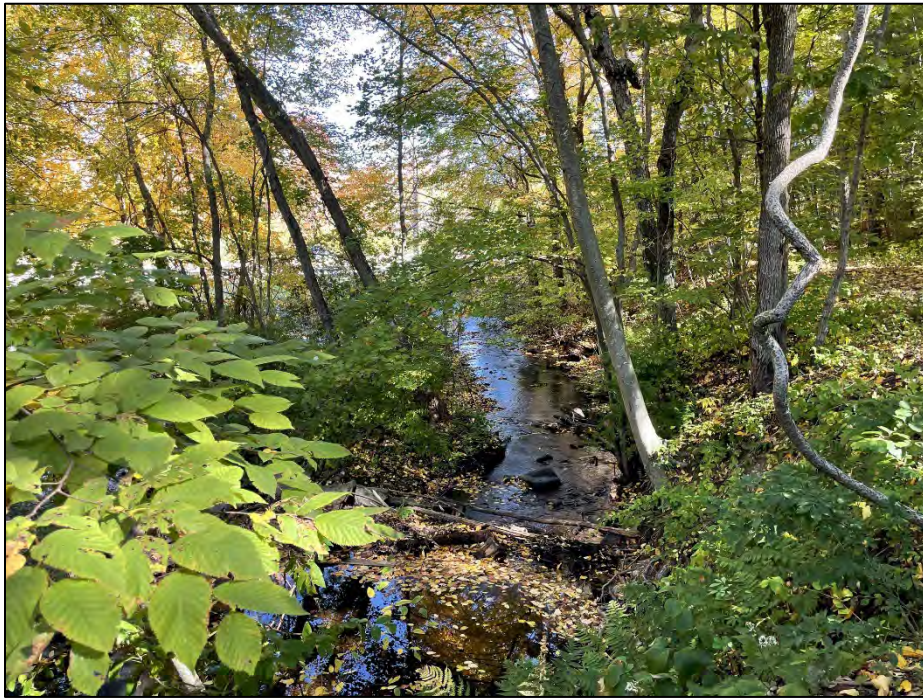


Photo No. 21.: Downstream view of the Eagle Brook

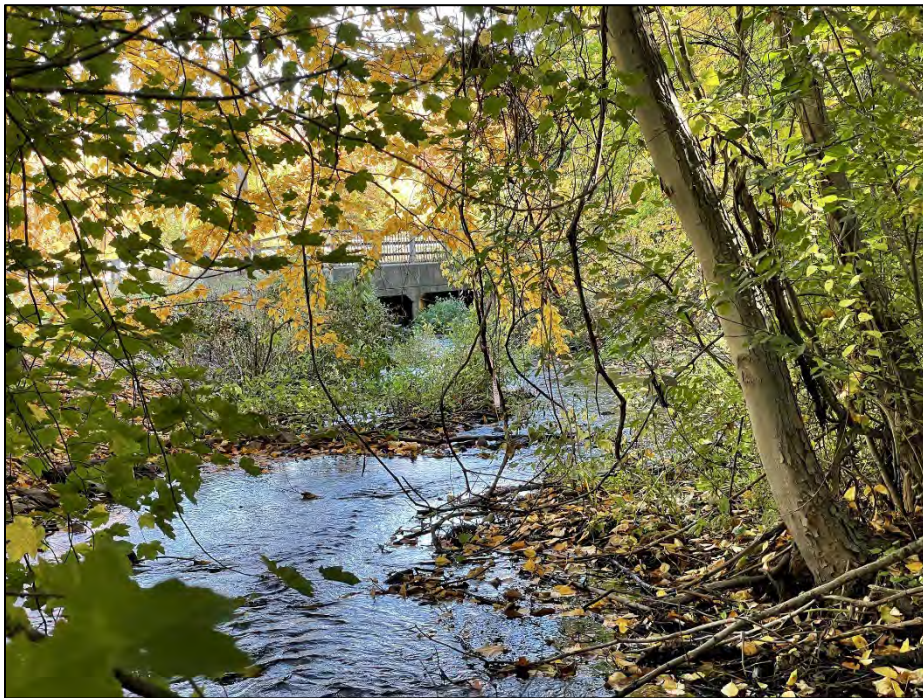



Photo No. 22.: Culvert approximately 200-feet downstream of the dam.

APPENDIX B
Inspection Checklist
Eagle Dam
Wrentham, MA

DAM SAFETY INSPECTION CHECKLIST

NAME OF DAM: <u>Eagle Dam</u>	STATE ID #: <u>6-11-350-2</u>
REGISTERED: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	NID ID #: <u>MA02263</u>
STATE SIZE CLASSIFICATION: <u>Small</u>	STATE HAZARD CLASSIFICATION: <u>Low</u>
	CHANGE IN HAZARD CLASSIFICATION REQUESTED?: <u>No</u>
<u>DAM LOCATION INFORMATION</u>	
CITY/TOWN: <u>Wrentham</u>	COUNTY: <u>Norfolk</u>
DAM LOCATION: <u>Route 140 Wrentham</u> (street address if known)	ALTERNATE DAM NAME: <u>N/A</u>
USGS QUAD.: <u>Wrentham, MA</u>	LAT.: <u>42.07251</u> LONG.: <u>71.34967</u>
DRAINAGE BASIN: <u>Charles</u>	RIVER: <u>Eagle Brook</u>
IMPOUNDMENT NAME(S): <u>Eagle Brook</u>	
<u>GENERAL DAM INFORMATION</u>	
TYPE OF DAM: <u>Earthen Embankment</u>	OVERALL LENGTH (FT): <u>200</u>
PURPOSE OF DAM: <u>Recreation</u>	NORMAL POOL STORAGE (ACRE-FT): <u>23</u>
YEAR BUILT: <u>Unknown</u>	MAXIMUM POOL STORAGE (ACRE-FT): <u>72</u>
STRUCTURAL HEIGHT (FT): <u>11</u>	EL. NORMAL POOL (FT): <u>196.5</u>
HYDRAULIC HEIGHT (FT): <u>5.0</u>	EL. MAXIMUM POOL (FT): <u>202.5 ±</u>
<u>FOR INTERNAL MADCR USE ONLY</u>	
FOLLOW-UP INSPECTION REQUIRED: <input type="checkbox"/> YES <input type="checkbox"/> NO	CONDITIONAL LETTER: <input type="checkbox"/> YES <input type="checkbox"/> NO

NAME OF DAM: <u>Eagle Dam</u>		STATE ID #: <u>6-11-350-2</u>	
INSPECTION DATE: <u>October 11, 2022</u>		NID ID #: <u>MA02263</u>	
<u>INSPECTION SUMMARY</u>			
DATE OF INSPECTION: <u>October 11, 2022</u>		DATE OF PREVIOUS INSPECTION: <u>November 20, 2012</u>	
TEMPERATURE/WEATHER: <u>60°F</u>		ARMY CORPS PHASE I: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO If YES, date _____	
CONSULTANT: <u>Pare Corporation</u>		PREVIOUS DCR PHASE I: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO If YES, date <u>November 20, 2012</u>	
BENCHMARK/DATUM: <u>Spillway crest with an elevation of 196.5 (NAVD88)</u>			
OVERALL PHYSICAL CONDITION OF DAM: <u>UNSAFE</u>		DATE OF LAST REHABILITATION: <u>Unknown</u>	
SPILLWAY CAPACITY: <u>>100% SDF w/ no actions by Caretaker</u>			
EL. POOL DURING INSP.: <u>196.5</u>		EL. TAILWATER DURING INSP.: <u>194.0</u>	
<u>PERSONS PRESENT AT INSPECTION</u>			
<u>NAME</u>	<u>TITLE/POSITION</u>	<u>REPRESENTING</u>	
<u>David Caouette, PE</u>	<u>Senior Project Engineer</u>	<u>Pare Corporation</u>	
<u>My Linh Pham, EIT</u>	<u>Engineer II</u>	<u>Pare Corporation</u>	
<u>Orell Baumann</u>	<u>Engineer I</u>	<u>Pare Corporation</u>	
<u>EVALUATION INFORMATION</u>			
Click on box to select E-code		Click on box to select E-code	
E1) TYPE OF DESIGN	<input type="text" value="2"/>	E8) LOW-LEVEL OUTLET CONDITION	<input type="text" value="1"/>
E2) LEVEL OF MAINTENANCE	<input type="text" value="1"/>	E9) SPILLWAY DESIGN FLOOD CAPACITY	<input type="text" value="5"/>
E3) EMERGENCY ACTION PLAN	<input type="text" value="1"/>	E10) OVERALL PHYSICAL CONDITION	<input type="text" value="1"/>
E4) EMBANKMENT SEEPAGE	<input type="text" value="4"/>	E11) ESTIMATED REPAIR COST	<input type="text" value="\$1.28 M - \$2.38 M"/>
E5) EMBANKMENT CONDITION	<input type="text" value="1"/>	ROADWAY OVER CREST	<input type="text" value="NO"/>
E6) CONCRETE CONDITION	<input type="text" value="1"/>	BRIDGE NEAR DAM	<input type="text" value="NO"/>
E7) LOW-LEVEL OUTLET CAPACITY	<input type="text" value="1"/>		
NAME OF INSPECTING ENGINEER: David Caouette, PE		SIGNATURE: 	

NAME OF DAM: <u>Eagle Dam</u>		STATE ID #: <u>6-11-350-2</u>	
INSPECTION DATE: <u>October 11, 2022</u>		NID ID #: <u>MA02263</u>	
OWNER: ORGANIZATION	<u>Town of Wrentham</u>	CARETAKER: ORGANIZATION	<u>Town of Wrentham</u>
NAME/TITLE	<u>Brian Antonioli, Acting Director DPW</u>	NAME/TITLE	<u>Brian Antonioli, Acting Director DPW</u>
STREET	<u>360 Taunton Street</u>	STREET	<u>360 Taunton Street</u>
TOWN, STATE, ZIP	<u>Wrentham, MA 02093</u>	TOWN, STATE, ZIP	<u>Wrentham, MA 02093</u>
PHONE	<u>508-384-5477</u>	PHONE	<u>508-384-5477</u>
EMERGENCY PH. #		EMERGENCY PH. #	
FAX	<u>508-384-5481</u>	FAX	<u>508-384-5481</u>
EMAIL	<u>bantonioli@wrentham.gov</u>	EMAIL	<u>bantonioli@wrentham.gov</u>
OWNER TYPE	<u>Municipality or Political subdivision</u>		
PRIMARY SPILLWAY TYPE <u>Composite Concrete and grouted riprap weir</u>			
SPILLWAY LENGTH (FT)	<u>36</u>	SPILLWAY CAPACITY (CFS)	<u>970</u>
AUXILIARY SPILLWAY TYPE	<u>Stoplog controlled sluiceway</u>	AUX. SPILLWAY CAPACITY (CFS)	<u>N/A</u>
NUMBER OF OUTLETS	<u>None</u>	OUTLET(S) CAPACITY (CFS)	<u>N/A</u>
TYPE OF OUTLETS	<u>N/A</u>	TOTAL DISCHARGE CAPACITY (CFS)	<u>970</u>
DRAINAGE AREA (SQ MI)	<u>7.5</u>	SPILLWAY DESIGN FLOOD (PERIOD/CFS)	<u>50 yr. / 470</u>
HAS DAM BEEN BREACHED OR OVERTOPPED	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	IF YES, PROVIDE DATE(S) <u>Not Reported</u>
FISH LADDER (LIST TYPE IF PRESENT)	<u>None</u>		
DOES CREST SUPPORT PUBLIC ROAD?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	IF YES, ROAD NAME: _____
PUBLIC BRIDGE WITHIN 50' OF DAM?	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	IF YES, ROAD/BRIDGE NAME: _____ MHD BRIDGE NO. (IF APPLICABLE) _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

EMBANKMENT (CREST)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	1. SURFACE TYPE	Earthen		X	
	2. SURFACE CRACKING	None observed, obscured by dead limbs and vegetation		X	X
	3. SINKHOLES, ANIMAL BURROWS	None observed, obscured by dead limbs and vegetation		X	X
	4. VERTICAL ALIGNMENT (DEPRESSIONS)	Alignment is variable throughout the embankment, the severe erosion on both sides of the spillway		X	X
	5. HORIZONTAL ALIGNMENT	Appeared okay.		X	
	6. RUTS AND/OR PUDDLES	None observed.		X	
	7. GRASS COVER CONDITION	Minimal grass covered.			X
	8. WOODY VEGETATION (TREES/BRUSH)	Woody brush, vines, and trees		X	X
	9. ABUTMENT CONTACT	Appeared good.		X	

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

EMBANKMENT (D/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S SLOPE	1. WET AREAS (NO FLOW)	None observed, although area obscured by heavy vegetation		X	X
	2. SEEPAGE	None observed		X	X
	3. SLIDE, SLOUGH, SCARP	None observed, slope obscured by heavy vegetation. A 4-foot wide by 1.5 feet deep erosion path was noted near Sta. 0+90.		X	X
	4. EMB.-ABUTMENT CONTACT	None observed, obscured by heavy vegetation		X	X
	5. SINKHOLE/ANIMAL BURROWS	None observed, although area obscured by heavy vegetation		X	X
	6. EROSION	None observed, although area obscured by heavy vegetation		X	X
	7. UNUSUAL MOVEMENT	None observed, although area obscured by heavy vegetation		X	X
	8. GRASS COVER CONDITION	Minimal grass cover		X	X
	9. WOODY VEGETATION (TREES/BRUSH)	Heavily overgrown with brush and trees. Several tree stumps in various stage of rot were noted within this area.		X	X

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

EMBANKMENT (U/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S SLOPE	1. SLIDE, SLOUGH, SCARP	Scarping up to 1-foot between Sta. 0+75 to 1+00.		X	X
	2. SLOPE PROTECTION TYPE AND COND.	None observed		X	X
	3. SINKHOLE/ANIMAL BURROWS	None observed, the slope is heavily overgrown limiting the inspection		X	X
	4. EMB.-ABUTMENT CONTACT	Appeared okay.		X	
	5. EROSION	Erosion was noted near between Sta. 0+25 to Sta. 0+50, and near Sta. 1+30,		X	X
	6. UNUSUAL MOVEMENT	None observed, although the area is heavily overgrown		X	X
	7. GRASS COVER CONDITION	No grass coverage		X	X
	8. WOODY VEGETATION (TREES/BRUSH)	Heavily overgrown with woody brush and trees		X	X

ADDITIONAL COMMENTS: The upstream wall between Sta 1+30 to Sta. 1+50 is in poor condition and has failed. A 16-inch by 8-inch deep void following by a crack was noted approximately mid-wall.

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

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NID ID #: MA02263

INSTRUMENTATION

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
INSTR.	1. PIEZOMETERS	None observed	X		
	2. OBSERVATION WELLS	None observed	X		
	3. STAFF GAGE AND RECORDER	None observed	X		
	4. WEIRS	None observed	X		
	5. INCLINOMETERS	None observed	X		
	6. SURVEY MONUMENTS	None observed	X		
	7. DRAINS	None observed	X		
	8. FREQUENCY OF READINGS	NA			
	9. LOCATION OF READINGS	NA			

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

DOWNSTREAM AREA

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S AREA	1. ABUTMENT LEAKAGE	None observed		X	
	2. FOUNDATION SEEPAGE	Seepage was noted at the toe along the left shoreline of Eagle Creek (0.2 GPM 15 feet downstream of the spillway, 1 GPM 20 feet downstream of the spillway), no sign of		X	X
	3. SLIDE, SLOUGH, SCARP	None observed		X	
	4. WEIRS	None observed		X	
	5. DRAINAGE SYSTEM	None observed		X	
	6. INSTRUMENTATION	None observed		X	
	7. VEGETATION WITHIN 15 FT	Wooded leading to grassed area around the stream channel		X	
	8. ACCESSIBILITY	Okay access from Route 140 (Franklin Street)		X	
9. DOWNSTREAM HAZARD DESCRIPTION	Route 140 (Franklin Street)			X	
10. Date of last EAP Update	None		X		

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

MISCELLANEOUS

AREA INSPECTED	CONDITION	OBSERVATIONS	
MISC.	1. RESERVOIR DEPTH (AVG)	Assumed at 5 feet	
	2. RESERVOIR SHORELINE	Generally wooded	
	3. RESERVOIR SLOPES	Steep	
	4. ACCESS ROADS	Cart path along the right abutment, paved access to pump house along the left abutment	
	5. SECURITY DEVICES	None observed	
	6. WATER PUBLIC HAZARDS & PROTECTION	None observed	
	7. LAND-SIDE PUBLIC HAZARDS & PROTECTION	None observed	
	7. VANDALISM OR TRESPASS	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	WHAT: debris
	8. AVAILABILITY OF PLANS	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	DATE:
	9. AVAILABILITY OF DESIGN CALCS	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	DATE:
	10. AVAILABILITY OF EAP/LAST UPDATE	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	DATE:
	11. AVAILABILITY OF O&M MANUAL	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	DATE:
	12. CARETAKER/OWNER AVAILABLE	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	DATE: Before the inspection
13. CONFINED SPACE ENTRY REQUIRED	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	PURPOSE:	

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

PRIMARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	Concrete and masonry overflow	X		
	WEIR TYPE	Sharp crest weir	X		
	SPILLWAY CONDITION	Spillway was in poor condition, leakage was noted in between stacked stones		X	X
	TRAINING WALLS	The left and right training wall continues to deteriorate with vertical cracks along the wall, spalls, missing section, and areas of scou. Erosion was noted behind the left and right training walls. Erosion on the right side was up to 10 feet tall.		X	X
	SPILLWAY CONTROLS AND CONDITION	None observed		X	
	UNUSUAL MOVEMENT	Training walls have failed		X	X
	APPROACH AREA	Accumulated leaves were noted at the spillway approach. Logs were noted on the spillway crest and in the immediate discharge area.		X	
	DISCHARGE AREA	Failed wall sections and driftwood within the channel		X	X
	DEBRIS	Logs and concrete debris was noted within the downstream channel creating a 2-foot tail water within the discharge area.		X	X

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

AUXILIARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO	ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	NOT APPLICABLE TO THIS DAM				
	WEIR TYPE					
	SPILLWAY CONDITION					
	TRAINING WALLS					
	SPILLWAY CONTROLS AND CONDITION					
	UNUSUAL MOVEMENT					
	APPROACH AREA					
	DISCHARGE AREA					
	DEBRIS					

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

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NID ID #: MA02263

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	NOT APPLICABLE TO THIS DAM			
	INTAKE STRUCTURE				
	TRASHRACK				
	PRIMARY CLOSURE				
	SECONDARY CLOSURE				
	CONDUIT				
	OUTLET STRUCTURE/HEADWALL				
	EROSION ALONG TOE OF DAM				
	SEEPAGE/LEAKAGE				
	DEBRIS/BLOCKAGE				
	UNUSUAL MOVEMENT				
	DOWNSTREAM AREA				
MISCELLANEOUS					

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

CONCRETE/MASONRY DAMS (CREST)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR	
CREST	TYPE	NOT				
	SURFACE CONDITIONS					
	CONDITIONS OF JOINTS					
	UNUSUAL MOVEMENT					
	HORIZONTAL ALIGNMENT					
	VERTICAL ALIGNMENT					
		APPLICABLE				
			TO THIS DAM			

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

CONCRETE/MASONRY DAMS (DOWNSTREAM FACE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR	
D/S FACE	TYPE	NOT				
	SURFACE CONDITIONS					
	CONDITIONS OF JOINTS					
	UNUSUAL MOVEMENT					
	ABUTMENT CONTACT					
	LEAKAGE					
		APPLICABLE				
			TO THIS DAM			

ADDITIONAL COMMENTS: _____

NAME OF DAM: Eagle Dam

STATE ID #: 6-11-350-2

INSPECTION DATE: October 11, 2022

NID ID #: MA02263

CONCRETE/MASONRY DAMS (UPSTREAM FACE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S FACE	TYPE	NOT APPLICABLE TO THIS DAM			
	SURFACE CONDITIONS				
	CONDITIONS OF JOINTS				
	UNUSUAL MOVEMENT				
	ABUTMENT CONTACTS				

ADDITIONAL COMMENTS: _____

APPENDIX C
Previous Reports and References
Eagle Dam
Wrentham, MA

PREVIOUS REPORTS AND REFERENCES

The following is a list of reports that were located during the file review, or were referenced in previous reports.

During the development of the report PARE also reviewed available information included within the following databases:

1. “Eagle Dam Removal Feasibility Assessment,” prepared by Town of Wrentham & Charles River Watershed association, dated April 19, 2021.
2. “Eagle Dam Office of Dam Safety Visual Inspection for Submittal to the Dam Safety File” prepared by ODS, dated February 5, 2020.
3. “Eagle Dam – Phase I Evaluation & Inspection,” prepared by Pare Corporation, dated November 20, 2012.
4. “Eagle Dam Jurisdictional and Ownership Inspections,” prepared by Tighe & Bond, dated June 22, 2007.
5. MADCR Office of Dam Safety Dam Database.

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

1. “Design of Small Dams”, United States Department of the Interior Bureau of Reclamation, 1987.
2. “ER 110-2-106 - Recommended Guidelines for Safety Inspection of Dams”, Department of the Army, September 26, 1979.
3. “Guidelines for Reporting the Performance of Dams” National Performance of Dams Program, August 1994.
4. 302 CMR: Department of Conservation and Recreation Section 10.00 Dam Safety.



APPENDIX D
Common Dam Safety Definitions
Eagle Dam
Wrentham, MA

COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to 302 CMR 10.00 Dam Safety, or other reference published by FERC, Dept. of the Interior Bureau of Reclamation, or FEMA. Please note should discrepancies between definitions exists, 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 be limited to, spillways; reservoirs and their rims; LLO 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, operational 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.



APPENDIX E
Visual Dam Inspection Limitations
Eagle Dam
Wrentham, MA

VISUAL DAM INSPECTION LIMITATIONS

Visual Inspection

1. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this report.
2. In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection, along with data available to the inspection team.
3. In cases where an impoundment is lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions, which might otherwise be detectable if inspected under the normal operating environment of the structure.
4. It is critical to note that the condition of the dam is evolutionary in nature and depends on numerous and constantly changing internal and external conditions. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Use of Report

1. The applicability of other environmental permits (ie., NOI, PGP, Water Quality Certificate, etc.) needs to be determined prior to undertaking maintenance activities that may occur within resource areas under the jurisdiction of MADEP, the local conservation commission or other regulatory agency.
2. This report has been prepared for the exclusive use of the Town of Wrentham for specific application to the Eagle Dam in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made.
3. This report has been prepared for this project by Pare. This report is for preliminary evaluation purposes only and is not necessarily sufficient to support design or repairs or recommendations or to prepare an accurate bid.

