

INSPECTION OF CUSHMAN POND DAM

LOVELL, MAINE

National ID: ME00556

State ID: 01645

*Submitted to:*

Town of Lovell and Kezar Lake Watershed Association  
Lovell, Maine

*Submitted by:*

MBP Consulting  
Portland, Maine

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July 2001

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## 1.0 INTRODUCTION

In accordance with the agreement for professional engineering services between the Town of Lovell (Town), Kezar Lake Watershed Association (KLWA), and MBP Consulting (MBPC) dated June 22, 2001, MBPC has performed the inspection of Cushman Pond Dam and prepared the report of the findings. This report contains a review of the project data, results of the visual observation of the project facilities, assessment, and recommendations.

The purpose of this inspection is to assess condition and recommend remedial measures to improve the integrity, operational reliability, and public safety of the dam.

## 2.0 PROJECT DESCRIPTION

Cushman Pond Dam (National ID # ME00556, State ID # 01645) is located on the Kezar Lake watershed, on an unknown stream (aka Cushman Pond Brook), a tributary to Little Trout Brook, in the Town of Lovell, Oxford County, Maine. According to the National Inventory of Dams, Cushman Pond Dam was built in 1898. The dam is owned and operated by the Town of Lovell.

The dam impoundment, Cushman Pond, has a surface area of 32 acres and maximum storage of 150 acre-ft and is used for fish and wildlife conservation, recreation, and fire protection. The pond is stocked with brook trout twice a year by the Maine Department of Inland Fisheries and Wildlife.

The dam and impoundment are shown on the USGS "North Waterford" Quadrangle Map with the impoundment water level at elevation 773 feet National Geodetic Vertical Datum (Figure 1). The dam is classified as a small size structure (the dam height is less than 40 ft, impoundment storage between 50 and 1,000 acre-ft) with low hazard potential<sup>1</sup>.

The 9-ft-high, 65-ft-long dry-laid stone masonry dam consists of a sluiceway flanked on each side with north and south walls. The type of dam foundation is unknown. A schematic sketch prepared during this inspection shows a plan, downstream view, and sections of the dam (Figure 2). The following description of the dam is based on the available project information and visual observations during this inspection which included an approximate dimensional survey.

The 10-ft-long sluiceway is located in the middle of the dam. The sluice opening is 6.5 ft wide with a sill at 2 ft below the top of the dam. The sluice acts as an uncontrolled broad-crested weir with no provisions made for a gate or stoplogs. The sluice opening is protected with three steel trashracks or screens stacked over each other. Each trashrack has different opening size ranging from ¼ inch to 1 inch. The trashracks are supported at the top with a 8-inch, 14-ft-long pressure

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<sup>1</sup> According to the Federal Emergency Management Agency, dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

treated wooden pole laid over the sluice opening. The access to the trashracks is provided by a 16-inch-high, 12-ft-long steel beam spanning the sluice.

The north wall abutting the sluiceway on the north side is approximately 30 ft long and 2 ft wide at the top. The north end of the wall is connected to a large, 10-ft-long, 6-ft-wide boulder.

The south wall flanking the spillway on the south side is approximately 25 ft long. The top of the dike provides access to the sluice. The south end of the wall is embedded in the access road fill which serves as the dam abutment.

### 3.0 PROJECT INFORMATION

The dam does not have engineering plans, survey or geotechnical data, and operation, maintenance, and repair records. The Cushman Pond Dam database sheet obtained from the Maine Dams Registration Master Report prepared by the Maine Department of Environmental Protection, January 23, 1993 is included in Appendix A of this report. The datasheet is corrected based on information collected from the National Inventory of Dams (1997) developed by the U.S. Army Corps of Engineers.

The bottom of the pond was reportedly drilled from a barge by the Maine Geological Survey four to five years ago. However, no geological data was available for review from that investigative program.

Three photographs of the dam dated July or August 1999 (Appendix A) and obtained from KLWA were reviewed.

The recent improvements to the dam included repair of a leaking sinkhole on the upstream side of the north wall located at the base of a large tree (August 2000), installation of a rubber sheet blanket on the upstream face of the sluiceway to reduce leakage through the stone masonry, and installation of a steel beam over the sluice opening to provide access to the trashracks.

### 4.0. PROJECT OPERATION AND MAINTENANCE

In general, the pond level is controlled by the sluice sill elevation and varies depending on precipitation, evaporation, hydraulic capacity of the sluice, and leakage through the dam. The normal summer pond (full pond) is reportedly maintained near the sluice sill elevation. The maximum pond occurs in the spring with the level near the top of the dam. During the fall and winter, the pond is at the minimum level, about 1 ft below the sluice sill. The total annual water level fluctuation in the pond is approximately 3 ft.

The pond was infested with milfoil (Eurasian watermilfoil variety) a few years ago. The milfoil is an aggressive aquatic plant that can form dense mats of vegetation, displace native aquatic

plants, clog boat propellers, and jeopardize recreation activities. To protect the Kezar Lake watershed from spreading the milfoil, two filtration barriers, approximately 10 ft apart, were installed upstream of the dam in 1999 and 2000. The barrier screens extend between the dam abutments and consist of geotextile fabric with openings about 1/4 inch by 3/8 inch.

The dam has an insufficient hydraulic capacity and has been reportedly overtopped or nearly overtopped during significant flood events causing damage to the structure. Ice movement at the site has resulted in additional damage to the structure, sluice trashracks, and geotextile filtration barriers.

Beaver activities at the dam were reported in the recent past. In the last 5 years, beavers were once trapped and transported from the site.

The condition of the dam has reportedly deteriorated significantly in the last 5 to 10 years resulting in movement, displacement, and loss of stone masonry, development of sinkholes, and an increase in seepage through and around the dam.

## 5.0 FIELD INSPECTION

The inspection of the dam was performed on July 10, 2001 by Myron Petrovsky of MBPC assisted by Gerald Nelson (KLWA). Mr. Nelson was interviewed on the project data, events, repairs, and operation and maintenance. The inspection was conducted on a cloudy day with the ambient temperature about 66 degrees. At the start of the inspection, the pond level was near the sluiceway sill or approximately 2 ft below the top of the dam.

The inspection was performed by visually observing the accessible dam features. The structures, abutments, upstream approach channel, and downstream discharge channel were observed for signs of weathering, deterioration, erosion, cracking, movement, seepage, leakage, undermining, vegetation, siltation, and accumulation of debris. Photographs showing the condition of the dam at the time of the inspection are presented in Appendix B. A general view of the dam is shown on Photos B-1 and B-2.

Sluice. The sluice appeared to be in poor condition (Photos B-3 through B-6). The stone masonry forming the sluice opening was uneven with some granite blocks displaced at the top. The masonry contained open voids, typical for this type of construction, and apparently had insufficient interlocking capacity resulting in creating a 1 ft to 1.5 ft-deep cavity in the south wall of the opening due to missing stone. A smaller cavity was also observed in the north wall below the sluice sill. The roots from a large tree located immediately downstream of the sluice were penetrating into the south wall contributing to dislodging and moving the masonry. The sluice sill stone blocks appeared to be intact and in sound condition. No leakage was observed below and around the sill apparently due to the rubber blanket installed on the upstream face of the sluice below the sill.

The inner, 1-inch opening steel trashracks immediately adjacent to the sluice were deeply corroded. The upstream trashrack screen was built with a ¼ - inch square wire mesh and the third, outer trashrack screen contained ½ - inch openings. The ¼ - inch and ½ - inch trashracks were bent noticeably inward reportedly by ice impact. All trashracks were densely clogged with leaves and twigs to a level about 1 ft above the sill. The 8-inch pressure treated log providing trashrack support appeared to be intact. The 16-inch-wide steel beam spanning the sluice opening was moderately corroded but appeared sound.

South Wall. The north wall appeared to be in poor condition (Photos B-1 through B-3). The top granite blocks showed signs of movement and displacement with open joints and voids. The upstream face of the structure was silted to a level about 1 ft below the top of the wall. The downstream face, constructed of rounded stone, exhibited numerous voids and signs of movement. The toe of the wall was heavily wooded with brush and trees. The south end of the wall was filled with sand and gravel and became a part of the access road.

North wall. The north wall was in poor condition and appeared to be in the worst state of all three dam structures (Photos B-7 and B-8). The top stone blocks of the wall were observed only at the ends of the structure and were missing in the middle. That area of the wall was apparently washed out in the past creating a significant, 6 to 10-inch-deep depression filled with debris and dead wood. The north end of the wall was tied to a large boulder and leakage was observed around the boulder and possibly at the boulder-wall interface. The leakage appeared to be moderate with an estimated flow of 5 to 10 gallons per minute (gpm). Additional leakage, about 10 gpm, was noted at the downstream toe of the wall at the area about 10 ft from the sluice and across a large upstream tree where the sinkhole was repaired in August 2000. A low area in the dam abutment evidently diverting flow during high water was observed north of the large boulder. The toe of the wall was covered with a large amount of dead wood and overgrown with trees and brush obstructing the inspection.

Approach Channel. The upstream approach channel appeared to be free from large trees and debris that could obstruct movement of water toward the dam. The channel at the dam was filled with silt to a level 1 ft below the sluice sill elevation reducing the hydraulic efficiency of the sluice. Two geotextile fabric barriers installed in 1999 and 2000 to control floating milfoil fragments appeared to be in fair to poor condition (Photo B-1). The barriers contained large holes and tears from impact of moving ice and debris.

Downstream Channel. The discharge channel immediately downstream of the dam contained a significant amount of debris. Large trees were growing on the stream bed and banks which may obstruct free movement of water during major storm events.

## 6.0 ASSESSMENT

On the basis of the July 10, 2001 field inspection, review of the project data, and the interview with the KLWA, the following assessment was made:

1. In general, Cushman Pond Dam appears to be in poor condition. Although no signs of immediate failure of the dam were observed, there are concerns which may present a threat to the integrity of the dam and its intended operation. The major concerns are progressive deterioration of the dam, partial washout of the north wall, leakage through the masonry and north dam abutment, large trees growing at the dam, difficulties with operation of the sluice trashracks, inadequate hydraulic capacity of the dam, and unreliable measure to control milfoil fragments.
2. The dam, constructed of dry-laid masonry, contains numerous open voids and joints. The masonry has insufficient interlocking capacity resulting in displacement and downstream movement of stones and loss of significant amount of stone at many locations, notably at the south sluice wall and north wall. Continuing deterioration and loss of masonry may jeopardize the integrity and stability of the dam. The dam condition has reportedly deteriorated in the last 5-10 years with observed progressive movement of masonry and increase in seepage.
3. The north wall experienced a partial washout in the past causing formation of a 6-10-inch-deep depression in the top of the wall filled with dead wood and debris. The reduced height of the dam can cause more frequent overtopping and additional removal of masonry at that area.
4. In general, due to the type of construction, the dam is not watertight and cannot hold the pond at the elevation about 1 ft below the top of the dam or 1 ft above the sluice sill. With the pond level above that elevation, water will flow through open voids in the masonry and over the low areas in the north wall and north dam abutment. Leakage was observed at the north wall with water seeping around the large abutment boulder, at the boulder-wall interface, and through the masonry at the middle section. The leakage may contribute to further deterioration of the masonry by freeze-thaw action and reduction in the dam impounding capacity.
5. The dam is heavily wooded with large trees. The tree roots were observed penetrating into the dam loosening and dislodging the masonry. The roots may also contribute to development of seepage and voids in the masonry and dam foundation. A large sinkhole was reported at the base of a tree growing on the upstream side of the north wall. The sinkhole conveyed a significant amount of water under the dam and required repair last year.
6. The sluiceway was built without a gate or stoplogs and acts as an uncontrolled overflow spillway. As such, the sluice cannot control the pond level, store water during the spring

runoff, and gradually release water during dry seasons. The sluice does not have the ability to lower the pond below the sill elevation. The existing steel sluice trashrack system appears to be cumbersome and difficult to operate and maintain. The two upstream screens are bent, silted at the bottom, and not easily removed. The downstream trashracks are heavily corroded and appear structurally unsound. All screens were densely clogged with debris impeding flow movement.

7. The dam apparently has inadequate hydraulic capacity and was reportedly overtopped or nearly overtopping during significant flood events in the recent past. Overtopping may result in dislodging and undermining the masonry with a potential for a failure of the dam. More frequent overtopping is mitigated by leakage between the upper stone blocks and a partial diversion of flow through the low area in the north dam abutment and depression in the north wall.
8. Two geotextile fabric barriers installed in the last two years upstream of the dam to control milfoil from entering into the brook should be considered as a temporarily measure. The fabric has experienced considerable damage by ice and debris impact and contains large voids and tears allowing passage of milfoil fragments. After passing the fabric barriers, small milfoil pieces can float downstream through open voids in the dam masonry.
9. There are no formal written operation and maintenance procedures in effect to control the impoundment level, routinely inspect the condition of the dam, and regularly provide necessary repairs.

## 7.0 RECOMMENDATIONS

### A. Remedial Measures

To improve the integrity, operational reliability, and public safety of Cushman Pond Dam, it is recommended that the Town and KLWA obtain the services of a registered professional engineer experienced in the design and construction of dams to implement the following remedial measures:

1. Replace or rehabilitate the north and south walls to provide adequate protection against leakage, seepage, erosion, and bypassing during high water. The top of the walls should be established with a sufficient freeboard to reduce the potential for overtopping of the dam.
2. Replace the sluiceway with a new structure. The new sluiceway should have sufficient hydraulic capacity to safely pass the design flood. Based on the size of the dam and hazard classification, the design storm should be selected between the 50-year to 100-year flood. The sluice should be equipped with a gate to provide reliable control of the

pond level and contain trashracks and a screen for debris and milfoil control. The sluice sill elevation should be selected based on required drawdown of the pond.

B. Operation and Maintenance

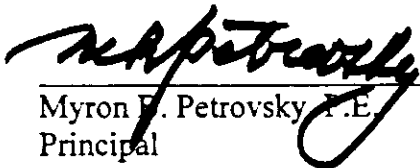
To improve operation and maintenance of the dam, it is recommended that the Town and KLWA implement the following measures:

1. Cut and remove brush and trees from the upstream and downstream areas and abutments of the dam.
2. Establish written operation and maintenance procedures at the dam. The procedures should include the following:
  - A schedule and guidelines for regular maintenance of the dam such as brush and tree removal, debris control, and repair of deteriorated structures.
  - A schedule and guidelines for maintaining the operating and flood levels in the impoundment.
  - A schedule and guidelines for inspection and monitoring of the dam including a checklist of inspection items. The inspection of the dam should be conducted annually and immediately after significant floods, heavy rainfall, hurricanes or other major project events. The observation findings should be recorded in a maintenance log.

**8.0 CERTIFICATION**

As authorized by the Town of Lovell and Kezar Lake Watershed Association, Maine, MBP Consulting has completed the inspection report for Cushman Pond Dam. The dam was inspected in accordance with our contract agreement dated June 22, 2001.

MBP CONSULTING

  
 Myron B. Petrovsky, P.E.  
 Principal



Date 7.24.01

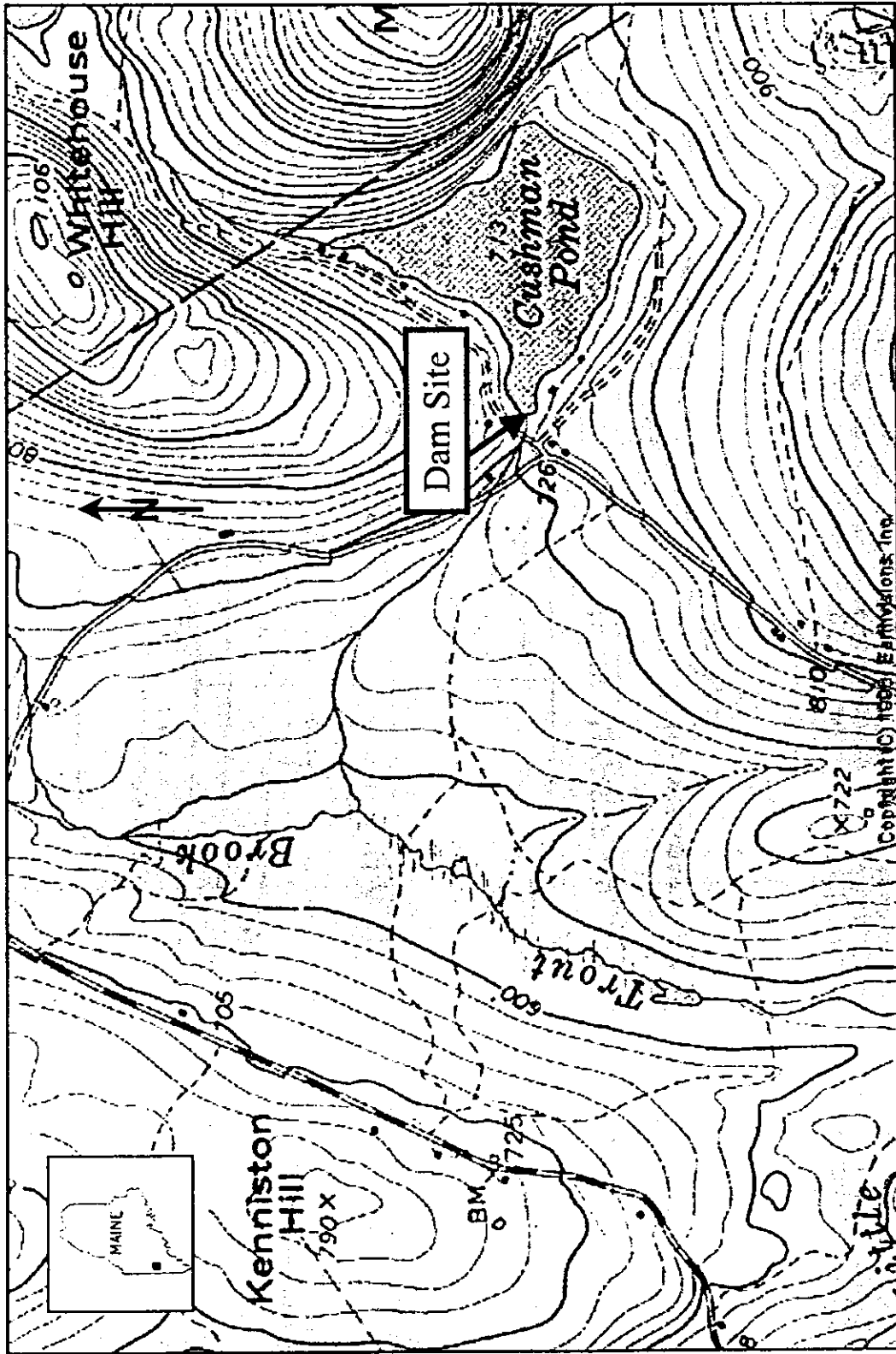


Figure 1. Location Map: Cushman Pond Dam, Lovell, ME. Ref.: USGS Quadrangle Map "North Waterford", Scale ~ 1" = 2000'