- LOWER LYNDE BASIN DAM -

PHASE I

INSPECTION / EVALUATION REPORT

Dam Name:	Lower Lynde Basin Dam
State Dam ID#:	3-14-282-8
NID#:	MA02302
Owner:	Town of Clinton
Owner Type:	Municipal
Town:	Sterling
Consultant:	Lenart Consulting Service, LLC
Date of Inspection:	December 20, 2018

Executive Summary

This Phase I Inspection/Evaluation Report details the inspection and evaluation of Lower Lynde Basin Dam, located in Sterling, Massachusetts. The inspection was conducted on December 20, 2018 by Lenart Consulting Service, LLC. Lower Lynde Basin Dam is classified as an intermediate sized, low (Class III) hazard potential dam.

The overall physical condition of Lower Lynde Basin Dam was found to be **Poor** based on the following deficiencies noted during the inspection and evaluation:

1. Sections of the right and left spillway training walls and discharge channel walls immediately downstream of the spillway have collapsed. Current conditions show more deterioration as compared to previous report photos.

2. The embankment is overgrown with brush and woody vegetation preventing satisfactory visual inspection.

3. Woody vegetation is growing behind the spillway training walls and from voids in both stone masonry walls within the discharge channel causing movement of the remaining wall sections.

4. There are cracks and voids in the concrete cap on the spillway weir at left end causing ice to form on the uneven surface which will lead to further damage to the spillway.

5. Some stones are missing from the cobble stone spillway approach apron.

6. Ice on the pond prevented visual inspection of the upstream slope below normal pool.

7. Debris from the collapsed sections of stone masonry walls and wood debris is in the discharge channel.

8. A significant area of seepage is located downstream of the gravel access road at toe of the embankment on the right side.

9. There is an eroded footpath on the downstream slope to the right of the spillway in the area of the former sinkhole location.

10. The erosion control mat installed in 2007 during the repair of the sinkhole in the downstream slope is exposed near the top of slope.

11. Vandalism to the gatehouse structure has been an ongoing problem at the site.

It is recommended that the following actions be taken to address the deficiencies found at the dam during this inspection and evaluation:

- Remove woody vegetation and root systems from the embankment.

- Continue to monitor and remove debris from the spillway crest, upstream and downstream areas.

- Monitor the seepage for any increases in flow, or movement of fines.
- Regrade the downstream slopes to provide a more gentle slope to stabilize the embankment and make maintenance more manageable.
- Loam and seed the embankment crest and slopes to establish grass cover.
- Repair the spillway to prevent further deterioration of the training walls and downstream discharge channel walls. If necessary, design and reconstruct the spillway to accommodate the SDF.
- Remove the existing gatehouse structure and secure access to the valve pit to discourage trespassing and vandalism, which creates an ongoing safety concern.

These recommendations should be performed with the guidance of a registered professional engineer familiar with the methods and materials used in the design, construction and repair of dams.

Dam Evaluation Summary Detail Sheet

1. NID ID:	MA02302	4. Inspection Date:	December 20, 2018
2. Dam Name:	Lower Lynde Basin Dam	5. Last Insp. Date:	April 26, 2007
3. Dam Location:	Sterling, MA	6. Next Inspection:	December 20, 2028
7. Inspector:	Cathleen A. Benben		
8. Consultant:	Lenart Consulting Service, LLC		
9. Hazard Code: Low	9a. Is Hazard Code Change Requested?:	No	
10. Insp. Frequency: 10 Years	11. Overall Physical Condition of Dam:	POOR	
12. Spillway Capacity (% SDF)	90-100% of the SDF		
E1. Design Methodology:	3	E7. Low-Level Discharge Capacity:	1
E2. Level of Maintenance:	3	E8. Low-Level Outlet Physical Condition:	2
E3. Emergency Action Plan:	3	E9. Spillway Design Flood Capacity:	3
E4. Embankment Seepage:	3	E10. Overall Physical Condition of the Dam:	2
E5. Embankment Condition:	3	E11. Estimated Repair Cost:	$320,000
E6. Concrete Condition:	N/A		

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

Preface

The following three paragraphs were excerpted from the sample dam inspection format provided by the Massachusetts Department of Conservation and Recreation. The paragraphs are valid for the dam inspection and assessment provided in this report.

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 depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. 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 would be detected.

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David M. Lenart, P.E.
Massachusetts License No. 27995
Lenart Consulting Service

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Executive Summary

Dam Evaluation Summary Detail Sheet

Preface

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C-010 Lower Lynde Basin Dam, Sterling 2018 Phase 1 Report

Section 1
Description of Project

1.1 General

1.1.1 Authority

The Town of Clinton retained Lenart Consulting Service, LLC to perform a visual inspection and develop a report of the conditions for Lower Lynde Basin Dam in Sterling, Massachusetts. The inspection and report were performed in accordance with MGL Chapter 253, Sections 44-50 of the Massachusetts General Laws as amended by Chapter 330 of the Acts of 2002.

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 CMR 10.07 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 an emergency action plan for the site and; 4) prepare and submit a final report presenting the evaluation of the structure, including recommendations and remedial actions, and opinion 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; and 5) miscellaneous.

1.1.4 Figures

Figures were created for this report to aid the reader in understanding the dam, its features, and the surrounding area. Figure 1 presents a topographic image showing the dam location, the impoundment area, the watershed area associated with the dam, and the surrounding area. Figure 2 presents an aerial overview of the dam and surrounding area. A site sketch of the dam, which serves as a photo location plan showing location and orientation of photos taken during the inspection, is also included in Appendix A.

1.2 Description of Project

1.2.1 Location

Lower Lynde Basin Dam is located in the Town of Sterling, Massachusetts in Worcester County. Access to the dam is by way of a gravel road off of Heywood Road. The dam is shown on the Sterling, MA USGS quadrangle map at Latitude 42.4825, and Longitude 71.7745. See Figure 1 - Site Locus.

1.2.2 Owner/Operator

	Dam Owner	Dam Caretaker
Name	Town of Clinton	Town of Clinton Christopher McGown, DPW Director
Mailing Address	242 Church Street	242 Church Street
Town	Clinton, MA 01510	Clinton, MA 01510
Daytime Phone	(978) 365-4110	(978) 365-4110
Fax	N/A	N/A
Cell		
Emergency Phone	911	911
Email Address	cmcgown@clintonma.gov	cmcgown@clintonma.gov

Current owner and caretaker data is also included in Table 1.1.

1.2.3 Purpose of the Dam

Lower Lynde Basin Dam was originally constructed to provide municipal water to the Town of Clinton. Currently, it is used for recreation.

The current purpose of the dam is also listed in table 1.1.

1.2.4 Description of the Dam and Appurtenances

Lower Lynde Basin Dam is a 350 foot long earthen embankment structure with an uncontrolled stone masonry spillway near the center of the embankment. The maximum height of the dam is 15 feet and the dam crest is 10 feet wide.

The upstream slope varies from 2H to 3H:1V. It is not clear if the slope is armored. The downstream slope varies from 1.5H to 2H:1V and may have been grass covered at one time, but is currently covered with woody vegetation and has exposed soils in areas where there are footpaths have worn into the slope, from top to bottom.

The spillway has a broad crested weir, 17.5 feet long and is 2.9 feet below the dam crest. The spillway training walls are constructed of stone masonry and extend to the upstream and downstream slope toes. Discharges through the spillway flow beneath a timber bridge that spans the channel at the toe of the slope and continues along an 11-foot wide channel with stone masonry walls more than 500 feet before discharging into a wetland area.

The low-level outlet has not been operable for many years. A gatehouse is located 20 feet to the right of the spillway on the dam crest. The 12-inch outlet pipe discharged to the downstream channel at the bottom of the right wall directly downstream of the gatehouse. The door of the gate house has been removed by vandals, making it a safety

concern, as the gate operators have been removed and there is no cover on the opening to the valve pit.

1.2.5 Operations and Maintenance

In general, the flow over the spillway is allowed to fluctuate based on the water level of the upstream impoundment. Wooden debris caught in the spillway is regularly removed.

1.2.6 DCR Size Classification

Lower Lynde Basin Dam has a maximum structural height of 15 feet and a maximum storage capacity of approximately 36 acre-feet. In accordance with Department of Conservation and Recreation classification, under Commonwealth of Massachusetts Regulations 302 CMR Dam Safety revised November 4, 2005, the dam is an **Intermediate** size structure.

1.2.7 DCR Hazard Potential Classification

Lower Lynde Basin Dam is currently classified as a **Low** (Class III) hazard dam. Detailed dam breach studies were conducted by Weston & Sampson Engineers, Inc. that concluded that loss of life is not expected due to breach of Lower Lynde Basin Dam and no homes, occupied buildings or improved roadways would be adversely affected.

Based on the **Low** (Class III) hazard classification, the required inspection frequency for Lower Lynde Basin Dam is every 10 years under 302 CMR 10.00 Dam Safety Regulations.

1.3 Engineering Data

The following sections are based on field measurements and review of USGS mapping.

1.3.1 Drainage Area

The total drainage area contributing to Lower Lynde Basin Dam is approximately 1.4 square miles. The drainage areas for Fitch Basin and Upper Lynde Basin are included in the overall drainage area. The terrain is mild to moderately sloped and largely undeveloped. See Figure 1.

1.3.2 Reservoir

Estimates based on information contained in previous reports.

	Impoundment Elevation (feet)	Surface Area (acres)	Storage Volume (acre-feet)
Normal Pool	568.1	2.8	27
Maximum Pool	571.0	3.3	36
SDF Pool	571.3	3.4	37

1.3.3 Discharges at the Dam Site

Discharges past the dam are from a spillway with a 17.5 foot wide concrete broad crested weir. The low-level outlet is no longer operational. The discharge past the dam for various pool elevations are summarized below:

Discharges are in cubic feet per second (cfs):

A.	Maximum Known Flood At The Dam Site	Unknown
B.	Spillway Capacity With Water Level At Top of Dam	285
C.	Design Flood Outflow (100-year flood)	443
D.	Low Level Outlet Capacity With Water Level At The Top of The Dam	NA

1.3.4 General Elevations (feet)

Elevations presented below are based on field measurements taken at the time of this inspection and survey data and the H&H conducted for the 2008 Phase II Investigations by Weston & Sampson Engineers, Inc. The survey elevations reference NGVD 1929 datum.

A.	Top Of Dam	571.0
B.	Spillway Design Flood Pool	571.3
C.	Normal Pool	568.1
D.	Spillway Crest	568.1
E.	Upstream Water At Time Of The Inspection	568.4
F.	Low Level Outlet Invert	548.8
G.	Streambed At Toe Of The Dam	550.0
H.	Low Point Along Toe Of The Dam	556.0

1.3.5 Main Spillway

A.	Type	Stone Masonry and Concrete Broad Crested Weir
B.	Weir Length	17.5 ft.
C.	Weir Crest Elevation with Stop-logs	No Stop-logs
D.	Weir Crest Elevation	568.1
E.	Upstream Channel	Lower Lynde Basin
F.	Downstream Channel	11’ w x 5’ d x 530’ l channel to wetland area
G.	Channel Bottom Elevation	550.0
H.	Downstream Water Elevation	550.4

1.3.6 Additional Information

Low Level Outlet

A.	Type	cast iron conduit
B.	Size	12-inch
C.	Inlet Invert Elevation	551.0
D.	Outlet Invert Elevation	548.8
E.	Control Mechanism	decommissioned gate

1.3.7 Design and Construction Records

A design plan prepared by Parker & Bateman Eng's dated 1894 is available.

1.3.8 Operating Records

There are no operating records available for review for the preparation of this report.

1.4 Summary Data Table

Table 1.1, summarizing the required Phase I Report data collected as part of this inspection, is presented on the following page.

1.1 Summary Data Table

Required Phase I Report Data	Data Provided by the Inspecting Engineer
National ID #	MA02302
Dam Name	Lower Lynde Basin Dam
Dam Name (Alternate)	N/A
River Name	Wekepeke Brook
Impoundment Name	Lower Lynde Basin
Hazard Class	Low
Size Class	Intermediate
Dam Type	Earthen Embankment
Dam Purpose	Recreation; Former Water Supply to Town of Clinton
Structural Height of Dam (feet)	15
Hydraulic Height of Dam (feet)	12.1
Drainage Area (sq. mi.)	1.4
Reservoir Surface Area (acres)	20
Normal Impoundment Volume (acre-feet)	27
Max Impoundment Volume ((top of dam) acre-feet)	36
SDF Impoundment Volume* (acre-feet)	37
Spillway Type	Broadcrested Weir
Spillway Length (feet)	17.5
Freeboard at Normal Pool (feet)	2.9
Principal Spillway Capacity* (cfs)	285
Auxiliary Spillway Capacity* (cfs)	N/A
Low-Level Outlet Capacity* (cfs)	abandoned, inoperable
Spillway Design Flood* (flow rate - cfs)	100-yr/448 cfs
Winter Drawdown (feet below normal pool)	N/A
Drawdown Impoundment Vol. (acre-feet)	N/A
Latitude	42.4825
Longitude	-71.7745
City/Town	Sterling
County Name	Worcester
Public Road on Crest	No
Public Bridge over Spillway	Gravel access road not intended for road traffic
EAP Date (if applicable)	N/A
Owner Name	Town of Clinton
Owner Address	242 Church Street
Owner Town	Clinton, MA 01510
Owner Phone	978 365-4119
Owner Emergency Phone	911
Owner Type	Municipality or Political subdivision
Caretaker Name	Chris McGown, DPW Director
Caretaker Address	242 Church Street
Caretaker Town	Clinton, MA 01510
Caretaker Phone	978 365-4119
Caretaker Emergency Phone	911
Date of Field Inspection	12/20/2018
Consultant Firm Name	Lenart Consulting Service, LLC
Inspecting Engineer	Cathleen A. Benben
Engineer Phone Number	(413) 535-5754

*In the event a hydraulic and hydrologic analysis has not been completed for the dam, indicate "No H&H" in this table, recommendation section shall include specific recommendation to hire a qualified dam engineering consultant to conduct analysis to determine spillway adequacy in conformance with 302 CMR 10.00.

Section 2
Inspection

2.1 Visual Inspection

Lower Lynde Basin Dam was inspected on December 20, 2018. At the time of the inspection, the weather was cloudy with a temperature of 24°F. Photographs to document the current conditions of the dam were taken during the inspection and are included in Appendix A. The level of the impoundment was 3-inches above the spillway crest, approximately El. 568.4 ft. Underwater areas were not inspected. A copy of the inspection checklist is included in Appendix B.

2.1.1 General Findings

In general, Lower Lynde Basin Dam was found to be in **Poor** condition. The deficiencies observed are identified in more detail in the sections below.

2.1.2 Dam

- Abutments
  - Abutment contact is good.
  - No Seepage was noted at the interfaces.
  - Small to large trees are located within 20 feet of the dam embankment contacts.
- Upstream Slope
  - Minor erosion exists at the normal pool elevation.
  - Slope varies along the length of the dam embankment.
  - The slope was difficult to inspect due to overgrowth of woody vegetation.
  - Slope could not be observed below normal pool level due to ice on pond.
- Crest
  - Overgrown with woody vegetation preventing a thorough visual inspection.
  - Established footpaths exist along right embankment.
- Downstream Slope
  - Overgrown with woody vegetation preventing a thorough visual inspection.
  - Exposed soils in area of sinkhole repair and along footpath up the slope near the spillway on right side.
  - A large pile of woody debris, cleared from spillway, exists left on slope.

- Drains
  - No toe drain system was observed.
- Instrumentation
  - No instrumentation was noted at Lower Lynde Basin Dam.
- Access Roads and Gates
  - Access to the dam is from a gated access road off of Heywood Road to the left of the dam. The access road runs along the toe of the dam and crosses the discharge channel by way of a timber bridge.

2.1.3 Appurtenant Structures

- Primary Spillway
  - Stone masonry training walls are in poor condition. Wall sections have collapsed with stone in the downstream channel hiding the previously reported undermining of the walls.
  - Woody vegetation is growing behind and from voids in the stone masonry.
  - Mortar is missing from the walls.
  - The concrete cap on the crest is cracked with some voids.
  - Some stones are missing from the cobble stone spillway approach apron.
  - Spillway cannot pass the SDF without overtopping.
- Low Level Outlet
  - The outlet works have been decommissioned.
  - Gatehouse building is in poor condition with a hole in the roof and door removed.
  - Open pit to valve pit is exposed inside gatehouse with gate operators removed.
- Auxiliary/Emergency Spillway
  - There is no auxiliary spillway.
- Dike
  - There is no dike associated with the Lower Lynde Basin Dam.

2.1.4 Downstream Area

- Discharges past the dam follows in an 11 feet wide channel lined with stone masonry walls more than 500 feet to a wetland area downstream.
- The stone masonry is in fair condition.
- The channel is in a wooded area with trees growing near the walls. A few fallen trees were observed in the channel.
- Seepage was observed in an area to the right of the discharge channel, approximately 60 feet downstream from the toe of the dam slope.

2.1.5 Reservoir Area

- Water level at the time of inspection was 3–inches above normal pool.
- The banks of the impoundment area are shallow, moderately sloped and tree and brush covered.

2.2 Caretaker Interview

Representatives of the Town of Clinton DPW were present during the inspection and provided information regarding the maintenance and operation of the dam.

2.3 Operation and Maintenance Procedures

2.3.1 Operational Procedures

The flow over the spillway is allowed to fluctuate based upon the level of the impoundment.

2.3.2 Maintenance of Dam and Operating Facilities

Periodic maintenance is performed by the Town of Clinton. Maintenance activities include clearing debris from the spillway weir and discharge channel as needed, and annual brush and vegetation cutting.

There are no formal operational procedures for this dam. The dam has not been operated as a water storage impoundment for many years.

2.3.3 Emergency Warning System

There is no Emergency Action Plan for the dam. According to Massachusetts General Law 253, Section 44, Chapter 302 CMR 10.00, low hazard dams are currently not required to have an Emergency Action Plan on file with DCR.

2.4 Hydrologic/Hydraulic Data

A hydraulic/hydrologic analysis was performed by Weston & Sampson Engineers, Inc. as part of the Phase II Investigations in 2008 for Lower Lynde Basin Dam. The dam is an Intermediate size, **Low** hazard dam. The follow values were reported.

SDF	100 year event

SDF Outflow	443 cfs
Spillway Capacity	285 cfs
Depth of Overtopping	0.3 ft

2.5 Structural Stability/Overtopping Potential

2.5.1 Embankment Structural Stability

An embankment stability analysis for Lower Lynde Basin Dam was not within the scope of this report and there were no records of a previous stability analysis for the dam available for review. Based on visual observations at the time of the inspection, the stability of the dam is questionable.

The 2007 repairs to the sinkhole significantly improved the stability of the embankment and appear to be holding up well. However, the stone masonry in the spillway continues to slowly deteriorate.

2.5.2 Structural Stability of Non-Embankment Structures

The condition of the stone masonry spillway should be addressed with improvements or repair. The stone masonry training walls are not stable and sections have collapsed and have stones or mortar missing.

2.5.3 Seepage Stability

Seepage was observed in the same area noted in previous reports and does not appear to have worsened.

2.5.4 Overtopping Potential

Based on the hydrologic/hydraulic data presented for the Lower Lynde Basin Dam, the overtopping potential during the SDF is high.

Section 3
Assessments and Recommendations

3.1 Assessments

On the basis of the visual inspection and a review of available information, Lower Lynde Basin Dam is currently in poor condition based on the following findings:

The following deficiencies were noted during the inspection and evaluation:

1. Sections of the right and left spillway training walls and discharge channel walls immediately downstream of the spillway have collapsed. Current conditions show more deterioration as noted in previous reports by comparing photos.

2. The embankment is overgrown with brush and woody vegetation preventing satisfactory visual inspection.

3. Woody vegetation is growing behind the spillway training walls and from voids in both stone masonry walls within the discharge channel causing movement of the remaining wall sections.

4. There are cracks and voids in the concrete cap on the spillway weir at the left end causing ice to form on the uneven surface which will lead to further damage to the spillway.

5. Some stones are missing from the cobble stone spillway approach apron.

6. Ice on the pond prevented visual inspection of the upstream slope below normal pool.

7. Debris from the collapsed sections of stone masonry walls and wooden debris is in the discharge channel.

8. A significant area of seepage is located downstream of the gravel access road at toe of the embankment on the right side.

9. There is an eroded footpath on the downstream slope to the right of the spillway in the area of the former sinkhole location.

10. The erosion control mat installed in 2007 during the repair of the sinkhole in the downstream slope is exposed near the top of slope.

11. Vandalism to the gatehouse structure has been an ongoing problem at the site.

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

3.2 Studies and Analyses

No studies or analyses are recommended at this time.

3.3 Yearly Recommendations

The following activities should be performed on a regular, or annual basis.

1. Continue to monitor and remove debris from the spillway crest, and upstream and downstream areas.

2. Continue to cut brush and overgrown vegetation at least annually.

3.4 Recommendations, Maintenance, and Minor Repairs

The following repairs and maintenance items are recommended to improve the overall condition of the dam:

1. Remove trees, brush and low vegetation within 20 feet of any part of the dam and spillway structure.

2. Slopes and dam crest should be stumped and grubbed. Holes and irregularities should be filled and compacted.

3. Add large stone to the downstream channel in the areas where the masonry walls are undermined.

4. Monitor the seepage.

3.5 Remedial Measures

This section presents recommended modification to the dam that alter the current configuration or design of the dam.

1. The spillway and embankments should be modified to safely pass the 100-year SDF and provide 1-foot of freeboard.

2. Downstream slope should be regraded to provide a maximum 2.5H:1V slope.

3. The gatehouse should be removed, piping abandoned and the valve pit backfilled.

3.6 Alternatives

Dam removal should be considered as an alternative to dam rehabilitation.

3.7 Opinion of Probable Costs

The following opinion of probable costs has been developed for the studies, analyses, recommendations and remedial measures noted above. The probable construction costs are based on very limited investigations. Once further detailed investigations are performed, the scope of work may change, affecting the actual construction costs. The

estimates include engineering, permits and contingencies where applicable. Tasks that can be carried out by the dam owner are noted as Force Account.

	Recommendation	**Probable Cost**
1	Continue to monitor and remove debris from the spillway crest, and upstream and downstream areas	Force Account
2	Remove all trees and tall vegetation a minimum of 20 feet from any part of the embankment and spillway structure	Force Account
3	Slopes and dam crest should be stumped and grubbed. Holes and irregularities should be filled and compacted and seeded	$5,000
4	Add large stone to the downstream channel in the areas where the masonry walls are undermined	$10,000
5	Monitor the seepage	Force Account
6	Repair the deteriorating spillway. The spillway and embankments should be modified to safely pass the 100-year SDF and provide 1-foot of freeboard	$150,000
7	Downstream slope should be regraded to provide a maximum 2.5H:1V slope	$50,000
8	The gatehouse should be removed, piping abandoned and the valve pit backfilled	$15,000
	Total	**$230,000**

The estimates of Construction Cost and Total Project Cost are made on the basis of Lenart Consulting Services' experience and qualifications and represent the best estimate as an experienced and qualified professional generally familiar with the construction industry. However, since Lenart Consulting Service has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, Lenart Consulting Service cannot and does not guarantee that proposals, bids, or actual costs will not vary from the cost estimates.

C-010\Lower Lynde Basin Dam, Sterling 2018 DCR Phase 1 Report text.doc

Figures

APPENDIX A
Photographs

APPENDIX B

Inspection Checklist

DAM SAFETY INSPECTION CHECKLIST

NAME OF DAM: Lower Lynde Basin Dam

STATE ID #: 3-14-282-8

REGISTERED: ☑ YES ☐ NO

NID ID #: MA02302

STATE SIZE CLASSIFICATION: Intermediate

STATE HAZARD CLASSIFICATION: Low

CHANGE IN HAZARD CLASSIFICATION REQUESTED?: No

DAM LOCATION INFORMATION

CITY/TOWN: Sterling

COUNTY: Worcester

DAM LOCATION: (street address if known) Can be accessed from Heywood Road

ALTERNATE DAM NAME: N/A

USGS QUAD.: Sterling

LAT.: 42.4825

LONG.: -71.7745

DRAINAGE BASIN: Nashua

RIVER: Wekepeke Brook

IMPOUNDMENT NAME(S): Lower Lynde Basin

GENERAL DAM INFORMATION

TYPE OF DAM: Earthen Embankment

OVERALL LENGTH (FT): 350

PURPOSE OF DAM: Recreation; Former Water Supply to Town of Clinton

NORMAL POOL STORAGE (ACRE-FT): 27

YEAR BUILT: 1924, reportedly

MAXIMUM POOL STORAGE (ACRE-FT): 36

STRUCTURAL HEIGHT (FT): 15

EL. NORMAL POOL (FT): 568.1

HYDRAULIC HEIGHT (FT): 12.1

EL. MAXIMUM POOL (FT): 571.0

FOR INTERNAL MADCR USE ONLY

FOLLOW-UP INSPECTION REQUIRED: ☐ YES ☐ NO

CONDITIONAL LETTER: ☐ YES ☐ NO

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

INSPECTION SUMMARY

DATE OF INSPECTION: December 20, 2018 DATE OF PREVIOUS INSPECTION: April 26, 2007

TEMPERATURE/WEATHER: 24° F, cloudy ARMY CORPS PHASE I: ☐ YES ☑ NO If YES, date

CONSULTANT: Lenart Consulting Service, LLC PREVIOUS DCR PHASE I: ☑ YES ☐ NO If YES, date 11/15/2006

BENCHMARK/DATUM: Survey referencing NGVD 1929

OVERALL PHYSICAL CONDITION OF DAM: POOR DATE OF LAST REHABILITATION: 2007

SPILLWAY CAPACITY: 90-100% of the SDF

EL. POOL DURING INSP.: 568.4 EL. TAILWATER DURING INSP.: 550.4

PERSONS PRESENT AT INSPECTION

NAME	TITLE/POSITION	REPRESENTING
Cathleen A. Benben	Engineer	Lenart Consulting Service, LLC
Clinton DPW Staff	Staff	Town of Clinton

EVALUATION INFORMATION

		Click on box to select E-code
E1)	TYPE OF DESIGN	3
E2)	LEVEL OF MAINTENANCE	3
E3)	EMERGENCY ACTION PLAN	3
E4)	EMBANKMENT SEEPAGE	3
E5)	EMBANKMENT CONDITION	3
E6)	CONCRETE CONDITION	N/A
E7)	LOW-LEVEL OUTLET CAPACITY	1

		Click on box to select E-code
E8)	LOW-LEVEL OUTLET CONDITION	2
E9)	SPILLWAY DESIGN FLOOD CAPACITY	3
E10)	OVERALL PHYSICAL CONDITION	2
E11)	ESTIMATED REPAIR COST	$320,000
	ROADWAY OVER CREST	NO
	BRIDGE NEAR DAM	YES

NAME OF INSPECTING ENGINEER: Cathleen A. Benben SIGNATURE:

NAME OF DAM: Lower Lynde Basin Dam

STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018

NID ID #: MA02302

OWNER:		CARETAKER:	
ORGANIZATION	Town of Clinton	ORGANIZATION	Town of Clinton
NAME/TITLE	Dept. of Public Works	NAME/TITLE	Chris McGown, DPW Director
STREET	242 Church Street	STREET	242 Church Street
TOWN, STATE, ZIP	Clinton, MA 01510	TOWN, STATE, ZIP	Clinton, MA 01510
PHONE	978 365-4119	PHONE	978 365-4119
EMERGENCY PH. #	911	EMERGENCY PH. #	911
FAX	N/A	FAX	N/A
EMAIL	cmcgown@clintonma.gov	EMAIL	cmcgown@clintonma.gov
OWNER TYPE	Municipality or Political subdivision		

PRIMARY SPILLWAY TYPE: Broadcrested Weir

SPILLWAY LENGTH (FT): 17.5

SPILLWAY CAPACITY (CFS): 285

AUXILIARY SPILLWAY TYPE: N/A

AUX. SPILLWAY CAPACITY (CFS): N/A

NUMBER OF OUTLETS: 1

OUTLET(S) CAPACITY (CFS): abandoned, inoperable

TYPE OF OUTLETS: 12-inch cast iron pipe

TOTAL DISCHARGE CAPACITY (CFS): 285

DRAINAGE AREA (SQ MI): 1.4

SPILLWAY DESIGN FLOOD (PERIOD/CFS): 100-yr/448 cfs

HAS DAM BEEN BREACHED OR OVERTOPPED ☐ YES ☑ NO IF YES, PROVIDE DATE(S)

FISH LADDER (LIST TYPE IF PRESENT): N/A

DOES CREST SUPPORT PUBLIC ROAD? ☐ YES ☑ NO IF YES, ROAD NAME:

PUBLIC BRIDGE WITHIN 50' OF DAM? ☑ YES ☐ NO IF YES, ROAD/BRIDGE NAME: 22 ft long timber bridge over discharge channel

MHD BRIDGE NO. (IF APPLICABLE)

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

EMBANKMENT (CREST)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	1. SURFACE TYPE	Vegetation - Grass, brush, 10 feet wide		X	
	2. SURFACE CRACKING	None observed	X		
	3. SINKHOLES, ANIMAL BURROWS	None observed	X		
	4. VERTICAL ALIGNMENT (DEPRESSIONS	Satisfactory alignment; small depressions		X	
	5. HORIZONTAL ALIGNMENT	Good alignment	X		
	6. RUTS AND/OR PUDDLES	None observed	X		
	7. VEGETATION (PRESENCE/CONDITION)	Heavily overgrown with brush and small trees			X
	8. ABUTMENT CONTACT	Good contact	X		

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

EMBANKMENT (D/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S SLOPE	1. WET AREAS (NO FLOW)	None observed	X		
	2. SEEPAGE	None on the slope. Seepage observed in downstream area		X	
	3. SLIDE, SLOUGH, SCARP	Minor settlement near top of slope; not recent, slope is stable		X	
	4. EMB.-ABUTMENT CONTACT	Good	X		
	5. SINKHOLE/ANIMAL BURROWS	None observed	X		
	6. EROSION	Erosion due to foot traffic, worn path up slope to right of spillway		X	
	7. UNUSUAL MOVEMENT	None observed	X		
	8. VEGETATION (PRESENCE/CONDITION)	Small trees and thick brush prevent thorough inspection			X

ADDITIONAL COMMENTS: A debris pile was left on slope, likely from clearing spillway
Downstream slope is very steep.

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

EMBANKMENT (U/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S SLOPE	1. SLIDE, SLOUGH, SCARP	Undercutting at normal water elevation	X		
	2. SLOPE PROTECTION TYPE AND COND.	None observed; Ice on pond prevented thorough inspection	X		
	3. SINKHOLE/ANIMAL BURROWS	None observed	X		
	4. EMB.-ABUTMENT CONTACT	Good	X		
	5. EROSION	Some erosion behind training walls, foot and animal paths to the water near gatehouse.			X
	6. UNUSUAL MOVEMENT	None observed	X		
	7. VEGETATION (PRESENCE/CONDITION)	Overgrown vegetation preventing thorogh inspection			X

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

INSTRUMENTATION

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
INSTR.	1. PIEZOMETERS	None observed			
	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	N/A	X		
	9. LOCATION OF READINGS	N/A	X		

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

DOWNSTREAM MASONRY WALLS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S WALLS	1. WALL TYPE	Mortared and dry stone masonry walls along discharge channel			X
	2. WALL ALIGNMENT	Some movement noted. Sections have collapsed, stones missing			X
	3. WALL CONDITION	Fair		X	
	4. HEIGHT: TOP OF WALL TO MUDLINE	min: N/A max: avg:	X		
	5. SEEPAGE OR LEAKAGE	None observed		X	
	6. ABUTMENT CONTACT	N/A	X		
	7. EROSION/SINKHOLES BEHIND WALL	Minor erosion behind sownstream spillway training walls		X	
	8. ANIMAL BURROWS	N/A		X	
	9. UNUSUAL MOVEMENT	N/A		X	
	10. WET AREAS AT TOE OF WALL	None observed. Water flowing through channel at time of inspection		X	

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

UPSTREAM MASONRY WALLS

AREA INSPECTED	CONDITION	OBSERVATIONS			NO ACTION	MONITOR	REPAIR
U/S WALLS	1. WALL TYPE	N/A					
	2. WALL ALIGNMENT	N/A					
	3. WALL CONDITION	N/A					
	4. HEIGHT: TOP OF WALL TO MUDLINE	min:	max:	avg:			
	5. ABUTMENT CONTACT	N/A					
	6. EROSION/SINKHOLES BEHIND WALL	N/A					
	7. ANIMAL BURROWS	N/A					
	8. UNUSUAL MOVEMENT	N/A					

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

DOWNSTREAM AREA

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S AREA	1. ABUTMENT LEAKAGE	Seepage observed in the right downstream area		X	
	2. FOUNDATION SEEPAGE	Seepage observed in the right downstream area		X	
	3. SLIDE, SLOUGH, SCARP	None observed	X		
	4. WEIRS	None	X		
	5. DRAINAGE SYSTEM	Unknown	X		
	6. INSTRUMENTATION	None observed		X	
	7. VEGETATION	Vegetation in spillway discharge channel			X
	8. ACCESSIBILITY	From gravel access roads off of Heywood Road through wooded area	X		
	9. DOWNSTREAM HAZARD DESCRIPTION	Low-loss of life is not expected due to breach and no homes, occupied buildings or improved roadways would be adversely affected			
	10. DATE OF LAST EAP UPDATE	No EAP			

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

MISCELLANEOUS

AREA INSPECTED	CONDITION	OBSERVATIONS
MISC.	1. RESERVOIR DEPTH (AVG)	estimate 10
	2. RESERVOIR SHORELINE	Wooded
	3. RESERVOIR SLOPES	Mild to moderately sloped
	4. ACCESS ROADS	Gravel access roads through woods
	5. SECURITY DEVICES	Locked gate at access road entry ; no security at dam site
	6. VANDALISM OR TRESPASS	☑ YES ☐ NO WHAT: Footpaths on emb. and vandalism at gateho.
	7. AVAILABILITY OF PLANS	☑ YES ☐ NO DATE: 1894 general design drwing
	8. AVAILABILITY OF DESIGN CALCS	☐ YES ☑ NO DATE: 2007 H&H
	9. AVAILABILITY OF EAP/LAST UPDATE	☐ YES ☑ NO DATE: no EAP
	10. AVAILABILITY OF O&M MANUAL	☐ YES ☑ NO DATE:
	11. CARETAKER/OWNER AVAILABLE	☑ YES ☐ NO DATE: December 20, 2018
	12. CONFINED SPACE ENTRY REQUIRED	☐ YES ☑ NO PURPOSE:
		Vandals have removed gatehouse door. There is no cover limiting access to valve pit inside structure

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

PRIMARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	Stone masonry.			X
	WEIR TYPE	Concrete overlay on stone masonry weir cracked.			X
	SPILLWAY CONDITION	Poor			X
	TRAINING WALLS	Sections of walls collapsed. Woody vegetation growing through walls. Misaligned			X
	SPILLWAY CONTROLS AND CONDITION	None	X		
	UNUSUAL MOVEMENT	Stones and mortar missing from walls			X
	APPROACH AREA	Cobblestone approach apron. Some stone are missing.			X
	DISCHARGE AREA	Vegetation growing in walls. Woody debris in channel.			X
	DEBRIS	Some wood debris , stones from mortar walls dowstream of weir			X
	WATER LEVEL AT TIME OF INSPECTION	About 0.3 feet above weir	X		

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

AUXILIARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	N/A			
	WEIR TYPE	N/A			
	SPILLWAY CONDITION	N/A			
	TRAINING WALLS	N/A			
	SPILLWAY CONTROLS AND CONDITION	N/A			
	UNUSUAL MOVEMENT	N/A			
	APPROACH AREA	N/A			
	DISCHARGE AREA	N/A			
	DEBRIS	N/A			
	WATER LEVEL AT TIME OF INSPECTION	N/A			

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	Inoperable gated, 12-inch cast iron pipe thrpough center of dam		X	
	INTAKE STRUCTURE	None	X		
	TRASHRACK	None	X		
	PRIMARY CLOSURE	Gate valve below dam crest, no longer operable		X	
	SECONDARY CLOSURE	None		X	
	CONDUIT	12-inch cast iron pipe		X	
	OUTLET STRUCTURE/HEADWALL	Outlet at stone masonry wall on right side of discharge channel at downstream toe		X	
	EROSION ALONG TOE OF DAM	None	X		
	SEEPAGE/LEAKAGE	None observed		X	
	DEBRIS/BLOCKAGE	None	X		
	UNUSUAL MOVEMENT	None observed	X		
	DOWNSTREAM AREA	Discharges to channel downstream of spillway		X	
	MISCELLANEOUS				

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

CONCRETE/MASONRY DAMS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
GENERAL	TYPE	N/A			
	AVAILABILITY OF PLANS	N/A			
	AVAILABILITY OF DESIGN CALCS	N/A			
	PIEZOMETERS	N/A			
	OBSERVATION WELLS	N/A			
	INCLINOMETERS	N/A			
	SEEPAGE GALLERY	N/A			
	UNUSUAL MOVEMENT	N/A			

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

CONCRETE/MASONRY DAMS (CREST)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	TYPE	N/A			
	SURFACE CONDITIONS	N/A			
	CONDITIONS OF JOINTS	N/A			
	UNUSUAL MOVEMENT	N/A			
	HORIZONTAL ALIGNMENT	N/A			
	VERTICAL ALIGNMENT	N/A			

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

CONCRETE/MASONRY DAMS (DOWNSTREAM FACE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S FACE	TYPE	N/A			
	SURFACE CONDITIONS	N/A			
	CONDITIONS OF JOINTS	N/A			
	UNUSUAL MOVEMENT	N/A			
	ABUTMENT CONTACT	N/A			
	LEAKAGE	N/A			

ADDITIONAL COMMENTS:

NAME OF DAM: Lower Lynde Basin Dam STATE ID #: 3-14-282-8

INSPECTION DATE: December 20, 2018 NID ID #: MA02302

CONCRETE/MASONRY DAMS (UPSTREAM FACE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S FACE	TYPE	N/A			
	SURFACE CONDITIONS	N/A			
	CONDITIONS OF JOINTS	N/A			
	UNUSUAL MOVEMENT	N/A			
	ABUTMENT CONTACTS	N/A			

ADDITIONAL COMMENTS:

APPENDIX C

Previous Reports and References

PREVIOUS REPORTS AND REFERENCES

The following is a list of reports that were reviewed or referenced in previous reports.

1. *Phase II Inspection and Investigation Report Lower Lynde Basin Dam Sterling, MA prepared by Weston & Sampson Engineers, Inc., June 2008.*

2. *Lower Lynde Basin Dam Inspection/Evaluation Report*, prepared by Weston & Sampson Engineers, Inc., November 15, 2006

3. Department of Environmental Management Office of Dam Safety Dam Inspection Report*, Lower Lynde Basin Dam,* prepared by Hydraulic & Water Resources Engineer, Inc., June 12, 1998.

APPENDIX D
Definitions

COMMON DAM SAFETY DEFINITIONS

To provide a better understanding of this report, definitions of commonly used terms associated with dams are provided below. The terms are presented under the following common categories:

1) Orientation;
2) Dam components;
3) Size classification;
4) Hazard classification; and
5) General.

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/Dike – 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 barrier that impounds water.

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

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

Appurtenant Works – Shall mean any ancillary feature of a dam and shall include but not be limited to, such structures as training walls, spillways, either in the dam or separate there from and low level outlet works; also water conduits such as tunnels, channels, pipelines, or penstocks, either through the dam or its abutments.

Riprap – Shall mean a loose assemblage of broken stones erected in water or soft ground as erosion protection.

Toe – Shall mean the protruding base of the dam on the downstream side either natural or man-made.

Weir – Shall mean the top of the spillway where the water flows to the downstream side

Size Classification

(as listed in Commonwealth of Massachusetts, 302 CMR *Dam Safety Rules and Regulations,* revised 11/04/05)

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

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

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

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

Hazard Classification

(as listed in Commonwealth of Massachusetts, 302 CMR *Dam Safety Rules and Regulations,* revised 11/04/05)

High Hazard (Class I) – Shall mean dams/dikes located where failure or misoperation will likely cause loss of life and/or serious damage to homes, industrial or commercial facilities, important public utilities, or major transportation arteries.

Significant Hazard (Class II) – Shall mean dams/dikes located where failure or misoperation may cause loss of life and/or damage to homes, industrial or commercial facilities, secondary highways or railroads, or cause the interruption of the use or service of important facilities.

Low Hazard (Class III) – Dams/dikes located where failure or misoperation may cause minimal property damage to others and loss of life is not expected.

General

DCR – Department of Conservation and Recreation, formerly the Department of Environmental Management (DEM).

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 volume equal to one foot of water over a one-acre area.

Height of Dam/Dike – 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/dike.

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.