-- PRINDLE LAKE DAM --

PHASE I

INSPECTION / EVALUATION REPORT

Dam Name:	PRINDLE LAKE DAM
State Dam ID#:	3-14-54-38
NID ID#:	MA01174
Owner:	THE SANTOS IRREVOCABLE TRUST
Owner Type:	PRIVATE
Town:	CHARLTON
Consultant:	LENARD ENGINEERING, INC.
Date of Inspection:	JUNE 6, 2008

EXECUTIVE SUMMARY

Representatives of Lenard Engineering, Inc. visually inspected Prindle Lake Dam in Charlton, MA on June 6, 2008. In general, the condition of the dam is POOR. Specific concerns include the wet area along greater than half of the toe of the dam, numerous locations of seepage, a lack of effective slope protection (grassy cover), loose sandy core material, the lack of an emergency spillway and a low level outlet, and tree and shrub growth along the upstream and downstream faces and the toe of the dam.

The Prindle Lake Dam is classified as an INTERMEDIATE size structure with a SIGNIFICANT (Class II) hazard classification. A request was made to the Department of Conservation and Recreation (DCR), Office of Dam Safety (ODS) to review the then current hazard classification of High. In accordance with M.G.L. Chapter 253 s.44-48 and 302 10.00 Dam Safety Rules and Regulations, the DCR determined in a letter dated October 22, 2007 that the classification of the dam shall be changed from High Hazard Potential to Significant Hazard Potential.

In addition to regular maintenance and as-needed repair, the following activities are recommended to improve the condition of the dam:

- Removal of tree growth from upstream and downstream dam faces and within 25 feet of the toe of the dam
- Improvements to the earth embankments and crest, including removing the apparent abandon spillway
- Installation of a low-level outlet structure and an emergency spillway
- Installation of toe drains

Dam Evaluation Summary Detail Sheet

1. NID ID: MA01174	**2. Dam Name:** Prindle Lake Dam	**3. Dam Location:** Charlton; off of Oak Ridge Drive
4. Inspection Date: 06/06/08	**5. Last Insp. Date:** 09/14/06	**6. Next Inspection:** 09/14/08
7. Inspector: Scott D. Charpentier	**8. Consultant:** Lenard Engineering, Inc.	
9. Hazard Code: Significant (Class II)	**10. Insp. Frequency:** 5 yrs.	**11. Insp. Condition:** Poor

E1. Design Methodology:	1	**E7. Low-Level Discharge Capacity:**	1
E2. Level of Maintenance:	2	**E8. Low-Level Outlet Physical Condition:**	1
E3. Emergency Action Plan:	1	**E9. Spillway Design Flood Capacity:**	5
E4. Embankment Seepage:	3	**E10. Overall Physical Condition of the Dam:**	2
E5. Embankment Condition:	3	**E11. Estimated Repair Cost (in thousand $):**	**235**
E6. Concrete Condition:	4		

Evaluation Description

E1: DESIGN METHODOLOGY
1. Unknown Design – no design records available
3. Some standard design features
5. State of the art design – design records available

E2: LEVEL OF MAINTENANCE
1. No evidence of maintenance, no O&M manual
2. Very little maintenance, no O&M manual
3. Some level of maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. 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

E4: EMBANKMENT SEEPAGE
1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but uncontrolled seepage
4. Controlled seepage
5. No seepage or piping

E5: EMBANKMENT CONDITION
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
1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment
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
2. Outlet with insufficient drawdown capacity
3. Inoperable gate with potentially sufficient drawdown capacity
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 - 20% of the SDF
2. 21- 40% of the SDF
3. 41- 60% of the SDF
4. 61- 80% of the SDF
5. 81- 100% of the SDF

E10: OVERALL PHYSICAL CONDITION OF THE 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

The hazard potential classification has been changed from High Hazard (Class I) to Significant Hazard (Class II).

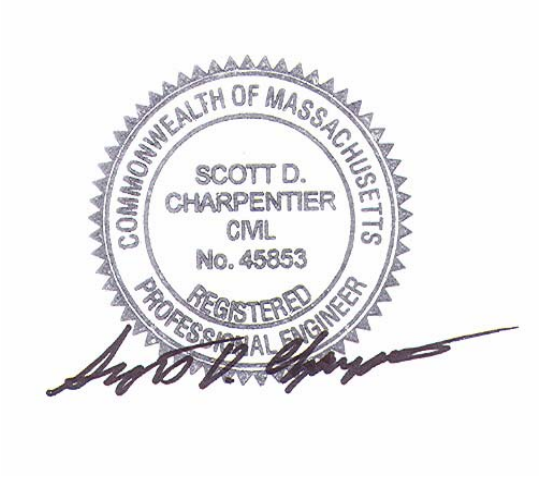
PREFACE

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 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 be detected.

Scott D. Charpentier
Massachusetts License No.: 45853
Project Manager
Lenard Engineering, Inc.



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1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The Santos Irrevocable Trust retained Lenard Engineering, Inc. (LEI) to perform Phase II Dam Inspection and Evaluation. As part of this work an updated visual inspection and report of conditions for the dam at Prindle Lake along a tributary of Cady Brook in Charlton, Massachusetts has been prepared. This 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 CMR10.07 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.

1.2 Description of Project

1.2.1 Location

Prindle Lake Dam is located in the Town of Charlton, Worcester County, Commonwealth of Massachusetts. Latitude and longitude are given as 42.1137 N and 72.0005 W respectively on the USGS Webster quadrangle. The dam is situated approximately 2,680 feet south of the intersection of Carpenter Hill Road and Hall Road and is located along the western shore of Prindle Lake near the end of Oak Ridge Road. Vehicular access to the dam is feasible via the unpaved way of Oak Ridge Road; access by foot should be undertaken for the last 500± feet.

1.2.2 Owner/Operator

	Dam Owner	Dam Caretaker
Name	The Santos Irrevocable Trust Mr. Carl Izzo, Trustee Fiduciary Real Estate Advisors	Nature's Classroom, Inc. Dr. John G. Santos, Director
Mailing Address	125 Summer Street	19 Harrington Rd.
Town	Boston, MA 02110-1624	Charlton, MA 01507
Daytime Phone	1-617-345-3600	1-508-248-2741
Emergency Phone	1-781-771-8356	
Email Address		

1.2.3 Purpose of the Dam

Prindle Lake Dam impounds Prindle Lake, which is used for boating, fishing, and other recreational purposes. The partial owner and caretaker Nature's Classroom, Inc., a private not-for-profit environmental educational center, provides campgrounds, trails, and both indoor and outdoor educational activities in the area immediately adjacent to and downstream of the dam. There is an unpaved walking path on the crest of the dam.

1.2.4 Description of the Dam and Appurtenances

Prindle Lake Dam is an earthen dam built approximately in 1952. The dam is approximately 235 feet long and 16 feet high. The primary spillway is a cast in place concrete box culvert with an opening 25" high by 83" wide, which serves as broad-crested weir. This spillway is centered approximately 62.5 feet from the left abutment and 173 feet from the right abutment. The crest of the dam has a width ranging from approximately 18 feet in the middle to 25.5 feet at the spillway. The crest elevation varies; the left end of the dam is 1.5 feet higher than the right end of the dam. The downstream face is sloped at 2H:1V. The upstream face was not observable under the vegetation. A timber railing, set on both the upstream and downstream sides on the top of the box culvert, provides for pedestrian safety crossing the spilling. Wire mesh fencing and an 18" picket fence have been placed on the shoulders of the crest to the left of the spillway to limit pedestrian traffic accessing the impoundment.

Remnants of an apparent abandon spillway inlet were located 105 ft to the right of the existing spillway on the upstream face. The outlet of the apparent abandon spillway was not observed. However, the old channel was observed on the downstream side of the dam.

1.2.5 Operations and Maintenance

One of the owner Trustees, Dr. John G. Santos is responsible for the operations and maintenance of the dam. No formal written procedures for operations or maintenance exist.

The dam cannot be "operated" in the normal sense since there are neither gates, nor stoplogs, nor low level outlets. The only maintenance of the dam appears to be mowing of the crest and recently dumped rip rap stone along portions of the downstream face.

1.2.6 DCR Size Classification

Prindle Lake Dam has a maximum structural height of approximately 11 feet and a maximum storage capacity of approximately 250 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 as amended by Chapter 330 of the Acts of 2002, Prindle Lake Dam is an INTERMEDIATE size structure.

1.2.7 DCR Hazard Classification

A request was made to the Department of Conservation and Recreation (DCR), Office of Dam Safety (ODS) to review the then current hazard classification of High. In accordance with M.G.L. Chapter 253 s.44-48 and 302 10.00 Dam Safety Rules and Regulations, the DCR determined in a letter dated October 22, 2007 that the classification of the dam shall be changed from High Hazard Potential to Significant Hazard Potential. Therefore, in accordance with Department of Conservation and Recreation classification procedures, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, Prindle Lake Dam is currently classified as a SIGNIFICANT (CLASS II) hazard potential dam.

1.3 Pertinent Engineering Data

Data contained in this report was taken from previous inspection/evaluation reports including work of the 2008 Phase II Report prepared by LEI which includes complete hydrologic, hydraulic and stability computations.

1.3.1 Drainage Area

The drainage area for Prindle Lake is approximately 0.4 square miles and extends through the community of Charlton. The drainage area consists primarily of steep, hilly terrain, dropping an estimated 807 feet from the upstream end of the watershed northwest of Prindle Lake to normal lake level.

1.3.2 Reservoir

	Length (feet)	Width (feet)	Surface Area (acres)	Storage Volume (acre-feet)
Normal Pool	2,400	1,140	80	150
Maximum Pool	2,680	1,380	85	250
SDF Pool	2,550	1,260	82.6	206

1.3.3 Discharges at the Dam Site

The 1955 flood resulting from Hurricane Diane caused a flood flow of 1,240 CFS at the USGS Gaging Station located on Upper Sibley Pond Outlet in Charlton, Massachusetts, approximately 2-miles from Prindle Lake Dam. Through a watershed comparison, this storm event caused an

approximate flow at the Prindle Lake Dam of 222 CFS. The dam was overtopped during this storm event and the hurricane of 1938.

1.3.4 General Elevations (Mean Sea Level (MSL), 1998)

A.	Top of Dam ……	707 – 708.5
B.	Spillway Design Flood Pool ……..…	706.04
C.	Normal Pool ……..	705
D.	Spillway Crest ……..	705
E.	Upstream Water at Time of Inspection ……..	spillway crest
F.	Streambed at Toe of the Dam ……	698
G.	Low Point along Toe of the Dam …….....	698 (approx.)
H.	Top of Abutments ……..	712.3

1.3.5 Main Spillway (Mean Sea Level (MSL), 1998)

A.	Type ……	Broad-crested weir (concrete box culvert)
B.	Length ……	6.92 FT(83 inches)
C.	Invert Elevation ……..	705
D.	Upstream Channel ……..	Not applicable
E.	Downstream Channel …….	692 (approx.)
F.	Downstream Water …….	Normal stream flow
G.	SDF …….	711 CFS (100-year inflow from watershed) 24.89 CFS (100-year spillway discharge)
H.	Spillway Capacity ……	65.51 CFS

1.3.6 Design and Construction Records

No records pertaining to design and construction of the dam were provided to LEI for this inspection.

1.3.7 Operating Records

No operating records were available at the time of inspection.

1.4 Other General Information

The referenced safety inspection from April 2008 depicts a downstream face condition without broad leaf vegetation (Photo 011-R). This report also depicts an active flow from the apparent abandon spillway (Photo 012-R).

The 1998 Inspection Report gives the National ID number as MA01826. However, current DCR data give the National ID as MA01174; this is the National ID used in this report.

SECTION 2

2.0 INSPECTION

2.1 Visual Inspection

Representatives of Lenard Engineering, Inc. visually inspected Prindle Lake Dam on June 6, 2008. At the time of the inspection, the weather was overcast with temperatures in the 60's. Photographs to document the current conditions of the dam were taken during the inspection and are included in Appendix A. Underwater areas were not inspected. A copy of the inspection checklist is included in Appendix B.

2.1.1 General Findings

In general, Prindle Lake Dam was found to be in POOR condition. General concerns include:

1) Saturated downstream toe
2) Multiple locations of minor seepage
3) Tree growth on the dam and areas within 25 feet of the toe
4) The lack of a low level outlet and/or an emergency spillway

Specific concerns are identified in more detail within the sections below.

2.1.2 Dam

Abutments

Some trees and shrubs were present within 25 feet of the abutments (Photos 001 and 008).

Upstream Face

The upstream face is covered with broad leaf vegetation, which made observation difficult (Photo 002). The face is possibly covered with earth and riprap. Some brushy vegetation was observed on the right side with a 12" tree stump located on the left side.

Crest

The crest exhibits minor erosion near the abutments and the spillway (Photo 001) apparently due to recreational foot traffic.

Shoulders of the crest are covered in broad leaf vegetation (Photo 007). The crest is paralleled along its limits with wood picket and chain link fence which deter foot traffic from accessing the dam faces.

Downstream Face

The downstream face is partially covered by broad leaf vegetation (Photos 006 and 010), which made observation difficult. Riprap has been dumped on two areas of the face to the right of the spillway (Photo 010). Some seepage was observed through the riprap on the face. A 12" stump had been left in place to

the right of the spillway. The condition of the earth underneath the riprap was not possible to assess.

The toe of the dam was saturated. Seeps (up to 1/2" gallons per minute) were observed to the left of the spillway along the toe.

Drains

None were observed.

Instrumentation

A piezometer was installed on the dam crest in conjunction with the work of the references Phase II evaluation. The water elevation within the peizometer was measured at 5-feet below dam crest at the time of inspection.

Access Roads and Gates

The dam is located on private property. Vehicular traffic is controlled with an unlocked steel gate and signage. There are no controls for pedestrian or ATV traffic.

2.1.3 Appurtenant Structures

Primary Spillway

The primary spillway, which is the only defined dam discharge, consists of a cast in place concrete slab supported on 16" wide cast-in-place concrete abutments (Photo 003). The top of the slab is spalled and the condition of the inside of the culvert is satisfactory. No trash rack was observed. However, the culvert appeared to be clear of debris.

Wingwalls built of concrete block exist on both sides of the entrance to the spillway. It is unknown if the blocks are a facing to a mechanically stabilized earth wall system or if the blocks are individual units. The grout between the blocks is cracked.

Downstream, the spillway discharges over a large piece of ledge. However, because the ledge sits lower than the floor of the spillway, it does not interfere with outflow (Photo 003). The right limit of the spillway is undermined approximately 6-inches (Photo 004).

On both sides of the spillway discharge, the downstream slope is terraced with stone masonry walls which rise to the crest. Stones have been placed on both sides of the channel immediately adjacent to the spillway discharge however, a clear running seep was found just left of the channel.

Further downstream, riprap was dumped alongside the right of the downstream channel.

Remnants of an apparent abandon spillway were located 150 ft to the right of the existing spillway. Erosion had occurred at the sides of the apparent abandon spillway. The discharge for this spillway was not able to be located. The channel that served this spillway was defined and wet. It is possible that existing

seepage at the toe of dam drains towards the right along the toe and finds it way into this old channel.

Low Level Outlet

No low level outlet exists.

Auxiliary/Emergency Spillway

No auxiliary/emergency spillway exists.

2.1.4 Downstream Area

The immediate area downstream is heavily wooded with trees, saplings, and woody brush growing close to the toe of the dam (Photos 009 and 010). At the toe of the dam is a marshy, wet area with evidence of seepage. The primary spillway channel winds to the right and joins with the wider, old channel 100± feet downstream from the dam. The old channel is partially blocked by the placement of cut timbers (Photo 009) which has resulted in ponding at the right toe of the dam.

Located further downstream, the brook passes under Harrington Road through a 4 foot diameter HDPE culvert pipe. The culvert inlet and outlet do not have erosion or scour protection in-place. From a visual inspection of the wooded area just upstream of Harrington road, the brook passes through a steep rocky valley.

Further west downstream is State Route 169 (Southbridge Road), along which is located an active commercial property, several residences, and a bridge.

2.1.5 Reservoir Area

The inspection was limited to the immediate dam area and downstream area.

2.2 Caretaker Interview

Dr. John G. Santos, director of the Nature's Campground is the caretaker and was not interviewed at the time of the inspection.

2.3 Operation and Maintenance Procedures

No information pertaining to formal operation and maintenance procedures was provided to LEI for this inspection.

2.4 Emergency Warning System

No information pertaining to a formal emergency warning system was provided to LEI for this inspection.

2.5 Hydrologic/Hydraulic Data

Based on an INTERMEDIATE size classification and a SIGNIFICANT hazard classification, the spillway design flood for this dam is the 100-year return frequency storm. The Phase II Report prepared by LEI contains the test flood analysis and hydrology and hydraulic calculations for this dam. This analysis determines that the current spillway will convey the spillway design flood without overtopping the dam.

2.6 Structural Stability/Overtopping Potential

2.6.1 Structural Stability

Structural stability and seepage analyses were conducted as part of the Phase II Report prepared by LEI. GeoInsight, Inc. provided an engineering analysis and recommendations regarding predicted stability and seepage rates for the dam. Veneer stability and global stability analysis were performed for the dam under the three different loading conditions with a required factor of safety (F.S.) area as follows; case I, steady seepage with maximum storage pool; case II, steady seepage with surcharge pool; and case III, steady seepage and a seismic loading

The slope stability analyses included ponded water being equivalent to two feet below the top of the dam (14 feet of head), one foot below the top of the dam (15 feet of head) and at the top of the dam (16 feet of head) with assessment being conducted of the upstream and downstream face under static and seismic conditions.

The dam stability analysis indicated that adequate resistance forces were available against sliding and overturning forces. However, the stability is based upon conditions that are currently not completely defined, including slope geometry and internal conditions against the spillway. Assessment of the upstream face during rapid drawdown conditions indicated that the veneer surface would most likely slough, leaving behind a steeper face that would in turn slough more until equilibrium between the soil and retained water within the dam core was reached. However, based on the gradation of the soil within the dam, it does not appear that the dam is significantly susceptile to liquefaction during seismic conditions.

Global stability analysis suggests that the upstream dam slope is currently in a state of failure but because this conflicts with visual observation, the face is likely stabilized by shallower grades than those modeled, vegetation and/or armor is not included in the evaluation. Overall global stability appears to be well below acceptable criteria. Global stability at the downstream face is highly dependent upon the existing fill material and natural soil, which is not readily quantifiable in terms of its integrity. The dam is significantly sensitive to a theoretical seismic loading because of the low density of the embankment materials. It is important to note that degraded, brittle existing structures such as the existing spillway could introduce very significant unknowns into the analysis. These loading scenarios are in accordance with State regulations, 302 CMR 10.14.

Global Stability

Case	Failure Mode	Required	Calculated
I	Overturning	3.0	**
II	Sliding	3.0	12.8
	Overturning	2.0	**
III	Sliding	2.0	11.4
	Overturning	>1.0	**
	Sliding	>1.0	9.9

Slope Stability

Location	Condition*	Required	Calculated
Upstream	Static	1.3	***0.9***
	Seismic	>1.0	***0.6***
Downstream	Static	1.3	3.1
	Seismic	>1.0	2.7

* all analyses considered impoundment at dam crest
** F.S. against overturning was analyzed by inspection and determined that the F>S. for the three conditions would be significantly higher than the required F.S.

GeoInsight, Inc. performed a limited seepage analysis of the dam structure. The results of the evaluation indicated that the dam could be seeping as much as 776 cubic feet per day across its entire alignment. The dam soil was estimated to have a seepage rate of $1x10^{-4}$ centimeter per second. However, this seepage rate was not consistent with observed conditions. The downstream side of the dam was observed to be moist, but seepage in the form of free flowing water was not observed. This suggests that either the upstream face materials restrict flow into the dam more than modeled in the analysis and/or the internal conductivity is higher and seepages exists into the base and largely out of view. It was also observed that a portion of the water exiting the spillway was traveling off-course from its designated channel, and instead was following a pathway along the base of the dam. It was difficult to determine if seepage was occurring at the base of the dam or if the wet soil conditions at the toe were due to standing water because of this pathway. During a site visit, it was observed that a large amount of tarp Rock has been placed on the northern portion of the dam's downstream face. According to a member of the Prindle Lake Association, this measure was taken to buttress an area of seepage that has been observed in this area. GeoInsight did not observe slough or other evidence of unstable conditions at the downstream face of the dam.

2.6.2 Overtopping Potential

The 1998 Inspection Report relates the previous flooding experiences. During Hurricane Diane in 1955, the entire Quinebaug drainage area suffered from severe flooding (see USGS Water Supply Paper 1420 "Floods of August – October 1955 New England to North Carolina"). The flood of record for the dam occurred on August 19, 1955 at 3:00 PM. The flow recorded at the USGS Gaging Station located on the Upper Sibley Pond Outlet at Charlton City, Massachusetts, about 2 miles from Prindle Lake Dam was 1240 CFS from a drainage area of 2.23 sq. mi. or

approximately 556 CFS / sq. mi. The estimated flow at Prindle Lake Dam during this event was 222 cfs. The dam was overtopped during both the 1955 and 1938 hurricanes.

The hydraulic analysis for the dam prepared as part of the 2008 Phase II Inspection indicates the dam will not be overtopped during the 100-year return frequency storm event. The dam does not have an emergency spillway therefore an overtopping potential exists. This potential is considered likely but low, with an occurrence frequency less that once per century.

SECTION 3

3.0 ASSESSMENTS AND RECOMMENDATIONS

3.1 Assessments

In general, Prindle Lake Dam was found to be in POOR condition. General concerns include:

1) Saturated downstream toe
2) Multiple locations of minor seepage
3) Loose sandy core material
4) Lack of effective slope treatments
5) Tree growth on the dam and areas within 25 feet of the toe
6) The lack of an emergency spillway and a low level outlet

Some of recommendations from the 2006 report have been executed. A detailed geotechnical evaluation and a hydrologic and hydraulic study have been performed, the results of which are presented with the Phase II Report.

In 2006, the condition of the dam was rated as poor. The current rating is also POOR. A safe means to convey storm flow in excess of the SDF needs to be provided. There are no controls to lower the water level should there be a need for a rapid drawdown of the lake. There is no positive mechanism of seepage control or conveyance (i.e., there are no toe drains).

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 measure, the applicability of environmental permits needs to be obtained 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

1) A toe drain system, emergency spillway, slope stabilization system, and mechanism of dam core compaction should be designed by a registered profession engineer.
2) Prepare an Operations and Maintenance Plan for the dam.

3.3 Yearly Recommendations

1) Reseed areas of thin vegetation on slopes with grassy cover. Fill low spots on crest with gravel or crushed stone and cover with loam and seed.
2) Mow grass surfaces regularly (at least three times per year).
3) Monitor seepage to look for changing conditions.
4) Inspect the dam as required by Massachusetts General Law (by a qualified, registered professional engineer).

3.4 Recommendations, Maintenance, and Minor Repairs

1) Remove brush and debris from the crest and embankments (do not grub stumps). Remove fallen trees and pulled stumps away from the dam area to prevent rodent inhabitation.
2) Fill low spots and small depressions with appropriate fill material; gravel or crushed stone on the crest; topsoil covered with seed on the embankments.
3) Remove riprap from the downstream slope. Establish a grassy cover on both upstream and downstream slopes.

3.5 Remedial Measures

1) Clear and grub the dam and areas within 25 feet of the abutments and downstream toe. Regrade and install slope protection for upstream and downstream slopes.
2) Remove apparent abandon spillway and reconstruct that portion of the dam.
3) Repair cracked or deteriorated concrete and grout, as necessary, on the spillway and outlet channel.
4) Construct a defined waterway (minimum 50 feet downstream of toe) to safely convey discharge away from the toe of the dam. Regrade the immediate downstream area so that the channel under the existing spillway is utilized and the old channel becomes abandoned.
5) Install toe drains along the downstream face.
6) In-situ compact the dam core material.
7) Construct an emergency spillway and a low level outlet.

3.6 Alternatives

The preferred alternative identified within the Phase II report should be implemented. These include:

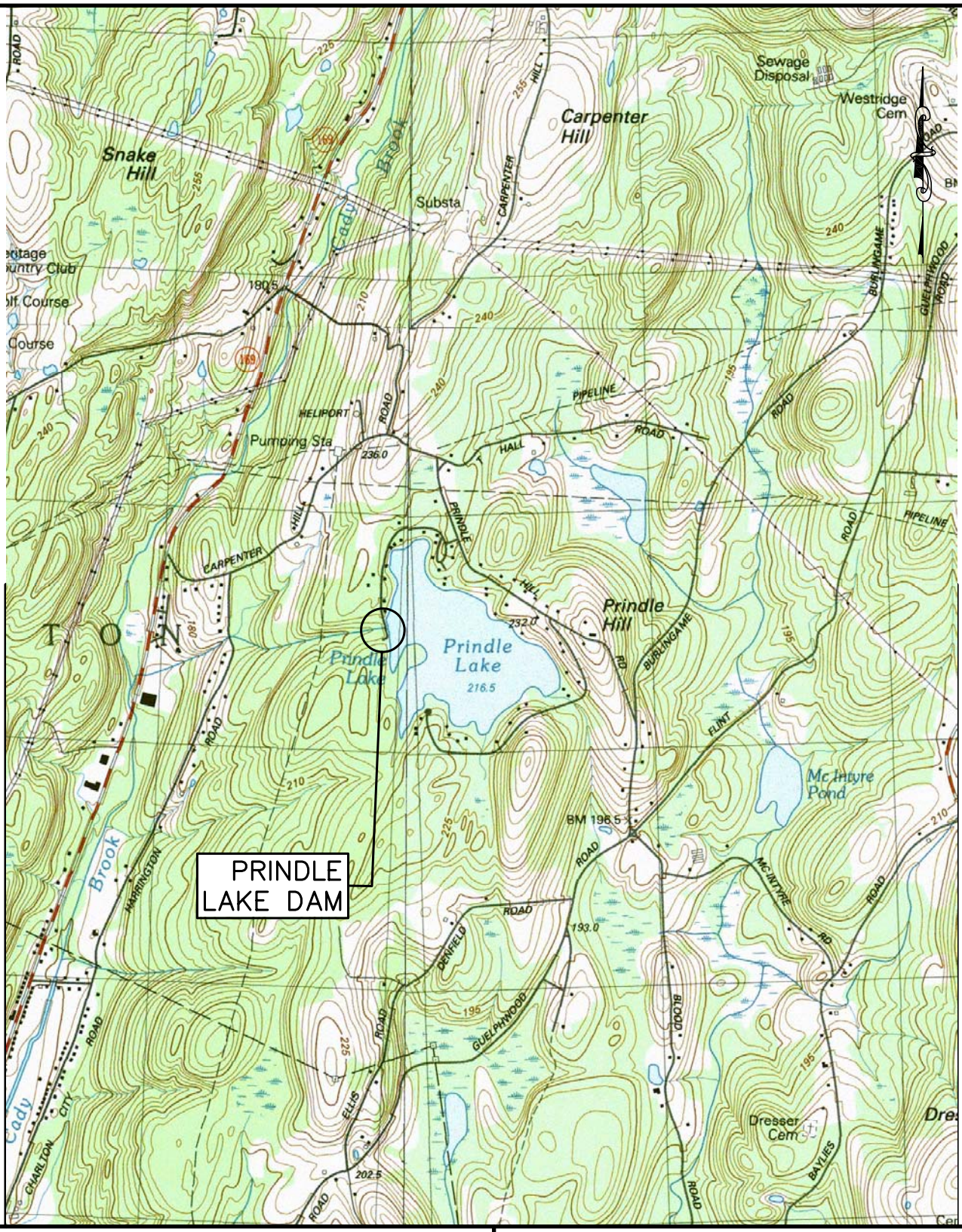
1) Installation of a low level outlet with controls;
2) Construction of an emergency spillway;
3) In-situ densification of the dam core material;
4) Installation of a toe drain;
5) Buttress downstream toe.

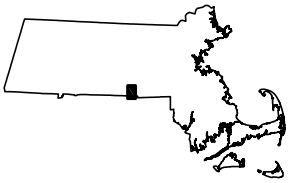
3.7 Opinion of Probable Construction Costs

Item	Opinion of Probable Cost
Engineering	$ 47,000
Permits	$ 7,500
Yearly Recommendations	$2,000 per year
Maintenance and Minor Repairs	$5,000
Remedial Measures	$288,000

TOTAL REPAIRS: $342,500 (does not include yearly recommendations)

FIGURES





Source:
USGS TOPOGRAPHIC MAP
WEBSTER, MA QUADRANGLE

Lenard Engineering, Inc.
Auburn, MA

FIGURE 1 - LOCUS PLAN

State ID# 3-14-54-68 NID# MA01174

PRINDLE LAKE DAM

CHARLTON, MA

Scale 1"=2000'

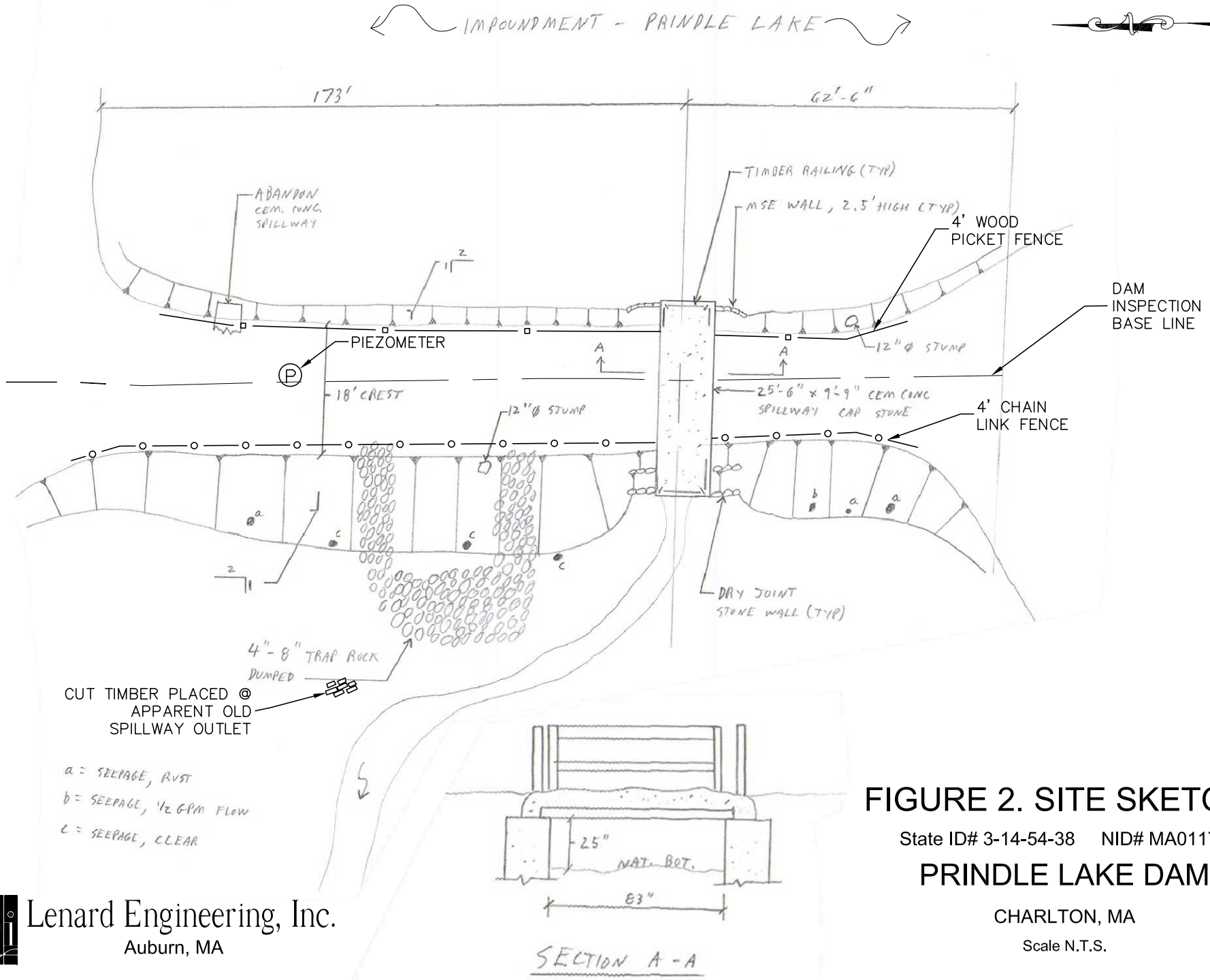


FIGURE 2. SITE SKETCH

State ID# 3-14-54-38 NID# MA01174

PRINDLE LAKE DAM

CHARLTON, MA

Scale N.T.S.

Lenard Engineering, Inc.
Auburn, MA

APPENDIX A
Photographs

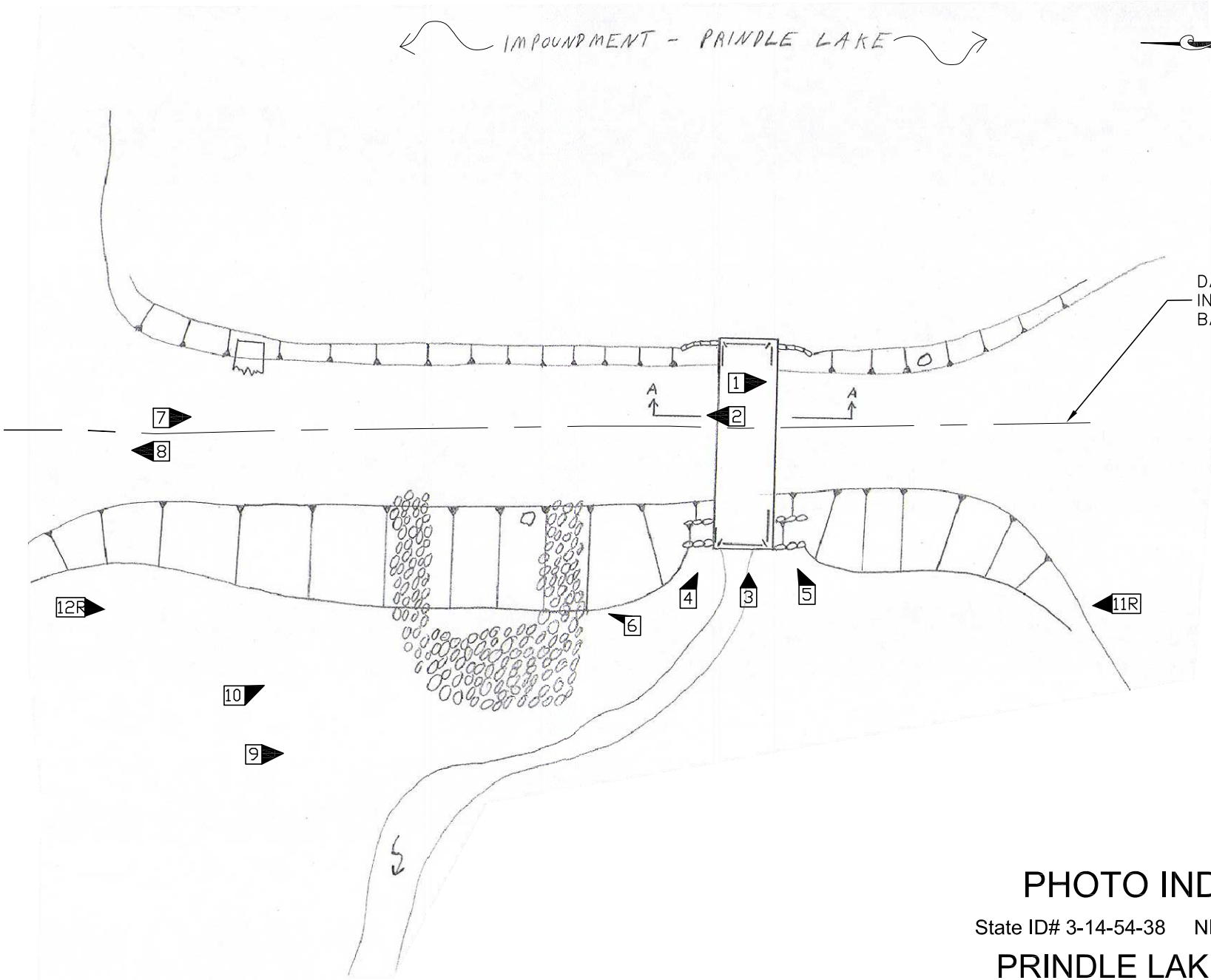


PHOTO INDEX

State ID# 3-14-54-38 NID# MA01174

PRINDLE LAKE DAM

CHARLTON, MA

Scale N.T.S.

Lenard Engineering, Inc.
Auburn, MA

Photo 001. Standing on spillway looking at left abutment


Photo 002. Standing on spillway looking right along crest

Photo 003. Spillway downstream opening

Photo 004. Spillway outlet undermining

Photo 005. Right of spillway outlet

Photo 006. Downstream face looking right

Photo 007. Crest looking right with piezometer location identified by stone

Photo 008. Right abutment

Photo 009. Cut timber placement at apparent old spillway outlet

Photo 010. Downstream face with apparent out spillway outlet left of center

Photo 011-R. Downstream face from April 2008 Inspection

Photo 012-R. Apparent abandon spillway seep from April 2008 Inspection (active spillway in left background)

APPENDIX B
Inspection Checklist

DAM SAFETY INSPECTION CHECKLIST INSTRUCTION PAGE

The checklist includes sections applicable to a variety of dam structure types. Complete those pages pertaining to each structure and omit pages that are not relevant. Checklist should be signed by the inspecting engineer and a clean, neat copy included in the final inspection report.

E1: DESIGN METHODOLOGY
1. Unknown Design – no design records available
3. Some standard design features
5. State of the art design – design records available

E2: LEVEL OF MAINTENANCE
1. No evidence of maintenance, no O&M manual
2. Very little maintenance, no O&M manual
3. Some level of maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. 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

E4: EMBANKMENT SEEPAGE
1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but uncontrolled seepage
4. Controlled seepage
5. No seepage or piping

E5: EMBANKMENT CONDITION
1. Severe erosion and/or large trees
2. Significant erosion or significant woody vegetation along lower
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
1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment
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
2. Outlet with insufficient drawdown capacity
3. Inoperable gate with potentially sufficient capacity
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 - 20% of the SDF
2. 21- 40% of the SDF
3. 41- 60% of the SDF
4. 61- 80% of the SDF
5. 81- 100% of the SDF

E10: OVERALL PHYSICAL CONDITION OF THE 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 for 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

See Appendix D for a complete listing of dam orientation and terminology definitions.

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.
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.
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; low level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.
Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

DAM SAFETY INSPECTION CHECKLIST

NAME OF DAM:	Prindle Lake Dam	STATE ID #:	3-14-54-38
REGISTERED:	☐ YES ☑ NO	NID ID #:	MA01174
STATE SIZE CLASSIFICATION:	INTERMEDIATE	STATE HAZARD CLASSIFICATION:	SIGNIFICANT

LOCATION INFORMATION

CITY/TOWN:	Charlton	COUNTY:	Worcester
DAM LOCATION:	Charlton; end of Oak Ridge Drive	AKA NAME:	
USGS QUAD.:	Webster	LAT.: 42.11365571	LONG.: -72.0005309
DRAINAGE BASIN:	9 - Quinebaug	RIVER:	Tributary of Cady Brook
IMPOUNDMENT NAME(S):	Prindle Lake		

GENERAL DAM INFORMATION

TYPE OF DAM:	Earthen with box-culvert spillway	OVERALL LENGTH (FT):	235.5
PURPOSE OF DAM:	Recreation	NORMAL POOL STORAGE (ACRE-FT):	150
YEAR BUILT:	1952	MAXIMUM POOL STORAGE (ACRE-FT):	250
STRUCTURAL HEIGHT (FT):	11	EL. NORMAL POOL (FT):	705 msl
HYDRAULIC HEIGHT (FT):	7	EL. MAXIMUM POOL (FT):	707 msl

FOR INTERNAL MADCR USE ONLY

FOLLOW-UP INSPECTION REQUIRED: ☐ YES ☐ NO CONDITIONAL LETTER: ☐ YES ☐ NO

NAME OF DAM: Prindle Lake Dam | STATE ID #: 3-14-54-38 | NID ID #: MA01174

INSPECTION SUMMARY

DATE OF INSPECTION: June 6, 2008 | DATE OF PREVIOUS INSPECTION: April 7, 1998

TEMPERATURE/WEATHER: Overcast, drizzle, 60's | ARMY CORP PHASE I: ☐ YES ☑ NO If YES, date

CONSULTANT: Lenard Engineering, Inc. | PREVIOUS DCR PHASE I: ☑ YES ☐ NO If YES, date 2006

BENCHMARK/DATUM:

OVERALL CONDITION: POOR | DATE OF LAST REHABILITATION: Unknown

EL. POOL DURING INSP.: 705 | EL. TAILWATER DURING INSP.: 692.5

PERSONS PRESENT AT INSPECTION

NAME	TITLE/POSITION	REPRESENTING
Scott D. Charpentier, P.E.	Project Manager	Lenard Engineering, Inc.
Karen Fung	Project Engineer	Lenard Engineering, Inc.

EVALUATION INFORMATION

E1) TYPE OF DESIGN	1	E8) LOW-LEVEL OUTLET COND.	1
E2) LEVEL OF MAINTENANCE	2	E9) SPILLWAY DESIGN FLOOD	5
E3) EMERGENCY ACTION PLAN	1	E10) GENERAL CONDITIONS	2
E4) EMBANKMENT SEEPAGE	3	E11) ESTIMATED REPAIR COST ($000)	150
E5) EMBANKMENT CONDITION	3	ROADWAY OVER CREST	☐ YES ☑ NO
E6) CONCRETE CONDITION	4	BRIDGE NEAR DAM	☐ YES ☑ NO
E7) LOW-LEVEL OUTLET CAP	1		

SIGNATURE OF INSPECTING ENGINEER: Scott D. Charpentier

NAME OF DAM:	Prindle Lake Dam	STATE ID #:	3-14-54-38
		NID ID #:	MA01174

MA01174

OWNER:	ORGANIZATION	The Santos Irrevocable Trust	CARETAKER:	ORGANIZATION	Nature's Classroom
	NAME/TITLE	Carl Izzo, Trustee; Fiduciary Real Estate Advisors		NAME/TITLE	Dr. John G. Santos, Director
	STREET	125 Summer Street		STREET	19 Harrington Rd.
	TOWN, STATE, ZIP	Boston, MA 02110-1624		TOWN, STATE, ZIP	Charlton, MA 01507
	PHONE	1-617-345-3600		PHONE	1-508-248-2741
	FAX	1-617-345-3640		FAX	1-508-248-2745
	EMAIL			EMAIL	
	OWNER TYPE	Private			

PRIMARY SPILLWAY TYPE	Concrete broad crested weir (box culvert)		
SPILLWAY LENGTH (FT)	6.92	SPILLWAY CAPACITY (CFS)	65.5
AUXILIARY SPILLWAY TYPE	No auxiliary spillway	AUX. SPILLWAY CAPACITY (CFS)	N/A
NUMBER OF OUTLETS	None	OUTLET(S) CAPACITY (CFS)	N/A
TYPE OF OUTLETS	N/A	TOTAL DISCHARGE CAPACITY (CFS)	65.5
DRAINAGE AREQ (SQ MI)	0.4	SPILLWAY DESIGN FLOOD (PERIOD/CFS)	100-YR - 711 cfs

HAS DAM BEEN BREACHED OR OVERTOPPED ☑ YES ☐ NO IF YES, PROVIDE DATE(S) Overtopped 1938 Hurricane & 1955 Hurricane Diane

FISH LADDER (LIST TYPE IF PRESENT) None

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

PUBLIC BRIDGE WITHIN 50' OF DAM? ☐ YES ☑ NO IF YES, ROAD/BRIDGE NAME:

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	SURFACE TYPE	Earthen	X		
	SURFACE CRACKING	None observed	X		
	SINKHOLES, ANIMAL BURROWS	None observed	X		
	VERTICAL ALIGNMENT (DEPRESSIONS)	Some minor depressions; crest has vertical radius, higher at left abut. than right		X	
	HORIZONTAL ALIGNMENT	Satisfactory	X		
	RUTS AND/OR PUDDLES	None observed	X		
	VEGETATION (PRESENCE/CONDITION)	Grassy vegetation, some spots of bare earth (see below).		X	X
	ABUTMENT CONTACT	Satisfactory	X		

ADDITIONAL COMMENTS: Shoulders exhibit broad leaf vegetation. Some brushy vegetation on shoulder near the upstream side of right abutment.

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
	WET AREAS (NO FLOW)	1 spot to rt of spway; unable to observe most of sl due to vegetation; toe saturated		X	X
	SEEPAGE	seepage along toe with measuable flow to lt of spillway (1/2 gpm)		X	X
	SLIDE, SLOUGH, SCARP	Riprap nearer to right abutment has slid		X	
D/S	EMB.-ABUTMENT CONTACT	Satisfactory	X		
SLOPE	SINKHOLE/ANIMAL BURROWS	Unable to observe		X	
	EROSION	Unable to observe		X	
	UNUSUAL MOVEMENT	Unable to observe		X	
	VEGETATION (PRESENCE/CONDITION)	Broad leaf vegetation		X	X

ADDITIONAL COMMENTS: Remove vegetation and inspect again. Regrade and reseed
Saturated toe for most of dam length
Rip rap dumped at two locations, unable to determine why, possibly to dress erosion
Slope of 2H:1V

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S SLOPE	SLIDE, SLOUGH, SCARP	Unable to observe		X	
	SLOPE PROTECTION TYPE AND COND.	Broad leaf vegetation, some brushy vegetation, bare soil below		X	X
	SINKHOLE/ANIMAL BURROWS	Unable to observe		X	
	EMB.-ABUTMENT CONTACT	Satisfactory	X		
	EROSION	Unable to observe		X	
	UNUSUAL MOVEMENT	Unable to observe		X	
	VEGETATION (PRESENCE/CONDITION)	Broad leaf vegetation, some brushy vegetation, bare soil below		X	X

ADDITIONAL COMMENTS: 12" stump left near left abutment
Upstream face below water surface appears to be partially protected by rip rap

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
INSTR.	PIEZOMETERS	one installed, water elevation found to be 5-feet below dam crest		X	
	OBSERVATION WELLS	None observed			
	STAFF GAGE AND RECORDER	None observed			
	WEIRS	None observed			
	INCLINOMETERS	None observed			
	SURVEY MONUMENTS	None observed			
	DRAINS	None observed			
	FREQUENCY OF READINGS	None observed			
	LOCATION OF READINGS	None observed			

ADDITIONAL COMMENTS:

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

UPSTREAM AND/OR DOWNSTREAM MASONRY WALLS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S WALLS	WALL TYPE	Stone masonry terraced walls at either side of spillway outlet	X		
	WALL ALIGNMENT	Fair		X	
	WALL CONDITION	Fair		X	
	HEIGHT: TOP OF WALL TO MUDLINE	Walls appear to go from crest to midway down slope	X		
	SEEPAGE OR LEAKAGE	None		X	
	ABUTMENT CONTACT	Not applicable	X		
	EROSION/SINKHOLES BEHIND WALL	None		X	
	ANIMAL BURROWS	None		X	
	UNUSUAL MOVEMENT	None		X	
	WET AREAS AT TOE OF WALL	None		X	

ADDITIONAL COMMENTS: Grout missing in many places

NAME OF DAM: Prindle Lake Dam STAE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

DOWNSTREAM AREA

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S AREA	ABUTMENT LEAKAGE	Toe is saturated		X	X
	FOUNDATION SEEPAGE	Toe is saturated		X	X
	SLIDE,SLOUGH,SCARP	Unable to determine	X		
	WEIRS	None observed	X		
	DRAINAGE SYSTEM	None observed	X		
	INSTRUMENTATION	None observed	X		
	VEGETATION	Woody plants, brush, saplings and trees		X	X
	ACCESSIBILITY	By foot	X		
	DOWNSTREAM HAZARD DESCRIPTION	Harrington Rd: private residences and a culvert; SR 169 (Southbridge St.): L&P Paper Inc., private residences, and a bridge (near Sherwood Ln).			
	DATE OF LAST EAP UPDATE	Unknown			X

ADDITIONAL COMMENTS: Unable to determine slide due to recently dumped rip rap.

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

MISCELLANEOUS

AREA INSPECTED	CONDITION	OBSERVATIONS
MISC.	RESERVOIR DEPTH (AVG)	8-10 feet
	RESERVOIR SHORELINE	Vegetated w/ grass, brush, trees. Private residences.
	RESERVOIR SLOPES	Unknown
	ACCESS ROADS	Dirt road (Oak Ridge Drive) and dirt foot paths
	SECURITY DEVICES	No special devices; timber rail along spway top; fencing along left shores
	VANDALISM OR TRESPASS	YES: ☐ NO: ☑ WHAT:
	AVAILABILITY OF PLANS	YES: ☐ NO: ☑ * DATE:
	AVAILABILITY OF DESIGN CALCS	YES: ☐ NO: ☑ * DATE:
	AVAILABILITY OF EAP/LAST UPDATE	YES: ☐ NO: ☑ * DATE:
	AVAILABILITY OF O&M MANUAL	YES: ☐ NO: ☑ * DATE:
	CARETAKER/OWNER AVAILABLE	YES: ☐ NO: ☑ DATE:
	CONFINED SPACE ENTRY REQUIRED	YES: ☐ NO: ☑ PURPOSE:

* UNKNOWN

ADDITIONAL COMMENTS:

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

PRIMARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	Broad crested weir; cast in place concrete box culvert (slab-over design)	X		
	WEIR TYPE	Broad crested weir	X		
	SPILLWAY CONDITION	Satisfactory; culvert top slab is spalled.		X	X
	TRAINING WALLS	7' long curved MSE wingwalls U/S; cracked grout		X	X
	SPILLWAY CONTROLS AND CONDITION	No controls observed	X		
	UNUSUAL MOVEMENT	None observed	X		
	APPROACH AREA	Satisfactory	X		
	DISCHARGE AREA	Channel sides defined w/ rocks/riprap		X	
	DEBRIS	Some debris		X	X
	WATER LEVEL AT TIME OF INSPECTION	18" deep at entrance; 1" over spway at exit	X		

ADDITIONAL COMMENTS: A large piece of ledge sits at the exit of the spillway but does not appear to be elevated above the spillway floor.

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

AUXILIARY SPILLWAY

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

ADDITIONAL COMMENTS:

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	N/A			
	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: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

CONCRETE/MASONRY DAMS

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

ADDITIONAL COMMENTS:

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

CONCRETE/MASONRY DAMS

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

ADDITIONAL COMMENTS:

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

CONCRETE/MASONRY DAMS

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

ADDITIONAL COMMENTS:

NAME OF DAM: Prindle Lake Dam STATE ID #: 3-14-54-38

INSPECTION DATE: June 6, 2008 NID ID #: MA01174

CONCRETE/MASONRY DAMS

AREA INSPECTED	CONDITION	OBSERVATIONS
CREST	TYPE SURFACE CONDITIONS CONDITIONS OF JOINTS UNUSUAL MOVEMENT HORIZONTAL ALIGNMENT VERTICAL ALIGNMENT	N/A

ADDITIONAL COMMENTS:

APPENDIX C
Previous Reports and References

PREVIOUS REPORTS AND REFERENCES

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

1. Department of Environmental Management, Office of Dam Safety, Inspection/Evaluation Report – Prindle Lake Dam, prepared by Fay Engineering Services for the DEM, Thorndike, MA, 1998.

2. Prindle Lake Dam Phase I Inspection / Evaluation Report, prepare by Lenard Engineering, Inc., September 2006

3. Prindle Lake Dam Poor and Unsafe Condition Dam Follow-up Inspection, prepare by Lenard Engineering, Inc., April 2008

4. Prindle Lake Dam Phase II Dam Evaluation Report, prepared by Lenard Engineering, Inc., April 2008

APPENDIX D
Definitions and Abbreviations

COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to 302 CMR10.00 Dam Safety, or other reference published by FERC, Dept. of the Interior Bureau of Reclamation, or FEMA. Please note should discrepancies between definitions exits, 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;low level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

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

Size Classification

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

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

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

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

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

Hazard Classification

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

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

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

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

General

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

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

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

Acre-foot – Shall mean a unit of volumetric measure that would cover one acreto a depth of one foot. It is equal to 43,560 cubic feet. On million U.S. gallons = 3.068 acre feet
Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

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

Condition Rating

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

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

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

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

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

Abbreviations

Abut – abutment
U/S – upstream
Lt - left
D/S – downstream
LL – low level
Rt - right