-- *SHAKER MILL POND DAM* --

PHASE I

INSPECTION / EVALUATION REPORT

Dam Name:	***Shaker Mill Pond Dam***
National ID No.:	***MA 00732***
Owner:	***Town of West Stockbridge***
Town:	***West Stockbridge***
Consultant:	***Foresight Land Services, Inc.***
Date of Inspection:	***August 8, 2023***

FORESIGHT
LAND SERVICES, INC.

ENGINEERING · SURVEYING · PLANNING · ENVIRONMENTAL SERVICES

EXECUTIVE SUMMARY

This Phase 1 Inspection/Evaluation Report details the inspection and evaluation of the Shaker Mill Pond Dam (NID #MA00732), located on Route 102/41 in the Town of West Stockbridge Massachusetts. Foresight Land Services, Inc. of Pittsfield, Massachusetts conducted the inspection on August 8, 2023.

The Shaker Mill Pond Dam is classified as an **Intermediate** size, **High Hazard Dam Potential (Class 1)** dam. In general the dam was found to be in **Satisfactory** condition with some deficiencies noted. Although the current owners maintain the dam regularly, it shall be noted that a formal Operation and Maintenance Plan is not available. Also, it is our recommendation that a detailed Hydraulic and Hydrologic Study be performed to assess the outlet works and emergency spillway.

The previous inspection performed on the dam was completed on September 16, 2020. Since that inspection, the following has occurred:

- Monitoring of boil at downstream toe – little to no change
- Maintenance mowing and clearing of spillway debris

Foresight Land Services, Inc. recommends the following action be taken to address the deficiencies found at the dam.

- Continue to monitor boil at downstream toe
- Repair/monitor minor sinkhole at downstream right training wall / Monitor wall movement
- Repair erosion at upstream right embankment
- Replace/repair eroded low level conduits at outlet
- Clean and caulk concrete joints in downstream abutment
- Prepare formal Operation & Maintenance plan
- Perform structural and seepage stability analysis

These repairs should be made in accordance with specifications provided by a qualified engineering company and, in many cases, will require site analyses to confirm the extent and materials/methods used for the repairs, and all applicable environmental permits.

Dam Evaluation Summary Detail Sheet

1. NID ID:	**MA 00732**	**4. Inspection Date:**	**August 8, 2023**
2. Dam Name:	**Shaker Mill Pond Dam**	**5. Last Insp. Date:**	**September 16, 2020**
3. Dam Location:	**W. Stockbridge, MA**	**6. Next Inspection:**	**August 8, 2025**
7. Inspector:	**Steven A. Mack, P.E.**		
8. Consultant:	**Foresight Land Services, Inc.**		
9. Hazard Code:	**High**	**9a. Is Hazard Code Change Requested?:**	**No**
10. Insp. Frequency:	**2 Years**	**11. Overall Physical Condition of Dam:**	**SATISFACTORY**
12. Spillway Capacity (% SDF)	**0-50% of the SDF or Unknown**		

E1. Design Methodology:	**3**	**E7. Low-Level Discharge Capacity:**	**4**
E2. Level of Maintenance:	**4**	**E8. Low-Level Outlet Physical Condition:**	**4**
E3. Emergency Action Plan:	**4**	**E9. Spillway Design Flood Capacity:**	**1**
E4. Embankment Seepage:	**2**	**E10. Overall Physical Condition of the Dam:**	**4**
E5. Embankment Condition:	**4**	**E11. Estimated Repair Cost:**	**$134,500 - $184,600**
E6. Concrete Condition:	**4**		

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 assessment of the general condition of the dam reported herein was based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations were beyond the scope of this report unless reported otherwise.

In reviewing this report, it should be realized that the reported condition of the dam was based on observations of field conditions at the time of inspection, along with data available to the inspection team.

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 reported 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.

Steven A. Mack, P.E.
Massachusetts License No.: 41744
License Type: Civil

Principal Engineer
Foresight Land Services, Inc.

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SECTION 1

1.0 DESCRIPTION OF PROJECT

1.1 General

Note: Portions of the data contained in this report have been taken from past reports and modified and/or confirmed in the field. See Appendix C for a list of reports used.

1.1.1 Authority

The Town of West Stockbridge retained Foresight Land Services, Inc. to perform a visual inspection and develop a report of conditions for the dam at the Shaker Mill Pond along the Williams River in West Stockbridge, Berkshire County, Massachusetts. 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 was 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 was 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

The Shaker Mill Pond Dam is located at the downstream end of Shaker Mill Pond at 42.334864 Latitude and -73.367967 Longitude in downtown West Stockbridge, MA. Routes 102 and 41 cross the crest of the dam. The dam can be accessed from Exit 1 (West Stockbridge) off the Massachusetts Turnpike (Interstate 90). Turn right off the exit ramp and then left on to Route 102. The dam is located where Route 102 crosses over the Williams River. The Dam discharges into the Williams River which flows through downtown West Stockbridge and then flows into the Housatonic River. The Shaker Mill Pond drainage area is located within the Towns of West Stockbridge; Richmond; Lenox; Canaan, New York; and Austerlitz, New York, an aerial photo of the dam is shown in Figure 2.

1.2.2 Owner/Caretaker

The Shaker Mill Pond was acquired by the Town of West Stockbridge in 1965 from the Southern Berkshire Power Company. The Department of Public Works Highway Superintendent, Mr. Curt Wilton, is the primary caretaker of the dam. See Table 1.1 for current owner and caretaker data (names and contact information).

1.2.3 Purpose of the Dam

The dam was originally constructed to provide hydropower to the adjacent "Shaker Mill". The Town has recently installed new hydroelectric turbines and has completed water quality testing at the pond under the regulations of the Massachusetts Fish and Wildlife Services to determine if reactivation of the hydroelectric generator can be achieved without negatively impacting the fish and wildlife associated with Shaker Mill Pond and the Williams River. See Table 1.1 for the current purpose of the dam.

1.2.4 Description of the Dam and Appurtenances

The Shaker Mill Pond Dam is a 100 foot long earthen embankment dam with a 33 foot by 18 foot tall concrete primary spillway and a hydroelectric generator vault. Route 41/102 crosses the embankment of the upstream spillway channel by a bridge that was reconstructed in 2007.

The upstream face of the embankment is sloped at approximately 1H:1V to 2H:1V and is protected with filter fabric covered by rip rap. The downstream face of the embankment is sloped at approximately 8H:1V to 10H:1V on the right and 4H:1V on the left. The Shaker Mill building and a small gravel parking area is located on the right abutment area and a building containing professional office space is located beyond the left abutment area. The roadway over the crest is approximately 36 feet wide and there is approximately 1 to 2 feet of clearance between the low chord of the bridge and the normal pool elevation of the impoundment.

The concrete bridge abutments serve as the training walls for the dam spillway. Upstream of the spillway, an inner right training wall narrows the approach channel to allow for a generator vault which is located between the weir and the outer right training wall.

Downstream of the vault, the inner training wall terminates, forming a stilling basin. The outer training wall then angles back toward the spillway discharge channel and then parallel to the flow of the Williams River. The training wall transitions from concrete to stone masonry and continues south as a channel training wall through downtown West Stockbridge. Prior to 2009, the right outer training wall was approximately 38 inches higher than the top of the inner training causing the generator vault to overtop. The inner training walls were raised (on both sides of the dam) in 2009 to prevent the generator vault and left training wall from overtopping. The height of the dam measured from the top of the primary right training wall was 17 feet to the downstream toe. The total structural height of the dam is 18 feet. Hydraulic impact evaluation of this repair was not available.

The generator vault is covered with open galvanized grating and includes a vertical downstream wall. The water surface elevation in the vault was measured to be equal to the water surface elevation in the downstream channel. The vault has recently been outfitted with two hydroelectric turbines.

The concrete spillway is approximately 33 feet in length and is sloped at approximately 1H:1V on the downstream side. Two low-level outlet pipes penetrate the spillway structure. The right outlet is reported to be a 36 inch diameter ferrous pipe with a gate at the upstream end of the pipe. The left outlet is reported to be a 46 inch diameter ferrous pipe (Fuss & O'Neill, 2008). Flow over the spillway prevented measurement of the pipes during the inspection. The gates are hydraulically operated from a control house located adjacent to the right upstream spillway training wall.

Shaker Mill Pond is a long, narrow, shallow, north to south impoundment with gentle to moderately sloping banks. The normal pool surface area of the impoundment is reported to be 30.2 acres (Fuss & O'Neill) and is measured to be 30.1 acres ± using 2009 color orthophotos obtained from MassGIS.

The maximum pool and Spillway Design Flood (SDF) pool areas were estimated to be approximately 112 acres and 330 acres using 1:24,000 USGS quadrangle titles obtained from MassGIS. The maximum pool and SDF pool surface areas are reported (Fuss & O'Neill, 2008) as 111.8 acres and 330 acres. The estimated values were obtained as the area of land shown on the USGS map approximately 5 feet (maximum pool) and 15 feet (SDF pool) above the normal pool elevation. These elevations correspond to the top of the dam (maximum pool) and approximately 10 feet above the top of the dam (SDF pool), based on a 1987 report by Keyes Associates.

1.2.5 Operations and Maintenance

The Town of West Stockbridge Director of Public Works, Mr. Curt Wilton, performs the operations and maintenance duties at the dam. An operations and maintenance plan was not available at the time of the inspection. Department of Public Works employees informally inspect the dam on a daily basis, remove debris from the spillway as needed, and mow the embankments frequently. The water surface elevation is also checked daily and more frequently during storm events, as reported by Town officials as part of this inspection.

1.2.6 DCR Size Classification

Shaker Mill Pond Dam has a height of dam of approximately 18 feet and a maximum storage capacity of 466 acre-feet. Refer to Appendix D for definitions of height of dam and storage. 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, Shaker Mill Pond Dam is an Intermediate size structure.

1.2.7 DCR Hazard Potential Classification

Shaker Mill Pond Dam is located upstream of moderate to densely developed downtown West Stockbridge area which consists of residential and commercial properties. Since the Williams River is channeled through the downtown area, it appears that a failure of the dam at maximum pool would lead to flooding of downtown West Stockbridge resulting in possible loss of life and probable damage to homes and commercial facilities and potentially important public utilities. 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, Shaker Mill Pond Dam should be classified as a High hazard potential dam. The Hazard Potential Classification recommendation is consistent with the Hazard Potential Classification on record with the Office of Dam Safety for Shaker Mill Pond Dam.

1.3 Pertinent Engineering Data

1.3.1 Drainage Area

The drainage area for Shaker Mill Pond Dam is approximately 32.6 square miles extending through the communities of West Stockbridge; Stockbridge; Richmond; Lenox; Canaan, New York; and Austerlitz, New York. The area closest to the dam consists of relatively flat valleys, several lakes, and large areas of wetlands. The outlying areas are steeper near the West Stockbridge and Lenox Mountain ranges.

1.3.2 Reservoir

See Table 1.1 for data about normal, maximum, and spillway design flood (SDF) pools. The normal pool volume was previously calculated as 119 acre-feet, with a maximum pool volume of 466 acre-feet and the spillway design flood (SDF) volume of 2,771 acre-feet.

1.3.3 Discharges at the Dam Site

There are no gauges located at the dam; therefore no record of discharges is available. It is known that the dam overtopped in 1948 causing considerable damage to the dam structure and flooding of the downtown area.

1.3.4 General Elevations (feet)

A.	Top of Dam	900.1*
B.	Spillway Design Flood Pool	910.8*
C.	Normal Pool	893.9*
D.	Spillway Crest	893.9*
E.	Generator Vault Gate	896.0*
F.	Upstream Water at Time of Inspection	892.4±
G.	Downstream Water at Time of Inspection	885.5±
H.	Streambed at Toe of the Dam	882.1*
I.	Low Point along Toe of the Dam	882.1*

* Reported Value

1.3.5 Main Spillway Data

A.	Type	Concrete – Spillway
B.	Weir Length	33 feet
C.	Weir Crest Elevation	893.9*
D.	Upstream Channel	Trained to Approximately 40 feet in Width Below Route 41/102 Bridge with Perpendicular Concrete Wall Transitions
E.	Downstream Channel	30-40 Foot Wide with Vertical Walls
F.	Downstream Channel Bottom Elevation	882.1*

* Reported Data

1.3.6 Outlet Data

There are two hydraulically operated low level outlet pipes, one 36 inch and one 46 inch, which extend through the concrete spillway. The hydraulically operated gates located at the upstream end of the pipes are operated using the control panel located within a housed structure on the right abutment of the dam. The inverts of the 36 inch and 46 inch outlet pipes are reported to be at an elevation of 885±.

1.3.7 Design and Construction Records and History

It is reported that there are construction records for the dam, as designed in 1909 by Barnes & Spaulding Engineers, in existence. We did not have access to these plans for this report. The dam was completed in 1910 and was originally used to power the Shaker Mill building located at the right abutment of the dam. The hydroelectric generator was installed in 1927 and power generation continued through the mid-1950s.

A storm in 1948 caused the dam to overtop resulting in significant damage to the dam and the Main Street Bridge. The dam was repaired and the right abutment was reconstructed and the spillway elevation was lowered by 1 foot. The Town of West Stockbridge acquired the dam from the Southern Berkshire Power Company in 1965. The dam was in poor condition at the time and significant repairs were completed in 1972.

Additional repairs were completed by the Massachusetts Department of Environmental Management (DEM) in 1995 according to designs by Goodkind & O'Dea. In 2006, MassDOT (formally MassHighway) performed extensive reconstruction on the Route41/102 Bridge that currently crosses the dam embankment.

In 2009, the Town installed two new hydroelectric generators in the generator vault, repaired erosion to the left training wall, and raised the training walls to avoid future erosion.

In 2017, the left downstream channel wall/embankment (directly adjacent to the downstream training wall) failed due to a failed highway drain outlet. The Town repaired this failure in the fall of 2017.

1.3.8 Operating Records

A record of the daily/weekly monitoring of the dam is kept in a log book located within the control cabinet on the right abutment of the dam. Entries include weather conditions and comments on the general operation of the dam and reasons for valve operation.

1.4 Summary Data Table

Table 1.1 on the following page is a summary of the Shaker Mill Pond Dam's characteristics that were determined during inspection or were provided from other sources if they were unavailable or unobservable at the time of inspection.

1.1 Summary Data Table

Required Phase I Report Data	Data Provided by the Inspecting Engineer
National ID #	MA 00732
Dam Name	Shaker Mill Pond Dam
Dam Name (Alternate)	Shaker Mill Dam
River Name	Williams River
Impoundment Name	Shaker Mill Pond
Hazard Class	High
Size Class	Intermediate
Dam Type	Earth Embankment with Concrete Spillway
Dam Purpose	Recreation, Former & Future Hydropower
Structural Height of Dam (feet)	18
Hydraulic Height of Dam (feet)	11.8
Drainage Area (sq. mi.)	32.5
Reservoir Surface Area (acres)	0.047
Normal Impoundment Volume (acre-feet)	119±
Max Impoundment Volume ((top of dam) acre-feet)	466±
SDF Impoundment Volume* (acre-feet)	2,771
Spillway Type	Concrete Weir
Spillway Length (feet)	33'
Freeboard at Normal Pool (feet)	5
Principal Spillway Capacity* (cfs)	1,500 (reported)
Auxiliary Spillway Capacity* (cfs)	N/A
Low-Level Outlet Capacity* (cfs)	Unknown
Spillway Design Flood* (flow rate - cfs)	1/2 PMF / 16,300
Winter Drawdown (feet below normal pool)	N/A
Drawdown Impoundment Vol. (acre-feet)	Unknown / likely approaches 0 (negligible volume)
Latitude	42.334864
Longitude	-73.3679967
City/Town	W. Stockbridge
County Name	Berkshire
Public Road on Crest	Route 102/41
Public Bridge over Spillway	Route 102/41
EAP Date (if applicable)	2015
Owner Name	Town of West Stockbridge
Owner Address	21 Stateline Road
Owner Town	West Stockbridge, MA 01266
Owner Phone	(413) 232-0319
Owner Emergency Phone	(413) 441-4318
Owner Type	Municipality or Political subdivision
Caretaker Name	Curt Wilton, DPW Director
Caretaker Address	21 Stateline Road
Caretaker Town	West Stockbridge, MA 01266
Caretaker Phone	(413) 232-0305
Caretaker Emergency Phone	(413) 232-4151
Date of Field Inspection	8/8/2023
Consultant Firm Name	Foresight Land Services, Inc.
Inspecting Engineer	Steven A. Mack, P.E.
Engineer Phone Number	(413) 499-1560

SECTION 2

2.0 INSPECTION

2.1 Visual Inspection

The Shaker Mill Pond Dam was inspected on August 8. 2023. At the time of the inspection, the weather was cloudy and overcast with recent rain. 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 approximately 893.9 at the crest. Underwater areas were not inspected. A copy of the inspection checklist is included in Appendix B.

2.1.1 General Findings

In general, Shaker Mill Pond Dam was found to be in **Satisfactory** condition with minor deficiencies noted**.**

Based on the E10 – Overall Safety Rating Guideline, the dam shall not be higher than the lowest ranking in categories: E4 Seepage, E5 Embankment Condition, and E6 Concrete Condition. As can be seen under the "Dam Evaluation Summary Sheet" the item E4 Seepage is ranked as a 2 (Evidence of Piping and Seepage). This ranking is due to the "boil" located within the downstream right channel adjacent to the hydro generation vault. This boil has been evaluated by Fuss and O'Neil in 2009 and their findings are attached to this report. In that report they note clear boil at the right downstream channel and they concluded:

> Although the seepage condition rating is 'poor' following ODS requirements (evidence of monitored piping and seepage), given the history and the involvement of DEM in the past construction and inspection of the boil, it appears unlikely to constitute a significant structural deficiency and thus does not warrant a 'poor' overall dam condition rating. It is recommended, however, that the Town continue to monitor the boil regularly, as they have since 1995 and observe the embankment for signs of settlement or void formation.

Our observations at the time of the current inspection align with the 2009 report and we recommend the same monitoring of the boil.

The specific concerns are identified in more detail in the sections below:

2.1.2 Dam

- Abutments

  The abutments of the Shaker Mill Pond Dam were in generally good condition. The easterly downstream training wall was repaired in 2017. There is minor spalling on the upstream face of the left concrete bridge abutment. Right downstream wall has a small sinkhole adjacent to an existing culvert outlet and wall stones appear to be moving.

- Upstream Face

  The upstream face of the embankment was in generally good condition with the exception of some small shrubs/trees on the left upstream embankment. There was an

area of erosion, an 18 inch wide sinkhole, at the upstream right embankment adjacent to the bridge end due to a broken culvert below. This eroded sinkhole found in 2020 was not found in the 2023 inspection due to dense vegetation.

- Crest

The crest of the dam consists of the approximately 36 foot wide roadway of Route 41/102, which was repaved in 2006 after reconstruction of the bridge over the upstream channel was completed. The pavement was in fair condition at the time of inspection. There are some animal burrows in the vegetated areas downstream. There is minor exposure of erosion control fabric under the guardrails on the upstream side.

- Downstream Face

The downstream face of the dam was in good condition. The area is vegetated with well-maintained grass and is clear of trees and brush with a slope of approximately 10H:1V to 8H:1V on the right and 4H:1V on the left.

- Drains

The dam does not include any known toe drains. The right outer downstream spillway training wall includes two 4 inch diameter weep holes near the waterline. These weep holes were flowing at the time of the inspection. There is one 4 inch diameter weep hole on the left downstream outer spillway training wall that was flowing lightly at the time of inspection.

- Instrumentation

Instrumentation at the Shaker Mill Pond Dam consists of the manually actuated hydraulic controls for the outlet gates. The weep hole in the left training wall was flowing approximately ± 0.25 gal/min.

- Access Roads and Gates

The dam has good access at both the upstream and downstream areas. The dam abuts a Town road to the west, which does not require permission for access. To the east, it may be required to obtain permission from the building owner. The dam is surrounded on the left and right sides of the downstream area by a split rail fence covered in wire mesh and by guardrails on either side of the crest inhibiting access. The control house is locked and can be accessed by a Town key.

2.1.3 Appurtenant Structures

- Primary Spillway

The primary spillway is a concrete structure of approximately 33 feet in length and approximately 12 feet in height. The vertical and horizontal alignment of the weir was

good. The stems for the outlet gates are located immediately upstream of the weir and are unprotected.

- Low-Level Outlets

The dam includes 36 inch and 46 inch low-level outlet pipes which are controlled by gates located on the upstream sides of the pipes. The outlet pipes pass through the concrete spillway and discharge immediately downstream of the spillway. The outlets/piping on both sections are corroding/eroded downstream where they interface with the spillway. The outlet pipes were not visible during the inspection due to flow. The gate stems are relatively small and the hydraulic lines are close to the water surface, which makes them susceptible to damage from floating debris.

- Auxiliary/Emergency Spillway

The dam does not include an auxiliary or emergency spillway. During a large precipitation event, the dam would likely begin overtopping and flow would then surround the roadway intersection beyond the right and left abutments and flow back toward the downstream channel.

- Generator Vault

The dam includes a generator vault located to the right of the spillway. The vault is fabricated from concrete walls and open galvanized steel grating. The vault appeared to be in good condition with the exception of an area of exposed brick beneath the concrete around the edge of the grate. The vault has been outfitted with two hydroelectric generators. There is minor concrete spalling at the top of the concrete hydro electric vault. There is boiling heavily at the downstream right area of the foundation just downstream of the generator vault.

- Downstream Channel Walls

Concrete spillway training walls transition to stone masonry walls which contain the Williams River downstream of the dam. The rebuilt portion of the left wall appears to be in good condition. There is a minor sinkhole on the capstone and undermined stones at the base of the right downstream wall.

The joint caulk in the concrete portion of the downstream wing walls has deteriorated and is allowing vegetation and dirt into the joints.

- Dikes

The Shaker Mill Pond Dam does not include any dikes.

2.1.4 Downstream Area

The downstream area consists of downtown West Stockbridge where the Williams River is channeled through the residential and commercial structures that line the bank of the river. The river flows below the Center Street Bridge approximately 350 feet downstream of the dam. Following the developed downtown area the river flows below the Massachusetts Turnpike and past a quarry approximately 1.8 miles downstream of the dam on the east side of the river. The

river then continues through the marshy low lands of the downstream area until it meets up with the Housatonic River in Great Barrington.

2.1.5 Reservoir Area

The Shaker Mill Pond is a long, narrow, shallow, north to south impoundment. The dam is located at the southern end of the pond. The pond consists of two primary basins connected by a narrow channel. The pond is located in a gently sloping valley that contains several other ponds immediately upstream of the impoundment. The outer areas of the watershed are more steeply sloping but it is likely that the upstream water bodies would likely ease storm flows. No areas of past or potential slides into the impoundment were observed.

2.2 Caretaker Interview

The caretaker was not onsite at the time of the inspection. Follow up conversations with the caretaker indicate no change in operations from previous inspections.

2.3 Operation and Maintenance Procedures

A formal Operations and Maintenance manual is not available for the dam. The operations and maintenance procedures for the dam are described in the following subsections.

2.3.1 Operational Procedures

Operation of the dam includes raising and lowering the gates for the two outlets in anticipation of hydrologic conditions. The impoundment responds rapidly to storm events, and since spillway capacity is limited by the low chord of the Route 41/102 Bridge, the caretaker must be proactive about responding to predicted precipitation.

Typical operation includes opening the smaller 36 inch outlet. The larger 46 inch outlet is only opened during storm events when drawdown of the impoundment is required. The dam is typically operated to maintain impoundment surface at approximately the level of the spillway weir. The gates were noted to be exercised frequently.

2.3.2 Maintenance of Dam and Operating Facilities

The maintenance at the Shaker Mill Pond Dam includes frequent mowing of the grass on the embankment, ensuring that the gates are properly lubricated, replacing rip rap on the upstream face, and removing unsuitable vegetation from the embankment. Mowing is performed monthly, or more frequently as needed, and other tasks are performed on an as-needed basis.

2.4 Emergency Warning System

An Emergency Action Plan, which was completed in November of 2008 and updated in 2015, is on file with the Town as well as with the Berkshire County Emergency Communication Center. The plan includes updated inundation mapping, a contact list of the potentially inundated properties, and emergency response procedures including notification procedures in the case of an emergency situation.

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

Potential public safety hazards associated with the Shaker Mill Pond Dam are relatively minimal. The main potential safety hazard of the dam and its surrounding area is the tall downstream abutment and wing walls. The wall presents the potential for a falling hazard that could cause injury however, they are protected from trespassing by fencing.

Mass DCR Office of Dam Safety recommendations for management of a potential falling hazard due to vertical walls include, signage, railings, fencing, and restriction of access. Foresight recommends that public access to the dam continues to be restricted by fencing and signage indicating that the dam and its impoundment are private property and pose potential safety risks.

Boat use on Shaker Mill Pond is minimal and access to the top of the dam, from the water, is restricted by the existing Route 41 bridge. Although boat access to the top of the dam is unlikely, the Town could consider marking or restricting the spillway area with buoys, fencing, or signage.

Shaker Mill Pond Dam has a hydraulic height of 11.8' and a structural height of 18'. Downstream conditions appear to have some indication of possible submerged hydraulic rollers/recirculating currents during higher flow conditions. As such, the Town should consider posting warning signage upstream of the dam.

Implementation of any recommendations may require local, state, or federal permits as well as securing property rights if subject areas are not owned by the dam owner. Securing such permits and/or land rights is the sole responsibility of the dam owner.

The dam owner is reminded that the Dam Safety Regulations *302 CMR Section 10.13: Liability (1)*, states: *The owner shall be responsible and liable for damage to property of others or injury to persons, including but not limited to, loss of life resulting from the operation, failure of or mis-operation of a dam.*

2.6 Hydrologic/Hydraulic Data

Based on the Massachusetts Dam Safety size and hazard classification system as previously registered, the selected spillway design flood (SDF) for the Shaker Mill Pond dam is the ½ Probable Maximum Flood (PMF).

A.	Spillway Design Flood (SDF) Return Period	½ PMF
B.	Precipitation (inches) and Methodology	72 Hour, 14" Rain Event
C.	SDF Inflow (cfs)	26,150 cfs
D.	SDF Outflow (cfs)	16,300 cfs
E.	Principal Spillway Capacity (cfs)	1,500 cfs
F.	Auxiliary Spillway Capacity (cfs)	N/A
G.	Low-Level Outlet Capacity (cfs)	Unknown
H.	Percentage of the SDF that can be safely routed through the reservoir without overtopping the dam	9%
I.	Maximum Depth of Overtopping for SDF (ft)	10' Above Dam
J.	Maximum Duration of Overtopping for SDF (hours)	Unknown

Based on the above information (obtained from others) it appears that the dam would overtop during the design flood.

2.7 Structural and Seepage Stability

2.7.1 Embankment Structural Stability

This structural stability is based on visual observation only; a formal stability analysis is not known to exist. Since the dam is a high hazard potential structure, stability analysis should be completed per 302 CMR 10.14(9) as was also recommended in the previous Phase I report.

The dam embankment appeared to be stable at the time of the inspection. No misalignment, cracking, sloughing, or slope failure was observed. The downstream slope of the embankment has a slope ranging from 8H:1V to 10H:1V on the right and 4H:1V on the left. The sinkhole and wall that was repaired on the easterly downstream location appears to be stable and corrected.

2.7.2 Structural Stability of Non-Embankment Structures

This structural stability evaluation is based on visual observation only; a formal stability analysis is not known to exist.

The non-embankment structural components of the dam, including the concrete portion of the spillway training walls, the spillway weir, and the generator vault, appeared to be well maintained and in good condition at the time of inspection.

The stability of the downstream channel training walls near the toe of the dam, to the left (east), where they join the spillway training walls has been repaired and appears to be in good condition. The misalignment/deficiency in the right training wall appears to be attributable to a failed culvert and does not appear that a failure of the wall would impact the dam at this location (downstream).

2.7.3 Seepage Stability

A boil at the toe of the dam, which has reportedly existed for approximately 19 to 20 years, is likely the result of piping or dispersed flow through high conductivity fill or construction debris below the generator vault. A Massachusetts Department of Environmental Management inspection of the structure was completed in September of 2001 and recorded the first formal documentation of the boil. Fuss & O'Neil further investigated the boil in February of 2009 and determined that it is unlikely that continued flow would cause the concrete components of the dam to destabilize but the boil should be monitored regularly for any changes in rate or water clarity which could be a sign of a potential problem. A copy of the Fuss & O'Neill boil investigation memorandum is included in Appendix C of the 2017 Phase 1 report.

At the time of the inspection, the boil appeared to be clear water and soil loss did not appear to be evident. The water level at the time of inspection was high, and observation of the boil was difficult. However, from previous photos, the rate of the water appears to be consistent and not increasing. Seepage through the spillway was not observed but it is recommended to drawdown the water to observe the spillway for seepage.

SECTION 3

3.0 ASSESSMENTS AND RECOMMENDATIONS

3.1 Assessments

In general, the overall condition of Shaker Mill Pond Dam is **Satisfactory.** The dam was found to have the following deficiencies:

1. Boil at downstream toe.
2. Minor sinkhole at right downstream training wall.
3. Erosion at upstream right embankment (from roadway drain failure).
4. Eroded low level conduits at outlet.
5. Loss of joint caulk in downstream abutments.
6. No formal Operations & Maintenance Plan.
7. No previous structural or seepage stability analysis performed as required for high hazard dams.

Previously Identified Deficiency	***Resolution or Current Condition***
No change in boil at downstream toe	***Boiling heavily at downstream right***
No significant change in minor sinkhole at downstream right training wall	***Minor sinkhole at capstone and undermined stones at base of downstream right training***
Repaired/replaced sinkhole and wall failure at downstream left training wall in 2017	***Repaired/replaced in 2017***
Loss of joint caulk in downstream abutments	***Joint caulk deteriorated at left and right concrete joints***
No formal Operations & Maintenance Plan	***No formal plan created***
No structural or seepage stability analysis	***No analysis completed***

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

3.2 Studies and Analyses

The following studies, analysis, and investigations are recommended to meet the requirements of the Dam Safety regulations of 302 CMR 10.14 and to investigate deficiencies that were observed:

- Structural and Seepage Stability Analysis
- Operations and Maintenance Manual
- Hydrology and Hydraulics Analysis

3.3 Recurrent Maintenance Recommendations

The town of West Stockbridge personnel are completing the majority of necessary periodic tasks to maintain the condition of the dam. These tasks, which are unlikely to require the assistance of a professional engineer, include:

- Mowing embankments and removing unnecessary vegetation, shrubs, and sapling trees
- Inspecting the embankment and spillway for erosion and deterioration
- Clearing debris and obstructions from the spillway and gate operations
- Inspecting the downstream boil and weep hole flow rates and water clarity
- Exercising the outlet valves
- Reviewing the Emergency Action Plan relative to emergency contact information and any changes in downstream land use

3.4 Minor Repair Recommendations

The following recommendations for maintenance and repair are recommended. These recommendations are likely to require design by a professional engineer and construction by a contractor experienced in dam repair. Additionally, these recommendations may also require one or more permits from local, state and federal agencies.

1. Repair Exposure of Erosion Control Fabric under Guardrails on Upstream Side of Embankment at Dam Crest

2. Repair Erosion at Downstream Right Embankment and Upstream Right Embankment Adjacent to Bridge End

3. Repair Undermining of Stones at Base of Downstream Right Masonry Training Wall

4. Strengthen or Protect Gate Stems and Hydraulic Lines

   Previous reports state that the gate stems, hydraulic lines, and fittings could be subject to damage from floating debris. The stems and lines could be protected through construction of guards attached to the spillway and extending upstream. Damage to the stems or lines could make the gates inoperable when needed and potentially result in the discharge of oil into the Williams River.

5. Repair Sinkhole on Upstream Right Embankment and Repair Culvert at Upstream Right Embankment

6. Evaluate and Repair Culvert at Upstream Right Embankment

7. Repair Spalling on Upstream Face of Left Concrete Bridge Abutment and Top of Concrete Hydro Electric Vault

8. Clean and Caulk Concrete Joints in Downstream Walls

3.5 Remedial Modifications Recommendations

The following remedial modifications must be implemented to ensure that the Shaker Mill Pond Dam complies with Massachusetts General Law 253, Section 44, and the Dam Safety regulations of 302 CMR 10.00. These recommendations are likely to require design by a professional engineer and construction by a contractor experienced in dam repair. Additionally, these recommendations may also require one or more permits from local, state and federal agencies.

1. Repair or Replace Low Level Outlet Conduits at Spillway Face

3.6 Alternatives

Previous reports state that the dam has a high potential for overtopping during storm events of less than the spillway design flood. The following alternatives could be considered for improving the response of the dam to significant precipitation events.

1. Increase Spillway Capacity

   Upgrade of the dam to provide adequate capacity to pass the SDF should be considered as part of future upgrades. Currently, however, a tail water condition may develop in the downstream area during large storms, inundating the dam and negating the benefits of additional spillway capacity. Dam configuration alternatives should be considered to provide spillway capacity that would result in a tail water elevation reaching the crest of the dam, at which point the dam would begin to overtop regardless of spillway capacity. This alternative would likely require reconstruction of the highway bridge over the crest along with bridge approaches.

2. Design the Dam to Overtop Safely

   Since overtopping is likely during large precipitation events, and the dam has been known to overtop in the past, providing adequate protection of the embankment to allow the dam to overtop safely should be considered. To achieve this goal, the downstream slope could be armored with vegetated rip rap, articulated concrete pavers, or other methods to prevent loss of embankment soils.

3. Remove the Dam

   This alternative is not desirable since Shaker Mill Pond provides important scenic, historical, and recreational resources to the Town of West Stockbridge, and will provide a source of hydropower as well.

4. Repair the Boil at the Downstream Toe

   As reported in the investigation completed by Fuss & O'Neill in 2009, the boil is unlikely to affect the long-term stability of the dam and repair of the boil is unlikely to be necessary at this time. This consideration should be reevaluated if any changes in the condition of the embankment or characteristics of the boil are observed.

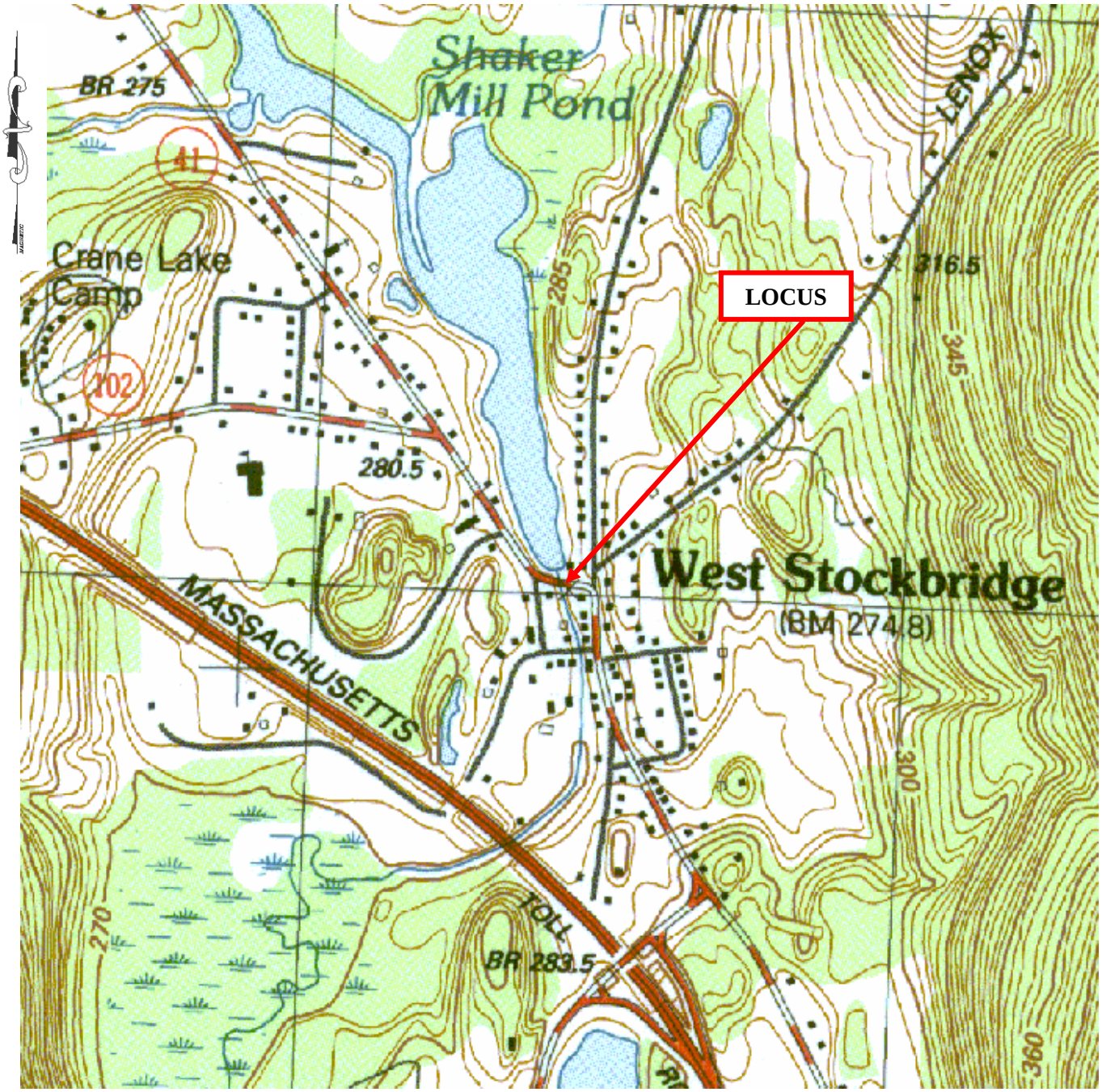
3.7 Opinion of Probable Construction Costs

The following table provides an order-of-magnitude opinion of probable construction cost for studies and repair of the Shaker Mill Pond Dam based on conditions observed during this inspection. Repair costs may vary following in-depth investigation and more detailed design. Costs for alternatives presented are based on cursory estimates. Prior to commencing construction of repairs or maintenance activity, the owner/caretaker should contact the Office of Dam Safety and the local Conservation Commission to determine whether a permit is required. Consultation with a professional engineer familiar with the dam safety regulatory process is recommended to determine which other federal, state, and local permits may apply.

Recommendation	**Order of Magnitude Range**		
Studies and Analysis			
Structural and Seepage Stability Analysis	$10,000	-	$15,000
Operation & Maintenance Manual	$5,000	-	$10,000
Hydrology & Hydraulics Analysis	$5,000	-	$10,000
Repairs			
Clean and Caulk Joints in Downstream Concrete Walls	$2,500	-	$5,000
Protect Gate Stems and Hydraulic Lines	$10,000	-	$15,000
Repair Erosion at Upstream Right Embankment and Culvert	$2,000	-	$4,000
Repair or Replace Low Level Conduit Outlets	$20,000	-	$40,000
Engineering	$15,000	-	$30,000
Permitting	$10,000	-	$15,000
Construction Contingency (30%)	$23,500	-	$42,600
Total	**$134,500**	-	**$184,600**
Alternatives			
Increase Spillway Capacity	$1,500,000	-	$2,000,000
Construct Dam to Overtop Safely	$750,000	-	$1,250,000
Remove Dam	$500,000	-	$1,000,000
Repair Boil/Upwelling	$50,000	-	$100,000

FIGURES

UNITED STATES GEOLOGICAL SURVEY MAP

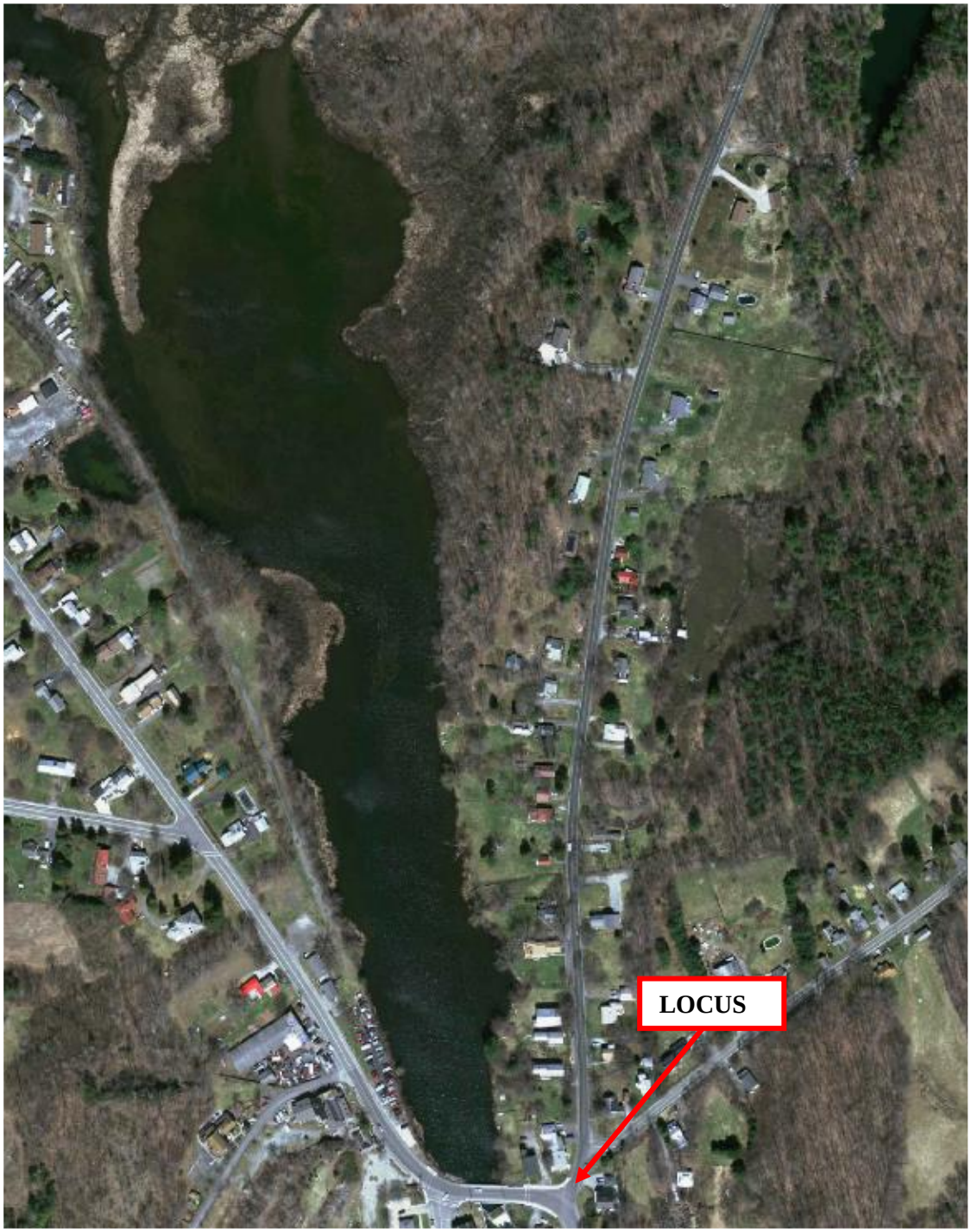


SCALE 1:1,000

FORESIGHT LAND SERVICES
ENGINEERING • SURVEYING • PLANNING
1496 West Housatonic Street
Pittsfield, MA 01201

Figure 1 - Locus Plan
USGS Stockbridge QUAD, 1988 ed.
Source MassGIS
Shaker Mill Pond Dam (MA00732)
42.334864 Latitude, -73.367967 Longitude
West Stockbridge, MA

AERIAL PHOTOGRAPH



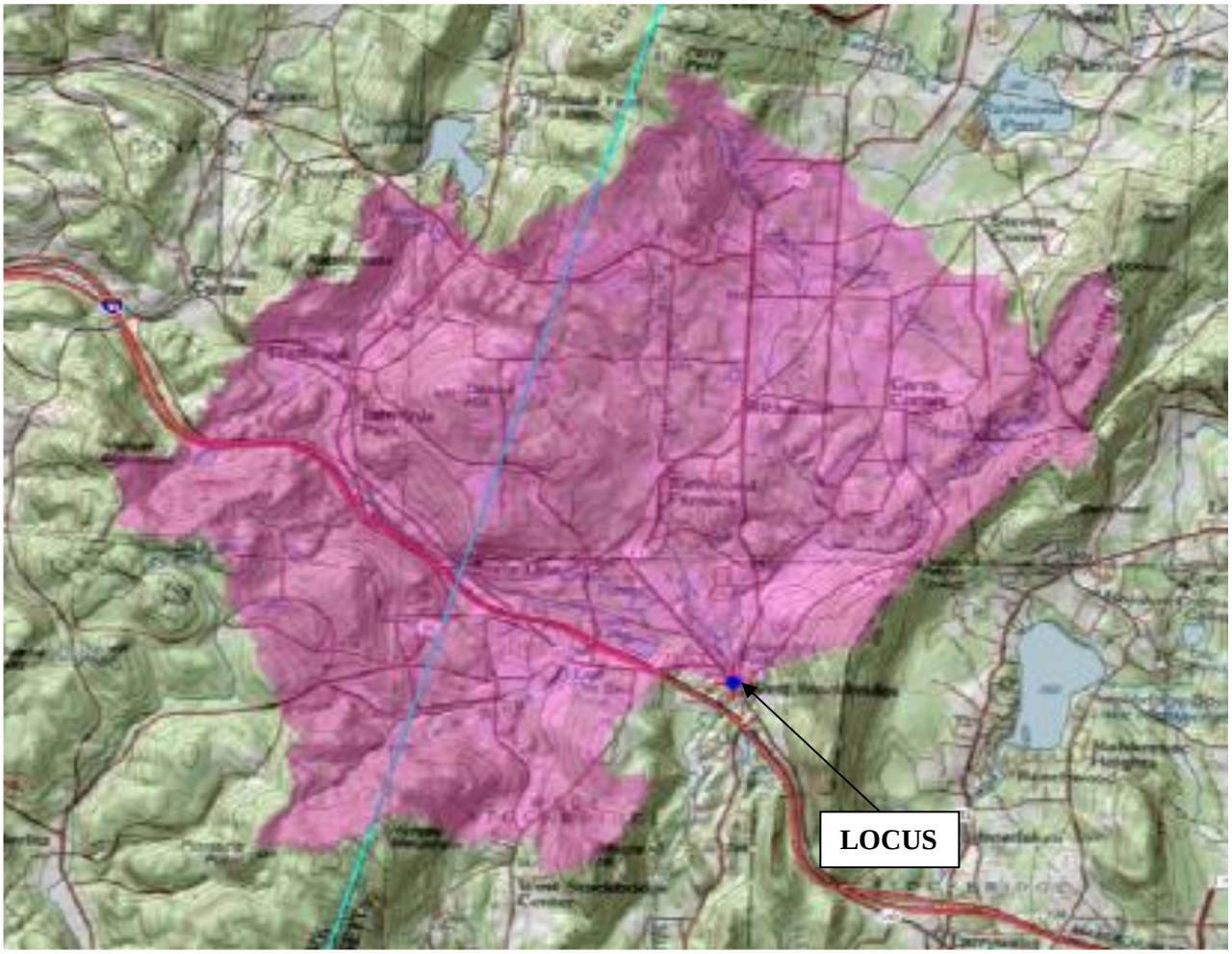
SCALE 1:400

FORESIGHT LAND SERVICES
ENGINEERING • SURVEYING • PLANNING
1496 West Housatonic Street
Pittsfield, MA 01201

Figure 2 - Aerial Photo
Source MassGIS

Shaker Mill Pond Dam (MA00732)
42.334864 Latitude, -73.367967 Longitude
West Stockbridge, MA

DRAINAGE AREA



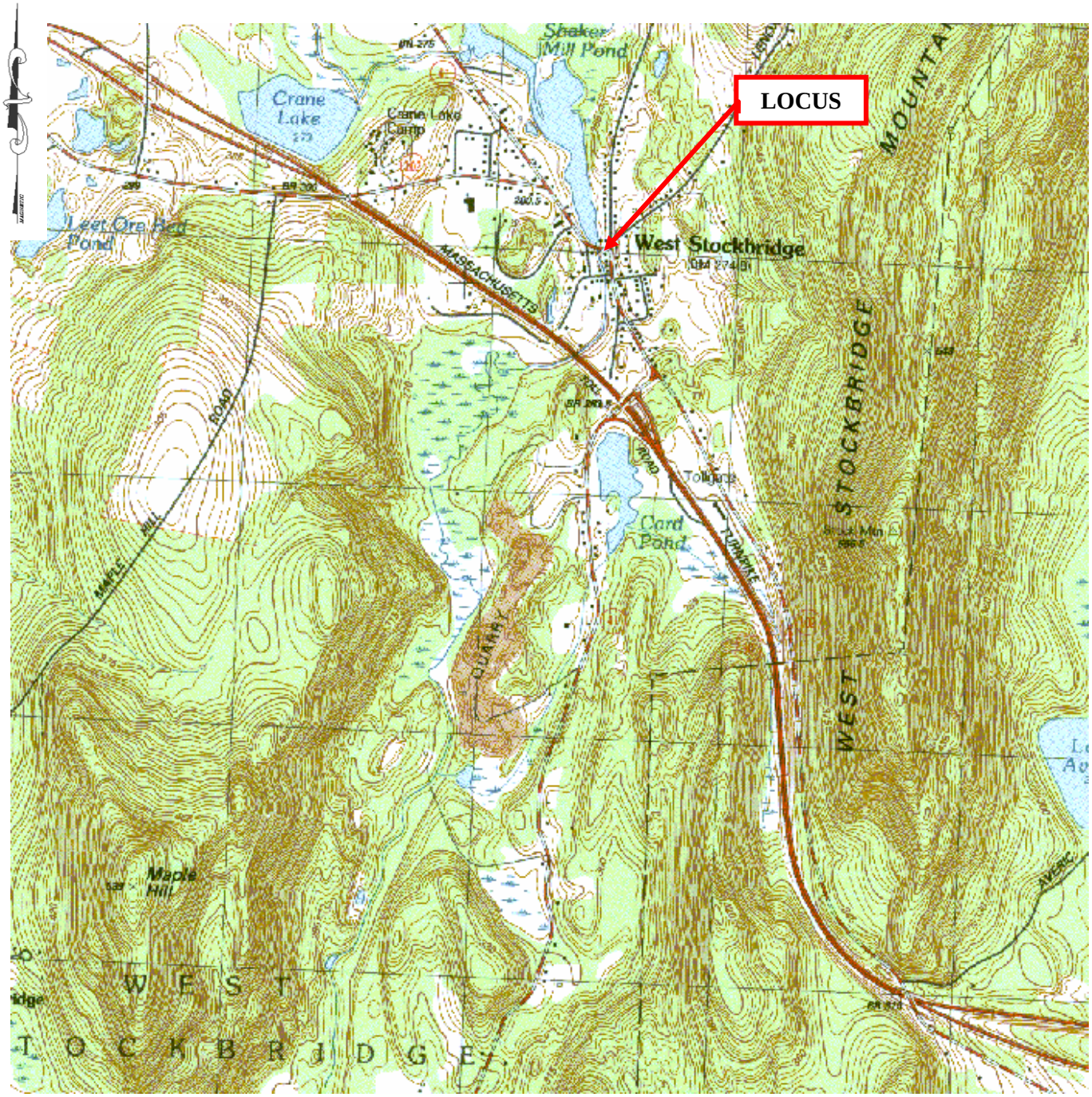
N.T.S.

FORESIGHT LAND SERVICES
ENGINEERING • SURVEYING • PLANNING
1496 West Housatonic Street
Pittsfield, MA 01201

Figure 3 - Drainage Area
Source USGS StreamStat

Shaker Mill Pond Dam (MA00732)
42.334864 Latitude, -73.367967 Longitude
West Stockbridge, MA

DAM & DOWNSTREAM AREA



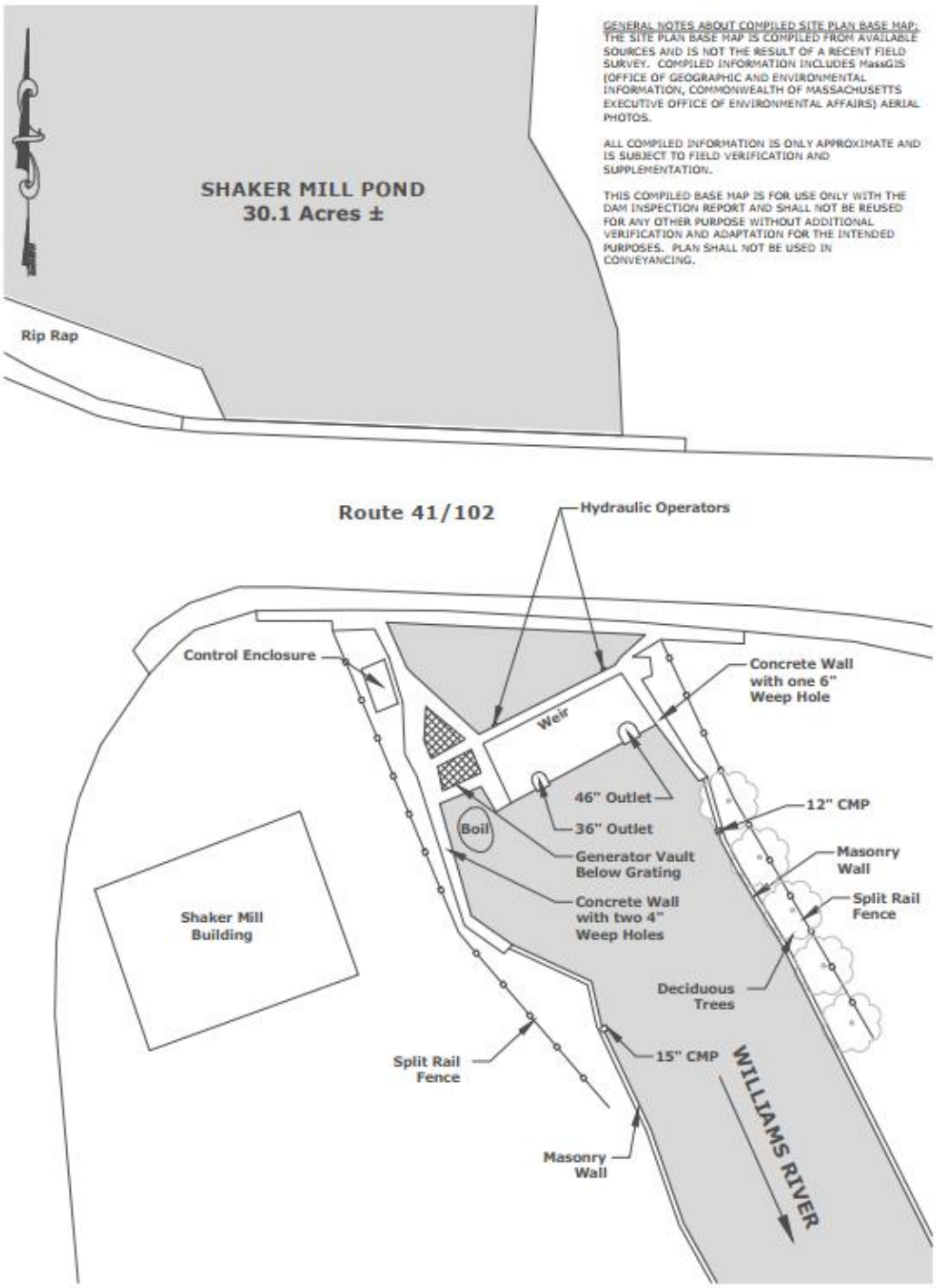
SCALE 1:24,000

FORESIGHT LAND SERVICES
ENGINEERING • SURVEYING • PLANNING
1496 West Housatonic Street
Pittsfield, MA 01201

Figure 4 - Dam and Downstream Area
Source MassGIS

Shaker Mill Pond Dam (MA00732)
42.334864 Latitude, -73.367967 Longitude
West Stockbridge, MA

SITE SKETCH



Not to Scale

FORESIGHT LAND SERVICES
ENGINEERING • SURVEYING • PLANNING
1496 West Housatonic Street
Pittsfield, MA 01201

Figure 5 - Site Sketch

Shaker Mill Pond Dam (MA00732)
42.334864 Latitude, -73.367967 Longitude
West Stockbridge, MA

APPENDIX A
Photographs

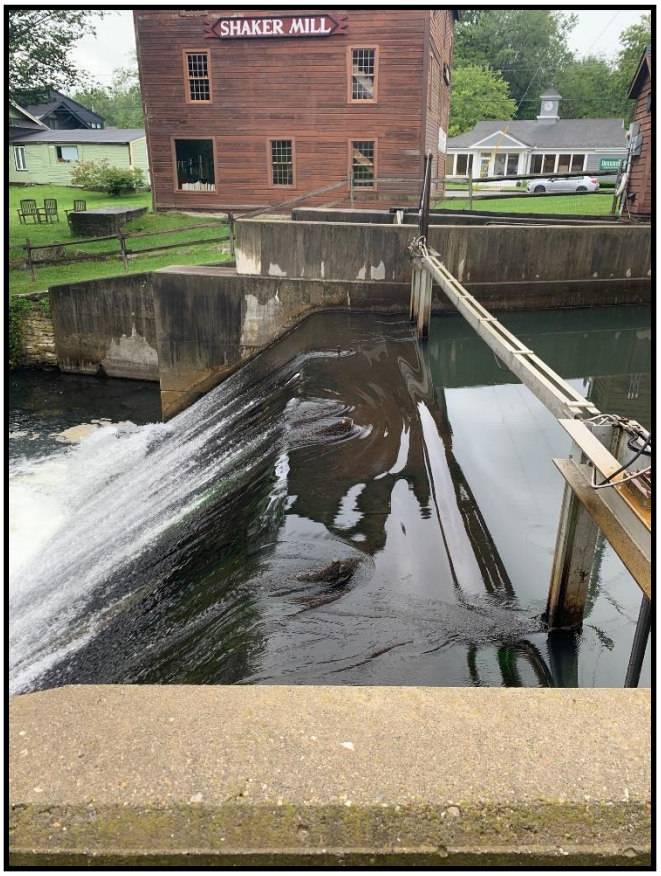
1. Overview of dam from upstream

2. Overview of dam from downstream

3. Overview of upstream face from right abutment

4. Overview of upstream face from left abutment

5. Overview of dam crest from right abutment



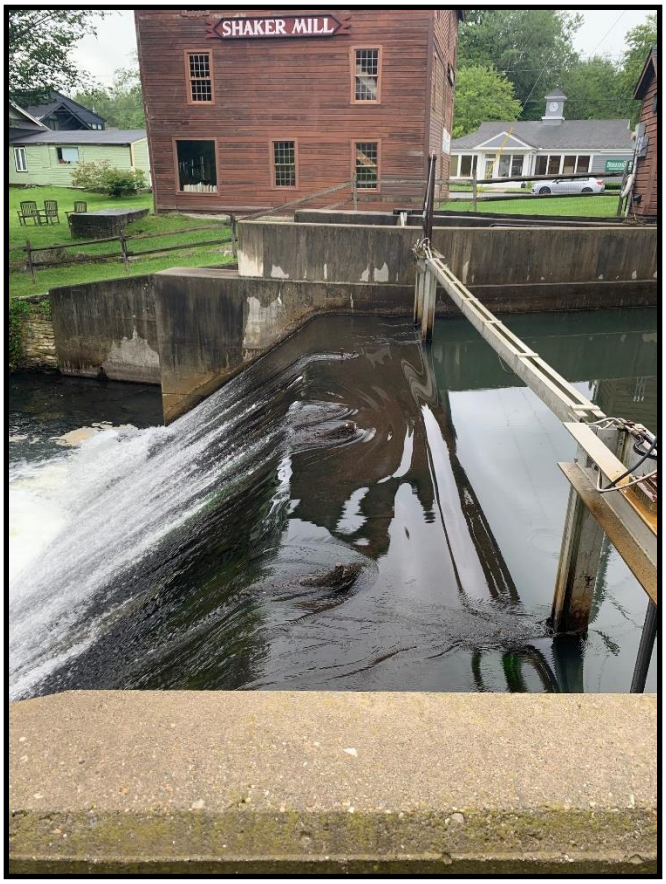
6. Overview of dam crest from left abutment

7. Overview of downstream face from right abutment

8. Overview of downstream face from left abutment

9. Overview of spillway from upstream

10. Overview of spillway from downstream

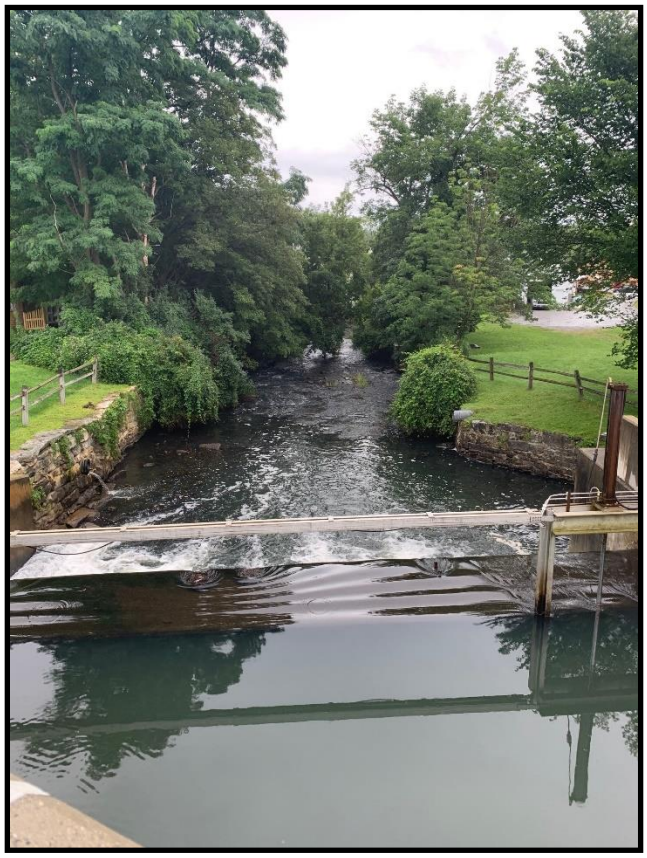


11A. Overview of right training wall

11B. Overview of right training wall

12. Overview of left training wall

13. Overview of weir



14. Overview of stilling basin

15. Overview of downstream channel

16. Overview of gatehouse exterior

17. Overview of gatehouse interior

18. Overview of operators

19. Outlet discharge points

20. Overview of reservoir

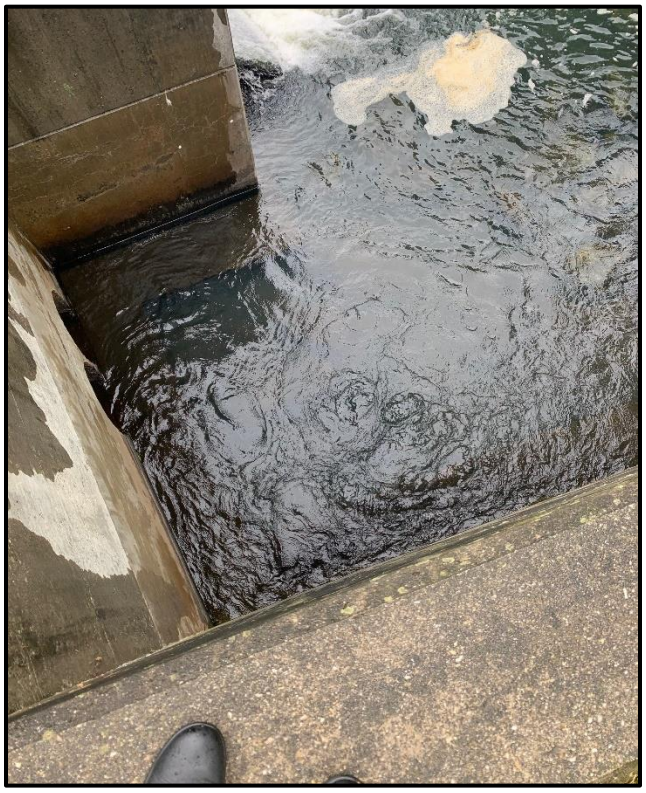
21A. Area of deficiency: Joint caulk missing

22. Area of deficiency: Erosion at right embankment at bridge end from upstream

23. Area of deficiency: Debris/erosion at left embankment at bridge end from upstream

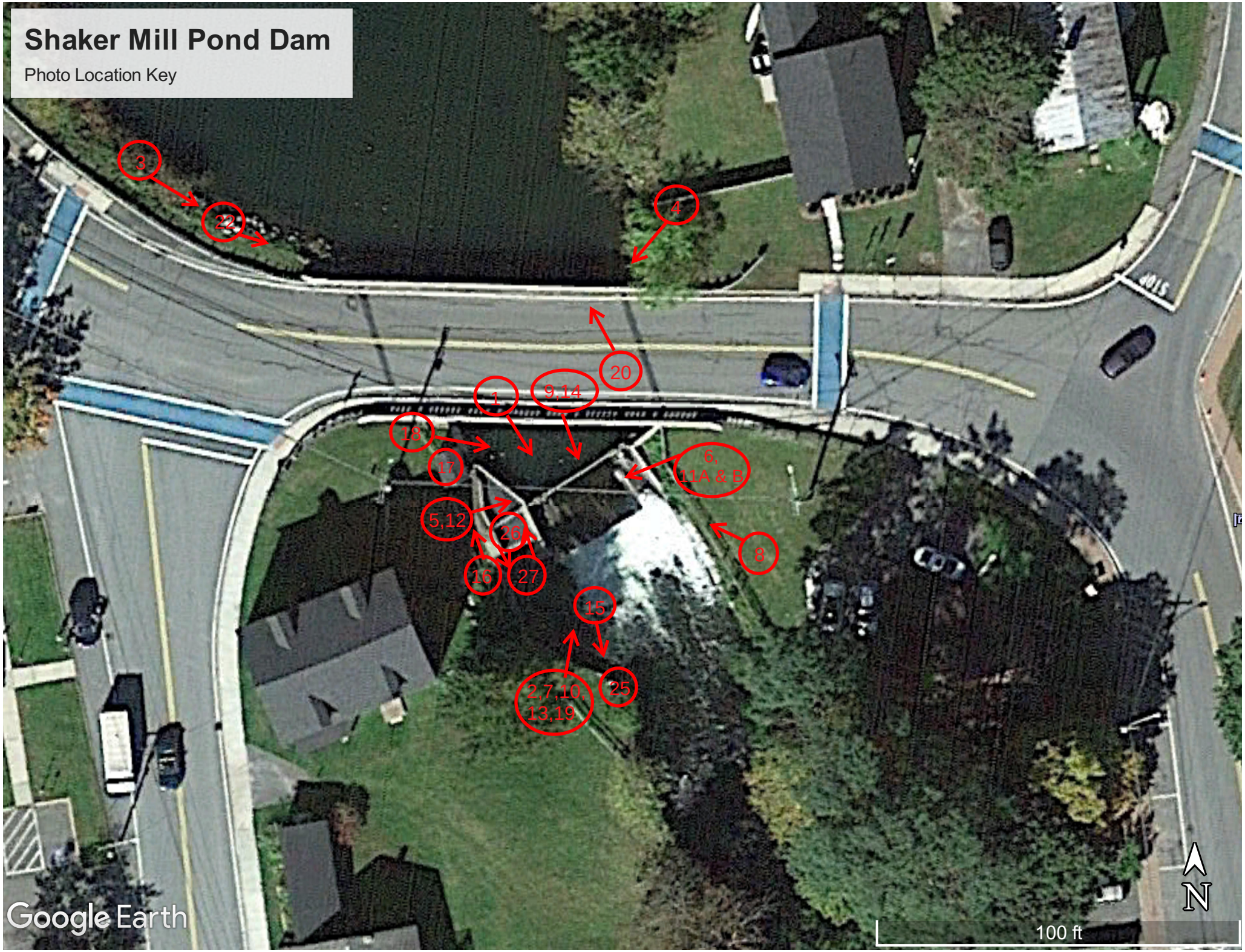
24. Area of deficiency: Undermined stone at base of right downstream masonry wall

25. Area of deficiency: Sinkhole at right side of downstream masonry wall capstone



26. Area of deficiency: Boiling at base of hydro area

27. Area of deficiency: Deteriorated joint caulk at downstream concrete joint


Shaker Mill Pond Dam
Photo Location Key
3
22
4
20
1
9,14
18
17
6,
11A & B
5,12
26
8
16
27
15
2,7,10,
13,19
25
Google Earth
N
100 ft

APPENDIX B
Inspection Checklist

DAM SAFETY INSPECTION CHECKLIST

NAME OF DAM: Shaker Mill Pond Dam
STATE ID #: 1-2-326-3

REGISTERED: ☑ YES ☐ NO
NID ID #: MA 00732

STATE SIZE CLASSIFICATION: Intermediate
STATE HAZARD CLASSIFICATION: High
CHANGE IN HAZARD CLASSIFICATION REQUESTED?: No

DAM LOCATION INFORMATION

CITY/TOWN: W. Stockbridge
COUNTY: Berkshire

DAM LOCATION: Main Street / Route 102/41
(street address if known)
ALTERNATE DAM NAME: Shaker Mill Dam

USGS QUAD.: Stockbridge
LAT.: 42.334864
LONG.: -73.3679967

DRAINAGE BASIN: Housatonic
RIVER: Williams River

IMPOUNDMENT NAME(S): Shaker Mill Pond

GENERAL DAM INFORMATION

TYPE OF DAM: Earth Embankment with Concrete Spillway
OVERALL LENGTH (FT): 100

PURPOSE OF DAM: Recreation, Former & Future Hydropower
NORMAL POOL STORAGE (ACRE-FT): 119±

YEAR BUILT: 1910 Original, Rebuilt in 2000, Minor Improvements in 2009
MAXIMUM POOL STORAGE (ACRE-FT): 466±

STRUCTURAL HEIGHT (FT): 18
EL. NORMAL POOL (FT): 893.9

HYDRAULIC HEIGHT (FT): 11.8
EL. MAXIMUM POOL (FT): 900.1

FOR INTERNAL MADCR USE ONLY

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

NAME OF DAM: Shaker Mill Pond Dam | STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 | NID ID #: MA 00732

INSPECTION SUMMARY

DATE OF INSPECTION: August 8, 2023 | DATE OF PREVIOUS INSPECTION: September 16, 2020

TEMPERATURE/WEATHER: 70F, Cloudy | ARMY CORPS PHASE I: ☑ YES ☐ NO If YES, date June 1979

CONSULTANT: Foresight Land Services, Inc. | PREVIOUS DCR PHASE I: ☑ YES ☐ NO If YES, date 10/11/2012

BENCHMARK/DATUM: Vertical Control NAGVD 29 (Reported - Not Found)

OVERALL PHYSICAL CONDITION OF DAM: SATISFACTORY | DATE OF LAST REHABILITATION: Oct-17

SPILLWAY CAPACITY: 0-50% of the SDF or Unknown

EL. POOL DURING INSP.: 893.9' crest | EL. TAILWATER DURING INSP.: 885.5'±

PERSONS PRESENT AT INSPECTION

NAME	TITLE/POSITION	REPRESENTING
Steven A. Mack, P.E.	Principal Engineer	Foresight Land Services, Inc.

EVALUATION INFORMATION

	Click on box to select E-code
E1) TYPE OF DESIGN	3
E2) LEVEL OF MAINTENANCE	4
E3) EMERGENCY ACTION PLAN	4
E4) EMBANKMENT SEEPAGE	2
E5) EMBANKMENT CONDITION	4
E6) CONCRETE CONDITION	4
E7) LOW-LEVEL OUTLET CAPACITY	4

	Click on box to select E-code
E8) LOW-LEVEL OUTLET CONDITION	4
E9) SPILLWAY DESIGN FLOOD CAPACITY	1
E10) OVERALL PHYSICAL CONDITION	4
E11) ESTIMATED REPAIR COST	$134,500 - $184,600
ROADWAY OVER CREST	YES
BRIDGE NEAR DAM	YES

NAME OF INSPECTING ENGINEER: Steven A. Mack, P.E. SIGNATURE: S A Mack

NAME OF DAM:	Shaker Mill Pond Dam	STATE ID #:	1-2-326-3
INSPECTION DATE:	August 8, 2023	NID ID #:	MA 00732

OWNER:		CARETAKER:	
ORGANIZATION	Town of West Stockbridge	ORGANIZATION	Town of West Stockbridge
NAME/TITLE	Marie Ryan, Administrator	NAME/TITLE	Curt Wilton, DPW Director
STREET	21 State Line Road	STREET	21 State Line Road
TOWN, STATE, ZIP	West Stockbridge, MA 01266	TOWN, STATE, ZIP	West Stockbridge, MA 01266
PHONE	(413) 232-0319	PHONE	(413) 232-0305
EMERGENCY PH. #	(413) 232-8500	EMERGENCY PH. #	(413) 232-4151
FAX	(413) 232-7195	FAX	(413) 232-7195
EMAIL	admin@weststockbridge-ma.gc	EMAIL	HighwaySuperintendent@weststockbridg
OWNER TYPE	Municipality or Political subdivision		

PRIMARY SPILLWAY TYPE	Concrete Weir		
SPILLWAY LENGTH (FT)	33'	SPILLWAY CAPACITY (CFS)	1,500 (reported)
AUXILIARY SPILLWAY TYPE	N/A	AUX. SPILLWAY CAPACITY (CFS)	N/A
NUMBER OF OUTLETS	2	OUTLET(S) CAPACITY (CFS)	Unknown
TYPE OF OUTLETS	46" and 36" Pipe with U/S Gate	TOTAL DISCHARGE CAPACITY (CFS)	Unknown
DRAINAGE AREA (SQ MI)	32.5	SPILLWAY DESIGN FLOOD (PERIOD/CFS)	1/2 PMF / 16,300

HAS DAM BEEN BREACHED OR OVERTOPPED ☑ YES ☐ NO IF YES, PROVIDE DATE(S) 1948

FISH LADDER (LIST TYPE IF PRESENT)

DOES CREST SUPPORT PUBLIC ROAD? ☑ YES ☐ NO IF YES, ROAD NAME: Route 102/41 a.k.a. Albany Road

PUBLIC BRIDGE WITHIN 50' OF DAM? ☑ YES ☐ NO IF YES, ROAD/BRIDGE NAME: Route 102/41 a.k.a. Albany Road

MHD BRIDGE NO. (IF APPLICABLE) W-22-107

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

EMBANKMENT (CREST)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	1. SURFACE TYPE	Vegetated/Paved	X		
	2. SURFACE CRACKING	None Observed	X		
	3. SINKHOLES, ANIMAL BURROWS	Some animal borrows in vegetated areas downstream		X	X
	4. VERTICAL ALIGNMENT (DEPRESSIONS	Good	X		
	5. HORIZONTAL ALIGNMENT	Good	X		
	6. RUTS AND/OR PUDDLES	None Observed	X		
	7. GRASS COVER CONDITION	Grass	X		
	8. WOODY VEGETATION (TREES/BRUSH)	None Observed	X		
	9. ABUTMENT CONTACT	Good	X		

ADDITIONAL COMMENTS: Some exposure of erosion control fabric under guardrails on upstream side - minor.

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

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 Observed	X		
	3. SLIDE, SLOUGH, SCARP	None Observed	X		
	4. EMB.-ABUTMENT CONTACT	See Additional Comments Below			X
	5. SINKHOLE/ANIMAL BURROWS	Some observed on right downstream grassed embankment		X	X
	6. EROSION	Minor erosion at downstream right side masonry wall capstone		X	X
	7. UNUSUAL MOVEMENT	See Additional Comments Below			X
	8. GRASS COVER CONDITION	Good/Fair	X		
	9. WOODY VEGETATION (TREES/BRUSH)	None Observed	X		

ADDITIONAL COMMENTS: Left downstream wall repaired in 2017 and appears to be in good condition
Joint caulk deteriorated at downstream concrete joints left and right.
Undermining of stones at the base of the downstream right side masonry wall.

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

EMBANKMENT (U/S SLOPE)

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S SLOPE	1. SLIDE, SLOUGH, SCARP	None Observed	X		
	2. SLOPE PROTECTION TYPE AND COND.	Rip rap and rock tailings	X		
	3. SINKHOLE/ANIMAL BURROWS	None Observed	X		
	4. EMB.-ABUTMENT CONTACT	Good	X		
	5. EROSION	Worsening erosion observed at right upstream embankment adjacent to bridge end.			X
	6. UNUSUAL MOVEMENT	None Observed	X		
	7. GRASS COVER CONDITION	Good/Fair	X		
	8. WOODY VEGETATION (TREES/BRUSH)	Good/Fair - Small trees and shrubs on left upstream embankment should be removed			X

ADDITIONAL COMMENTS: An approximately 18" wide sinkhole, due to a broken culvert below, was observed on the right upstream embankment. The broken culvert should be repaired and the sinkhole filled.
Minor cracking/spalling was observed on the upstream face of the left concrete bridge abutment.

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

INSTRUMENTATION

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
INSTR.	1. PIEZOMETERS	Not Applicable			
	2. OBSERVATION WELLS	Not Applicable			
	3. STAFF GAGE AND RECORDER	Not Applicable			
	4. WEIRS	Not Applicable			
	5. INCLINOMETERS	Not Applicable			
	6. SURVEY MONUMENTS	Reported - Not Found	X		
	7. DRAINS	Weephole in left training wall observed to be flowing approximately 0.25 gal/min.		X	
	8. FREQUENCY OF READINGS	Not Applicable			
	9. LOCATION OF READINGS	Not Applicable			

ADDITIONAL COMMENTS:

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

DOWNSTREAM AREA

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S AREA	1. ABUTMENT LEAKAGE	Not Observed	X		
	2. FOUNDATION SEEPAGE	Boiling heavily at downstream right. See photos		X	
	3. SLIDE, SLOUGH, SCARP	Not Observed	X		
	4. WEIRS	Good Condition	X		
	5. DRAINAGE SYSTEM	Weephole in left downstream training wall observed to be flowing ± 0.25 gal/min		X	
	6. INSTRUMENTATION	Not Observed	X		
	7. VEGETATION WITHIN 15 FT	Channel is tree-lined dowstream and should be maintained			X
	8. ACCESSIBILITY	Good grass/maintained			X
	9. DOWNSTREAM HAZARD DESCRIPTION	High - business district			

ADDITIONAL COMMENTS:

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

MISCELLANEOUS

AREA INSPECTED	CONDITION	OBSERVATIONS
MISC.	1. RESERVOIR DEPTH (AVG)	3' - 4'
	2. RESERVOIR SHORELINE	Gently sloping and vegetated
	3. RESERVOIR SLOPES	Gently sloping and vegetated
	4. ACCESS ROADS	Accessible from Route 102/41
	5. SECURITY DEVICES	Fenced and split rail and wire fencing. Gate house locked.
	6. WATER PUBLIC HAZARDS & PROTECTION	
	7. LAND-SIDE PUBLIC HAZARDS & PROTECTION	
	7. VANDALISM OR TRESPASS	☐ YES ☑ NO WHAT:
	8. AVAILABILITY OF PLANS	☑ YES ☐ NO DATE: 1994
	9. AVAILABILITY OF DESIGN CALCS	☐ YES ☑ NO DATE:
	10. AVAILABILITY OF EAP/LAST UPDATE	☑ YES ☐ NO DATE: 2015
	11. AVAILABILITY OF O&M MANUAL	☐ YES ☑ NO DATE:
	12. CARETAKER/OWNER AVAILABLE	☐ YES ☑ NO DATE:
	13. CONFINED SPACE ENTRY REQUIRED	☐ YES ☑ NO PURPOSE:

ADDITIONAL COMMENTS:

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

PRIMARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	Concrete weir	X		
	WEIR TYPE	Broad crested	X		
	SPILLWAY CONDITION	Appeared good - See additional comments below	X		
	TRAINING WALLS	See sheet 5			X
	SPILLWAY CONTROLS AND CONDITION	Good	X		
	UNUSUAL MOVEMENT	See sheet 5			X
	APPROACH AREA	Appeared good	X		
	DISCHARGE AREA	Stable	X		
	DEBRIS	Some debris at gate operators		X	X

ADDITIONAL COMMENTS: Recommend draining impoundment down and observing spillway condition with no flow for possible seepage.

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

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				

NOT APPLICABLE

ADDITIONAL COMMENTS:

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	Metal outlet pipes - 36" right, 46" left (heavily corroded at connection to spillway)			X
	INTAKE STRUCTURE	Hydro intake	X		
	TRASHRACK	None Observed	X		
	PRIMARY CLOSURE	Slide gates on each outlet pipe			X
	SECONDARY CLOSURE	Hydro gates (2)			X
	CONDUIT	Both metal conduits are heavily corroded/deteriorated at connection to spillway		X	X
	OUTLET STRUCTURE/HEADWALL	Spillway	X		
	EROSION ALONG TOE OF DAM	None Observed	X		
	SEEPAGE/LEAKAGE	See boil note on Sheet 10		X	
	DEBRIS/BLOCKAGE	None Observed	X		
	UNUSUAL MOVEMENT	Outlet piping/conduits/secondary outlets are heavily corroded			X
	DOWNSTREAM AREA	See boil note on Sheets 8 and 10.			X
	MISCELLANEOUS				

ADDITIONAL COMMENTS: The left low level outlet pipe was observed to be flowing ±5 gal/min and the right pipe was observed to be flowing ±0.5 gal/min

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

CONCRETE/MASONRY DAMS (CREST)

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

NOT APPLICABLE

ADDITIONAL COMMENTS:

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

CONCRETE/MASONRY DAMS (DOWNSTREAM FACE)

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

NOT APPLICABLE

ADDITIONAL COMMENTS:

NAME OF DAM: Shaker Mill Pond Dam STATE ID #: 1-2-326-3

INSPECTION DATE: August 8, 2023 NID ID #: MA 00732

CONCRETE/MASONRY DAMS (UPSTREAM FACE)

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

NOT APPLICABLE

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.

Fuss & O'Neill (2008). *Shaker Mill Pond Dam Emergency Action Plan*. 11/17/08

Fuss & O'Neill (2008) *Shaker Mill Pond Dam Phase 1*. 10/31/08

Haley & Aldrich (2006). *Shaker Mill Pond Dam Phase 1*. 9/7/06

GZA GeoEnvironmental, Inc. (1998). *Department of Environmental Management Office of Dam Safety Municipally Owned Dam Inspection/Evaluation Report*. 7/8/1998

Goodkind & O'Dea (1994). *Repairs to Shaker Mill Dam*. 6/29/94 Updated Design Plans

(Author Unknown) (1991). Letter to Town Describing Phase 1 Inspection. 5/1/91

(Author Unknown) (1987). Phase 1 Inspection.

Bureau of Reclamation (1987). *Design of Small Dams*. 3rd Edition. United States Department of the Interior.

(Author Unkown) (1979). Army Corps of Engineers Phase 1 Inspection.

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

Foresight Land Services (2020) *Shaker Mill Pond Dam Phase 1*. 9/16/2020

Foresight Land Services (2017) *Shaker Mill Pond Dam Phase 1*. 12/15/2017

Foresight Land Services (2015) *Shaker Mill Pond Dam Phase 1*. 7/1/2015

Foresight Land Services (2012) *Shaker Mill Pond Dam Phase 1*. 10/11/2012

Foresight Land Services (2010) *Shaker Mill Pond Dam Phase 1*. 10/20/2010

Fuss & O'Neill (2008) *Shaker Mill Pond Dam Phase 1*. 10/31/08

Haley & Aldrich (2006). *Shaker Mill Pond Dam Phase 1*. 9/7/06

GZA GeoEnvironmental, Inc. (1998). *Department of Environmental Management Office of Dam Safety Municipally Owned Dam Inspection/Evaluation Report*. 7/8/1998

FUSS & O'NEILL

MEMORANDUM

TO: File - 20080563.A20

FROM: Phil Moreschi, P.E.
Mike Gagnon, P.E.
Dan Buttrick, E.I.T.

DATE: April 8, 2009

RE: Shaker Mill Dam Seepage Investigation

This memorandum summarizes findings regarding sources of potential seepage observed at Shaker Mill Dam in West Stockbridge. The areas of concern included:

1. A boil present on the right side downstream of the turbine vault
2. Discharge from a weephole in the left spillway training wall at a relatively high rate (5 to 10 gallons per minute), with soil loss of the embankment behind the spillway training wall.

These areas of seepage were of significant concern during preparation of the Draft Phase I inspection report in October, 2008, and warranted a finding of 'poor' condition for the structure based on guidance in the Phase I inspection template provided by the Office of Dam Safety (ODS) in September 2008.

At the request of the Town, we completed additional investigations and interviewed people involved with various projects related to the dam. Our findings, described below, suggest that these conditions are unlikely to affect the long-term stability of the structure, and as such, we have revised the Phase I report to give the dam the higher rating of "Fair." We are satisfied that the information meets the following test (underlined in the ODS guidance excerpted below) to justify this rating:

> *E10-Overall Safety Rating Guideline*
> *Unless the inspecting engineer presents compelling data, analyses, and observations that justify a higher rating, E10-Overall Safety Rating of the Dam shall not be higher than the lowest ranking in these high importance categories:*
> *-E4-Seepage,*
> *-E5-Embankment Condition (for embankment dams),*
> *-E6-Concrete Condition (for dams where concrete structures retain water).*

Right Downstream Boil

Fuss & O'Neill attended a site meeting on February 26, 2009 at Shaker Mill Dam along with representatives from the Town of West Stockbridge and MassHighway. The MassHighway

representative present was involved in the construction of the bridge over the spillway and its approaches in 2006/2007.

Regarding the boil observed adjacent to the pump chamber on the right side of the dam: this boil was reported to be present prior to the bridge reconstruction project, and its existence was well documented. Mark Webber (Board of Selectman administrator) presented a copy of a letter from the bridge contractor, J.H. Maxymillian of Pittsfield dated August 10, 2006 notifying MassHighway of the presence of the "what appears to be a leak coming under the dam's footing on the downstream, west side. The water appears clean and of a relatively high volume." Mr. Webber stated that the leak was first documented following major repairs to the dam that were funded and observed by the Massachusetts Department of Environmental Management (DEM). A DEM inspection of the structure dated 9/26/2001 described the boil, stating:

> Very clear turbulent or upwelling area was observed within the streambed, immediately adjacent to the right training wall footing and downstream of the dry-well. The observation was immediately brought to the attention of the Town Administrator. After local officials examined the upwelling area, an effort to determine the source of the water was initiated, including discussions with previous Town DPW personnel, etc.
>
> Based on correspondence with the Town of West Stockbridge, the Town is confident the upwelling or roiling water is an on-going and non-degrading condition. The Town is of the opinion that the upwelling existed and was only observable due to abnormally low river levels.
>
> However, the Office of Dam Safety suspects that a short-circuiting condition exists at the site or a construction dewatering pipe has not been adequately capped. Construction photos from 1995 indicate a crushed stone dry-well floor and foundation base and location of a 4-inch diameter CIP used for dewatering.

However, a more detailed review of available information was performed by Fuss & O'Neill to investigate the potential for the stability of the structure to be disrupted if the boil results from a short circuiting condition.

The MassHighway representative present during the February 26, 2009 site visit stated that the cause of the leak was investigated during reconstruction of the bridge. During construction, a cofferdam was installed across the impoundment approximately 10 feet upstream of the bridge, connecting in to the opposite banks of Shaker Mill Pond and relieving hydrostatic pressure from the dam embankment. Despite the presence of the cofferdam, the leak was still present, suggesting that water is flowing through a long seepage path below the roadway embankment, or flowing first below the cofferdam foundation, then below the Shaker Mill Dam foundation.

There are two points of interest which together suggest that flow seeping below the roadway embankment right of the dam is unlikely to destabilize the dam. The first point of interest

regards the likely composition of historical fill materials surrounding the dam. Curt Wilton (DPW superintendent), Earl Moffat (former DPW superintendent), and Mr. Webber all agreed that the area surrounding the dam site has been highly modified during the previous 200 years. Excavation at the intersection of Depot St./Albany Rd. during the bridge reconstruction project uncovered a significant quantity of shot rock fill, stone blocks, mill structure remnants (including a mill grist stone), and other debris. Mr. Moffat indicated that a sluiceway for mill structures was formerly present in this area.

This evidence suggests that the fill along the abutment of the right side of the dam could be highly porous and subject to seepage, while being composed of materials that are unlikely to be carried away by seepage.

The second point of interest is that, for the boil to be originating from seepage in this area, the seepage must be passing below the foundation of the right spillway training wall or below the turbine wetwell (both of which were installed in 1995 during the reconstruction) prior to discharging in the downstream channel.

However, design drawings for the 1995 rehabilitation of the dam on file at ODS suggest that the new structures, including the right downstream training wall, the downstream wall of the wetwell, and the spillway training wall were to be founded on bedrock (pertinent details are attached to this memorandum). The boil is surrounded by these features on the upstream, left, and right sides. As such, the boil must be flowing either through fissures in bedrock or through areas of poor concrete-bedrock contact.

Additionally, if the seepage were to be flowing below the dam foundation and discharging into the downstream channel, this flow would also have to be passing through either fissures in bedrock or through areas of poor concrete-bedrock contact.

As such, it is unlikely that continued flow would cause the concrete components of the dam to destabilize. Since there is potential that the flow is travelling through abutment or embankment soil, then the potential for soil loss may still exist, and the boil should be monitored regularly for changes in rate or clarity (it was consistently clear and discharging at similar flow rates during our site visits) and the embankment should be monitored for any signs of subsidence, which would most commonly first appear on the downstream side of the dam, adjacent to the training wall where seepage is discharging.

Although the seepage condition rating is 'poor' following ODS requirements (evidence of monitored piping and seepage), given the history and the involvement of DEM in the past construction and inspection of the boil, it appears unlikely to constitute a significant structural deficiency and thus does not warrant a 'poor' overall dam condition rating. It is recommended, however, that the Town continue to monitor the boil regularly, as they have since 1995 and observe the embankment for signs of settlement or void formation.

Left Training Wall Soil Loss

Fuss & O'Neill visited the site on April 8, 2009 to further investigate the source of the weep hole seepage and soil loss. A concern is that water flowing along the soil side of the spillway training wall was carrying soil and discharging through the weep hole at a high rate.

However, both the MassHighway representative and Mr. Wilton recall the left spillway training wall overtopping during the 2006/2007 bridge reconstruction, causing erosion of the surface soils of the embankment. In support of this theory, it appeared that topsoil was missing along the training wall; if the soil were being eroded by piping, the topsoil would still be present. Additionally, drainage gravel was visible behind the wall, and some gravel was on the embankment surface downgradient from the erosional area, suggesting that it had been carried by flowing surface water. The Town plans to remove unsuitable materials from the eroded area, lay geotexile in the void, and backfill with a layer of bedding material below a layer of riprap to protect the embankment from future erosion.

Regarding the flow of water observed through the weep hole on the left spillway training wall, the MassHighway representative indicated on February 26 that a vitrified clay pipe was encountered during excavation of the roadway (he later provided daily inspection logs documenting the discovery of the pipe). The origin and destination of the pipe was unknown. He suggested that the pipe is a foundation or basement drain for two nearby structures, and that the pipe connects to the weep hole, and that it is unrelated to the soil embankment soil loss located above it.

To investigate this possibility, on April 8 DPW personnel probed the weep hole with a spring steel plumber's snake. The snake was inserted approximately 78 feet with little resistance, suggesting a straight line pipe directed below the roadway at an angle away from Shaker Mill Pond. It is notable that sediment and gravel was present in the pipe and was disturbed as the snake was inserted, resulting in an opaque brown flow, but the flow became clear within a few minutes of retracting the snake

It is conclusive that a small drainage pipe is connected to the weep hole, and that the discharging water is not embankment seepage. As such, this condition does not warrant a 'poor' seepage condition or overall dam rating. The Town will continue to monitor the weep hole and the discharge.

Groundwater behind the training wall needs to be considered since the weep hole is unlikely to be functioning properly. Currently, groundwater behind the training wall would be allowed to drain freely through joints in the downstream channel training wall, which is constructed from mortared and dry masonry. However, when this wall is repaired in the future, it will be important to maintain drainage through the wall by providing a weep hole or other provision to prevent groundwater pressure from building.

C: Mark Weber, Town of Stockbridge
Attach to Phase I Inspection Report

The following details were photographed from design drawings for the 1995 rehabilitation on file at the Office of Dam Safety:

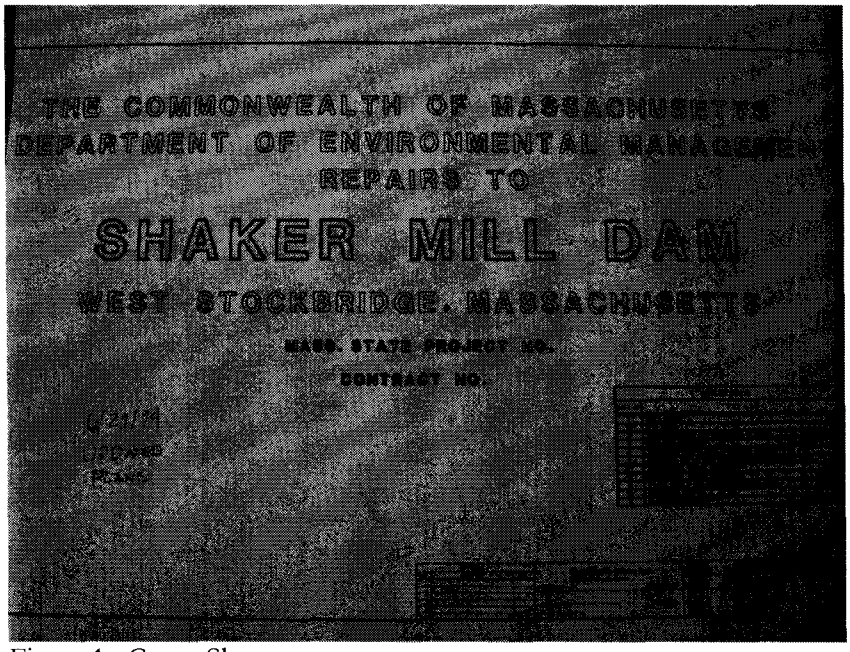


Figure 1. Cover Sheet

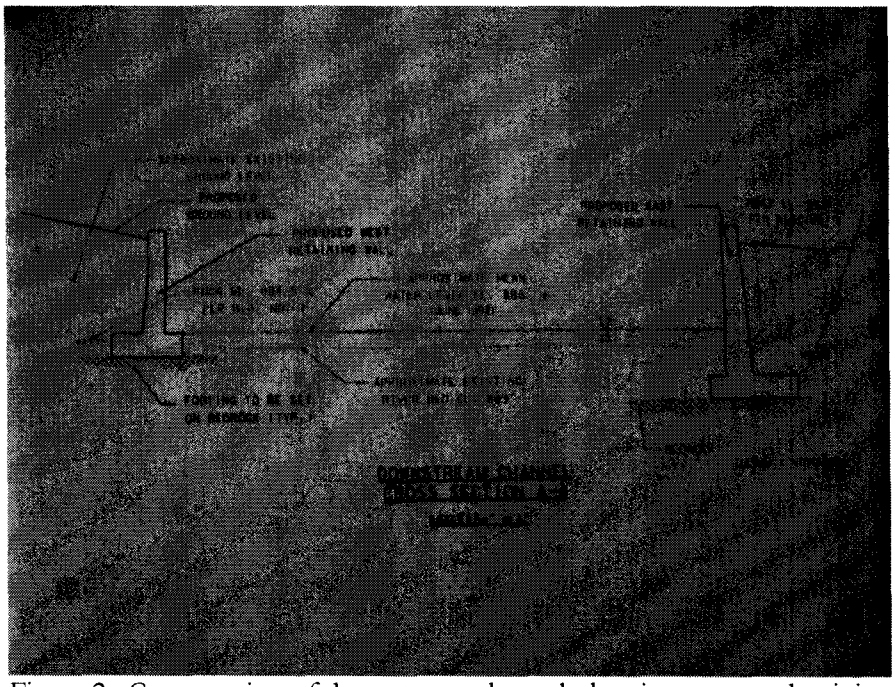


Figure 2. Cross section of downstream channel, showing proposed training walls. Note that training wall footings are shown on bedrock, which is represented by a diamond hatch pattern.

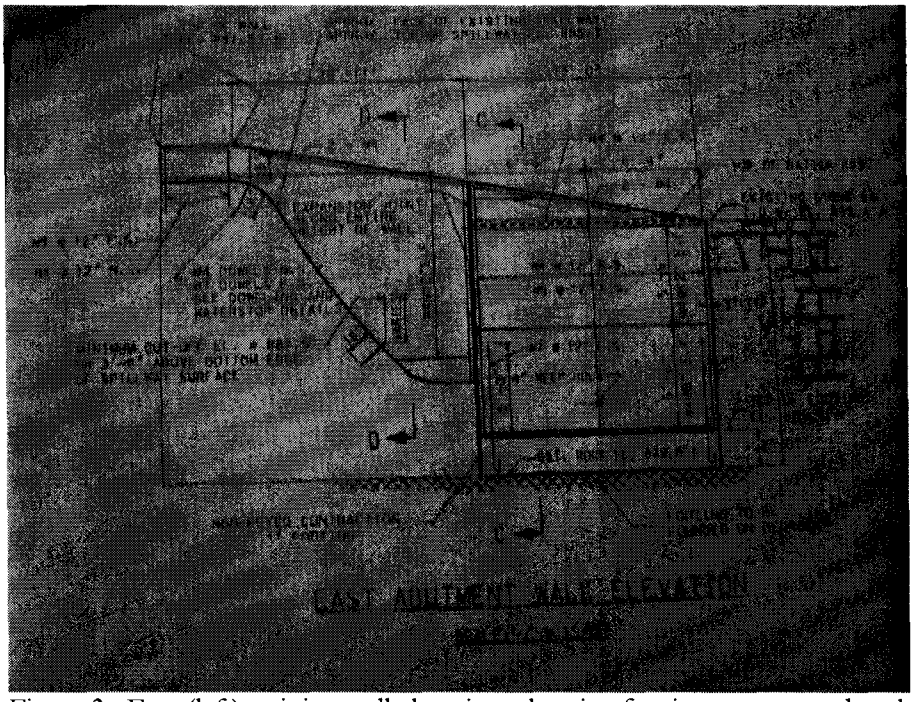


Figure 3. East (left) training wall elevation, showing footing constructed on bedrock represented by a diamond hatch pattern.

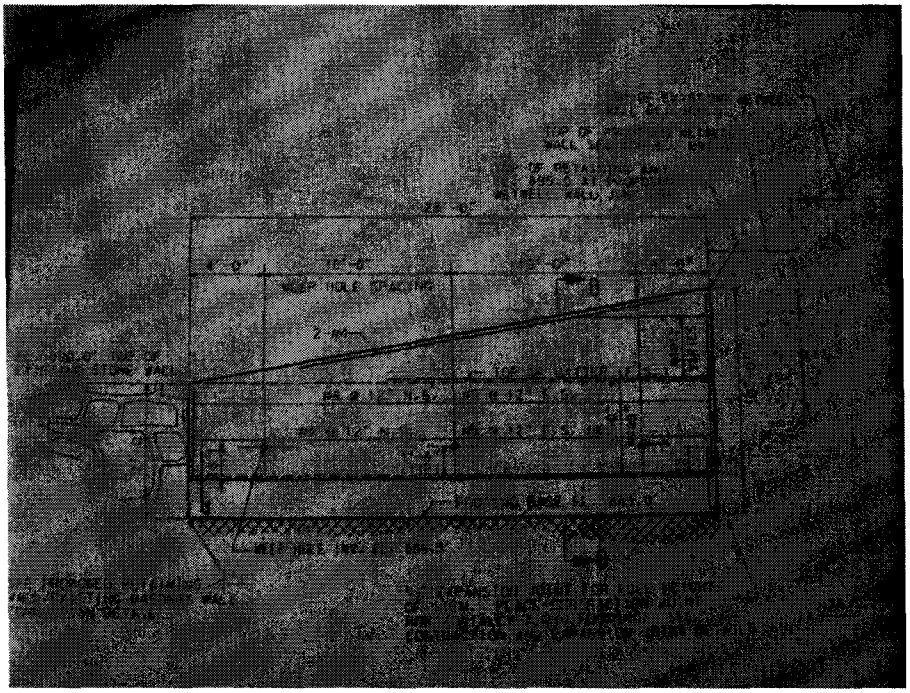


Figure 4. View of the west (right) training wall downstream of wetwell. Note that the footing is shown constructed on bedrock indicated by the diamond hatch pattern.

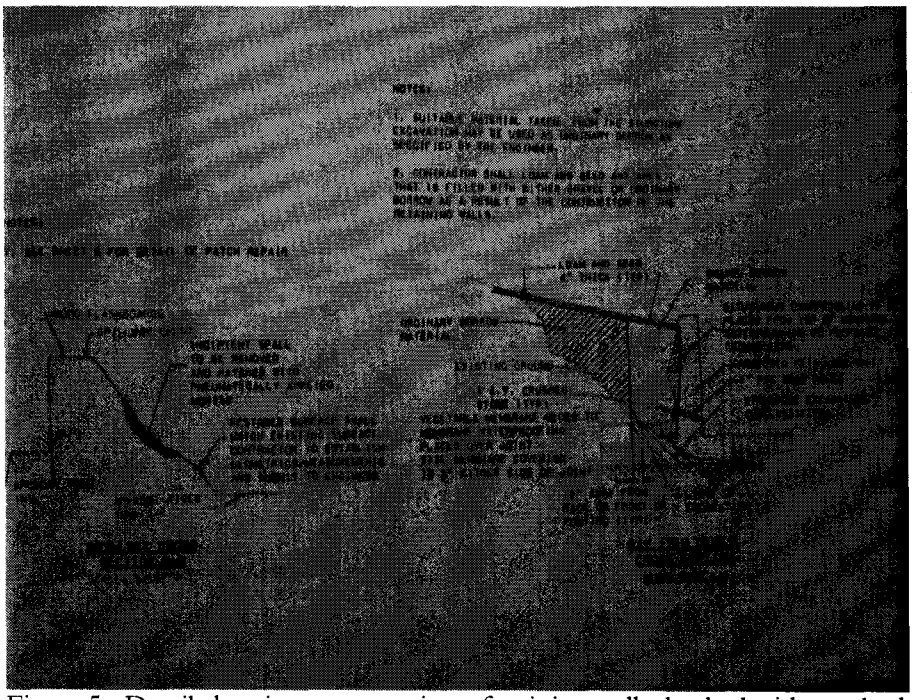


Figure 5. Detail showing cross section of training walls, backed with crushed gravel for drainage and with footing shown bedrock indicated by diamond hatch pattern.

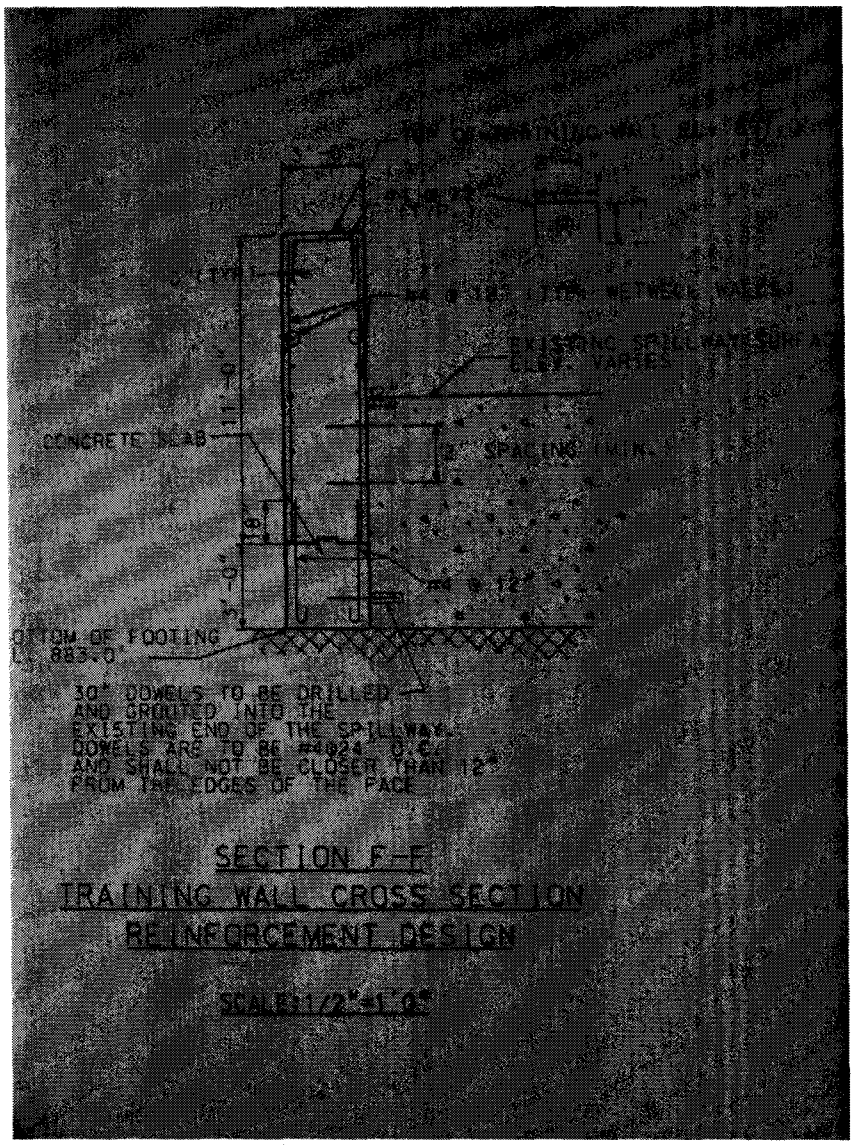


Figure 6. Spillway training wall design, showing wall to be constructed on bedrock indicated by diamond hatch pattern.

THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

REPAIRS TO

SHAKER MILL DAM

WEST STOCKBRIDGE, MASSACHUSETTS

MASS. STATE PROJECT NO. 475-95

CONTRACT NO. 475-95

INDEX OF SHEETS	
SHEET NO.	TITLE
1	TITLE SHEET
2	SITE PLAN
3	PROPOSED CONSTRUCTION PLAN
4	RETAINING WALLS
5	WETWELL CONSTRUCTION PLAN
6	CONCRETE REPAIR AND WATER DIVERSION LOCATION PLAN
7	STRUCTURAL REPAIR DETAILS I
8	STRUCTURAL REPAIR DETAILS II
9	GATES - GENERAL PLAN
10	GATES - UPSTREAM DEVELOPED ELEVATION AND DETAILS
11	GATES - ELECTRICAL DETAILS

REVISIONS		
NO.	DESCRIPTION	DATE
	Chg. 617-364-0232	

Goodkind & O'Dea, Inc.
A GEIGERRY AND DAVIS COMPANY
BOSTON MASSACHUSETTS
P.E. MA LICENSE NO. ____ DATE ____

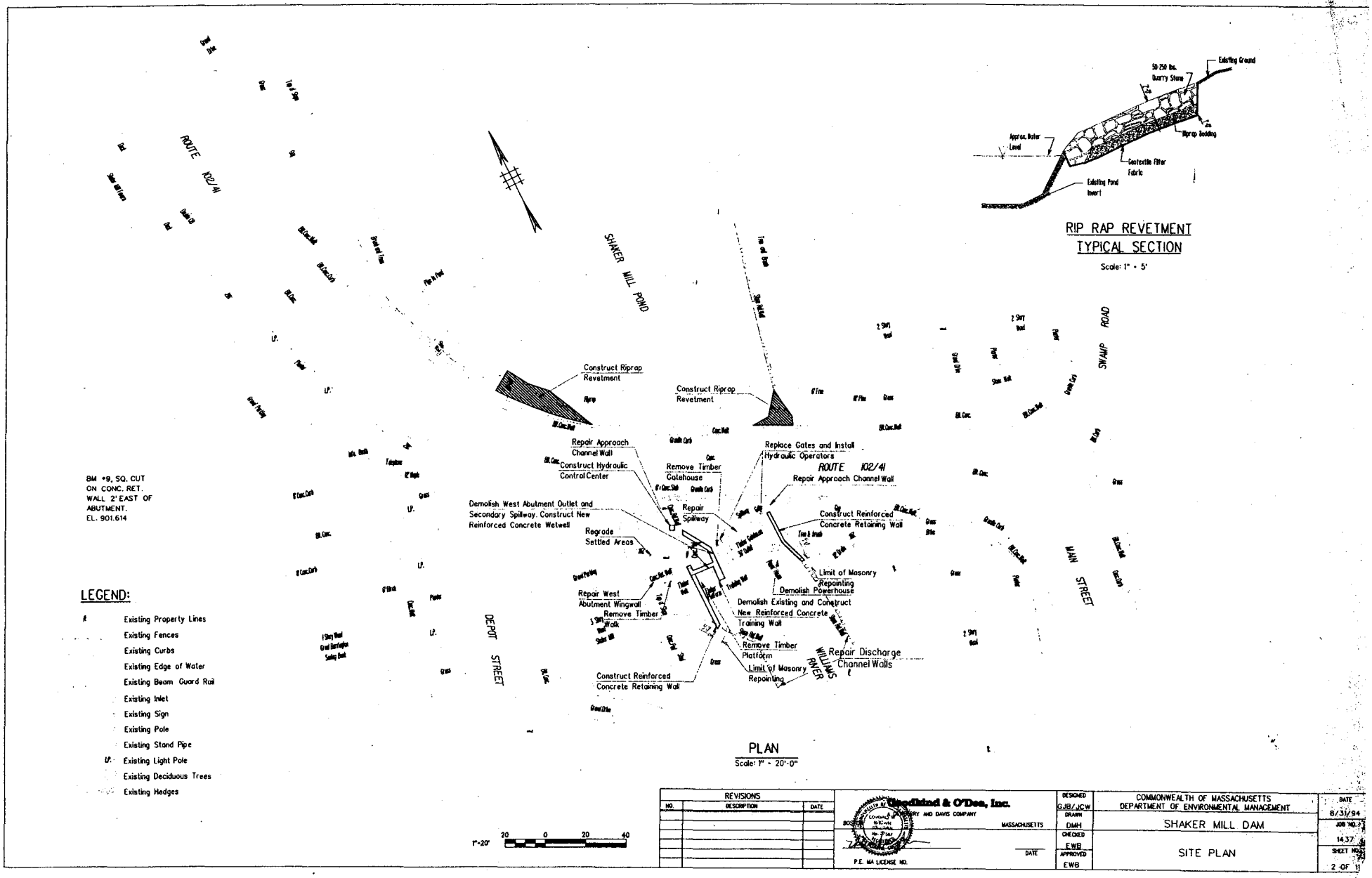
DESIGNED	GJB/JCW
DRAWN	GJB/JCW
CHECKED	EWB
APPROVED	EWB

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

REPAIRS TO SHAKER MILL DAM

TITLE SHEET

DATE 8/31/
JOB NO.
SHEET NO. 1 OF 11



RIP RAP REVETMENT
TYPICAL SECTION
Scale: 1" = 5'

PLAN
Scale: 1" = 20'-0"

REVISIONS		
NO.	DESCRIPTION	DATE

Woodward & O'Dea, Inc.
ENGINEERS AND SURVEYORS
BOSTON MASSACHUSETTS
P.E. MA LICENSE NO. DATE

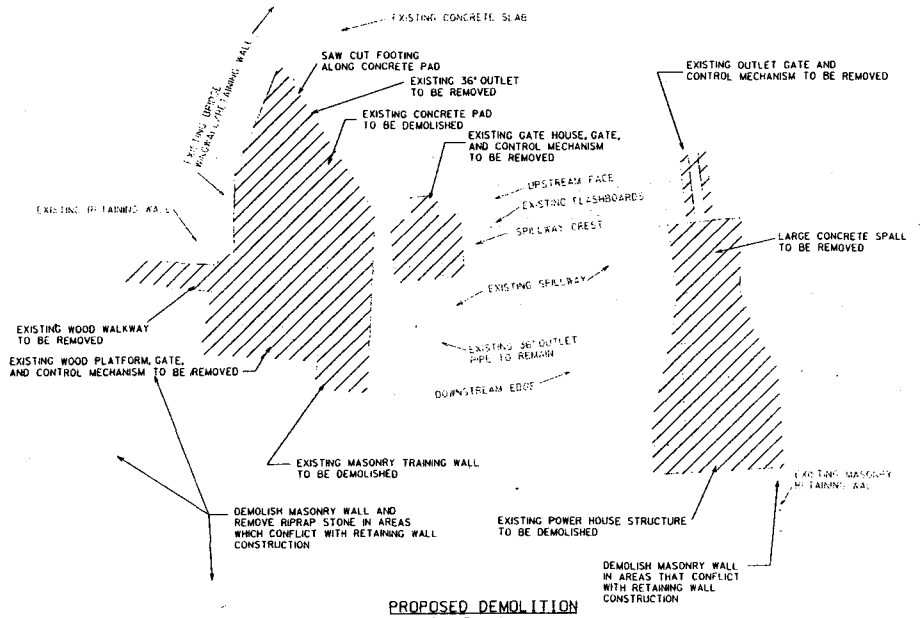
DESIGNED	GJB/JCW
DRAWN	DMH
CHECKED	EWB
APPROVED	EWB

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

SHAKER MILL DAM

SITE PLAN

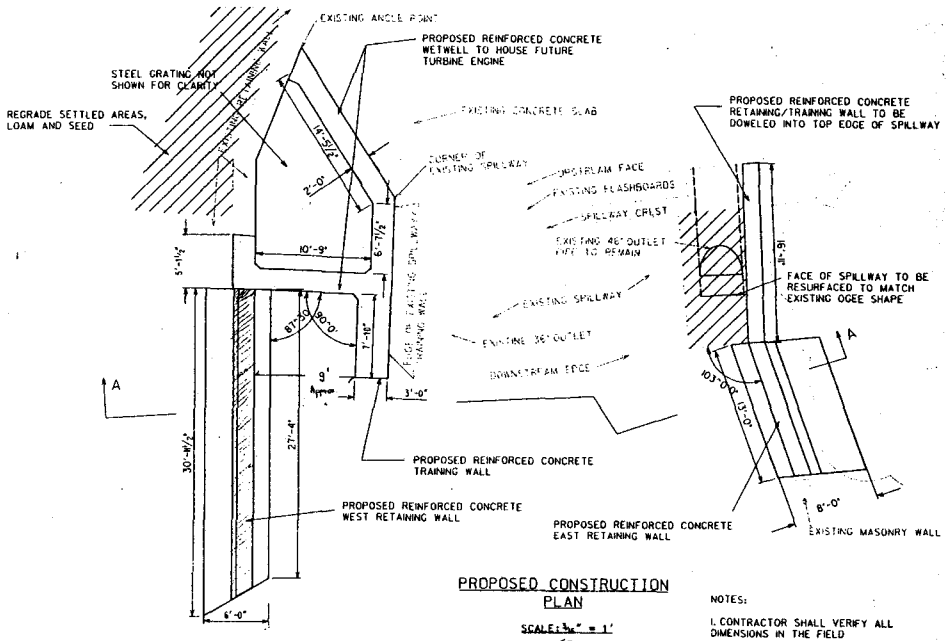
DATE	8/31/94
JOB NO.	1437
SHEET NO.	2 OF 11



PROPOSED DEMOLITION PLAN

SCALE: 3/16" = 1'

50/5



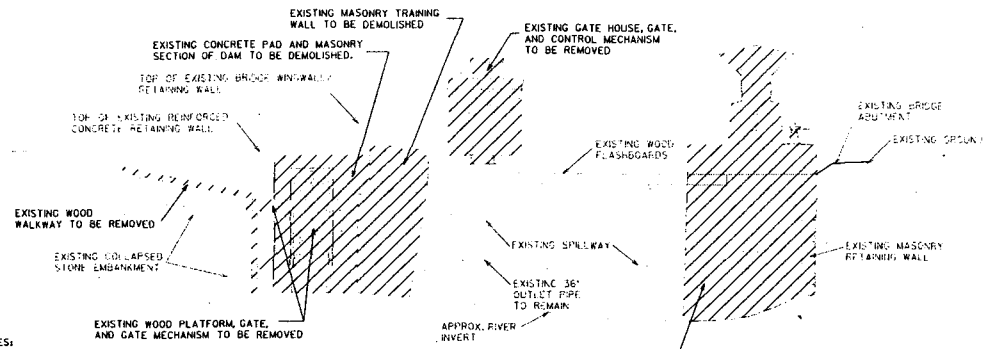
PROPOSED CONSTRUCTION PLAN

SCALE: 3/16" = 1'

50/5

NOTES:

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD
2. ALL AREAS DISTURBED AS A RESULT OF THE RETAINING WALL CONSTRUCTION WILL BE LOAMED AND SEEDED AS DIRECTED BY THE ENGINEER.

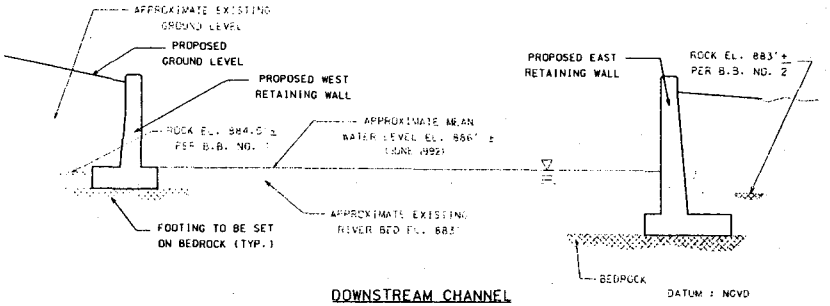


PROPOSED DEMOLITION DOWNSTREAM ELEVATION

SCALE: 3/16" = 1'

NOTES:

1. EXISTING REINFORCING STEEL IN THE RETAINING WALL OR SPILLWAY SHALL BE CLEANED AND REINCORPORATED INTO THE REHABILITATION FOLLOWING INSPECTION BY THE ENGINEER.
2. ALL ITEMS TO BE REMOVED BY THE CONTRACTOR SHALL BE INSPECTED BY THE TOWN OR MASSACHUSETTS HISTORICAL COMMISSION BEFORE DISPOSAL.

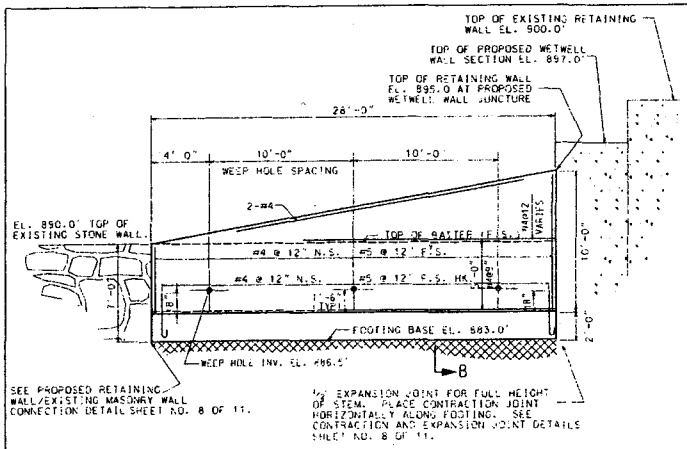


DOWNSTREAM CHANNEL CROSS SECTION A-A

SCALE: 3/16" = 1'

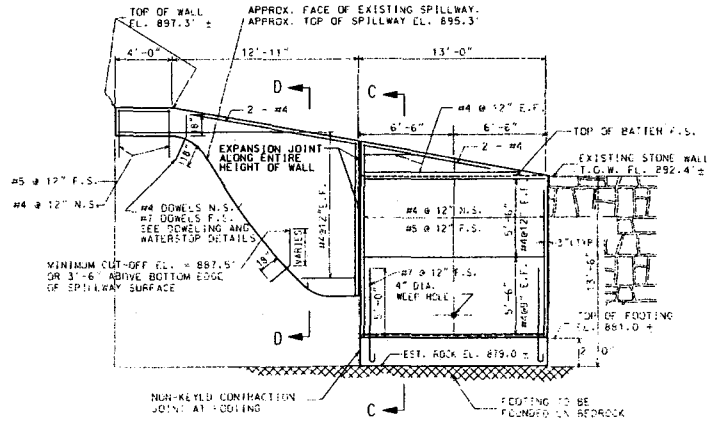
50/5

REVISIONS			Goodkind & O'Dea, Inc.	DESIGNED	COMMONWEALTH OF MASSACHUSETTS	DATE
NO.	DESCRIPTION	DATE	A DEWBERRY AND DAVIS COMPANY	GJB/JCW	DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	8/31/94
			BOSTON MASSACHUSETTS	DRAWN GJB/JCW	REPAIRS TO SHAKER MILL DAM	JOB NO. 1437
			P.E. DATE	CHECKED EWB	PROPOSED CONSTRUCTION PLAN	SHEET NO. 3 OF 11
				APPROVED EWB		



WEST ABUTMENT WALL ELEVATION

SCALE: 1/4" = 1'-0"

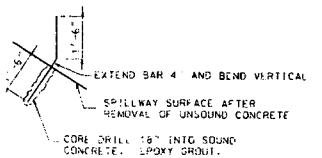


EAST ABUTMENT WALL ELEVATION

SCALE: 1/4" = 1'-0"

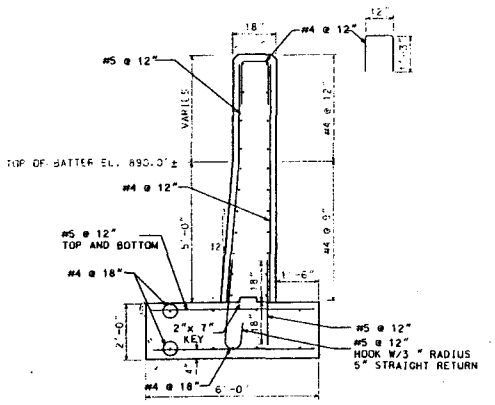
NOTES:

1. MINIMUM COVER OVER REINFORCEMENT TO BE 3" UNLESS NOTED OTHERWISE.
2. ROCK ELEVATION SHOWN ON THE DRAWING HAS BEEN ESTIMATED FROM BORING EXCAVATIONS AND REVIEW OF PREVIOUS DESIGN DRAWINGS. ELEVATIONS ARE TO BE VERIFIED DURING CONSTRUCTION.
3. THE DOWNSTREAM FACE OF THE SPILLWAY HAS BEEN VISUALLY ESTIMATED. ACTUAL DIMENSIONS ARE TO BE VERIFIED
4. WEEP HOLES ARE TO BE PLACED AT 10' INTERVALS ALONG THE STEM OF THE RETAINING WALLS. PLACED JUST ABOVE PROTECTIVE COURSE.
5. ALL FOOTINGS ARE TO BE FOUNDED ON BEDROCK.
6. THE SPILLWAY SURFACE IS TO BE CUT AND REMOVED TO SOUND CONCRETE. THE RETAINING WALL ON THE SPILLWAY IS THEN TO BE CUT 4" INTO THE SURFACE OF THE SOUND CONCRETE.
7. ALL TOP CORNERS OF RETAINING WALLS TO BE CHAMFERED 2" x 2".
8. IF BEDROCK IS NOT ENCOUNTERED AT THE FOOTING BASE ELEVATION. THE ENGINEER SHALL BE CONTACTED.



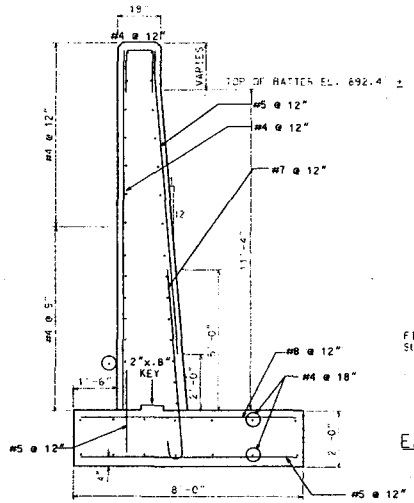
CROSS SECTION DETAIL OF SPILLWAY DOWELING CONNECTION

SCALE: 1/2"=1'0"



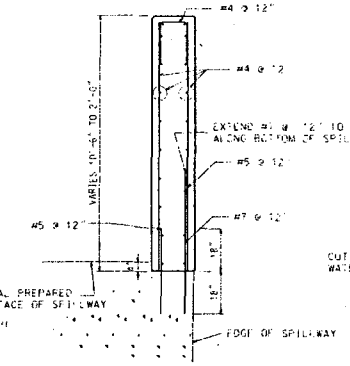
SECTION B-B
WEST RETAINING WALL
REINFORCEMENT DESIGN

SCALE: 1/2"=1'0"



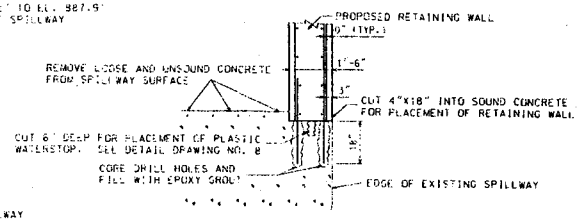
SECTION B-B
EAST RETAINING WALL
REINFORCEMENT DESIGN

SCALE: 1/2"=1'0"



SECTION D-D
EAST RETAINING WALL ON SPILLWAY
REINFORCEMENT DESIGN

SCALE: 1/2"=1'0"



CROSS SECTION DETAIL OF RETAINING WALL TO SPILLWAY CONNECTION

SCALE: 1/2"=1'0"

REVISIONS		
NO.	DESCRIPTION	DATE

Goodkind & O'Dea, Inc.
A DEWBERRY AND DAVIS COMPANY
BOSTON MASSACHUSETTS
DATE

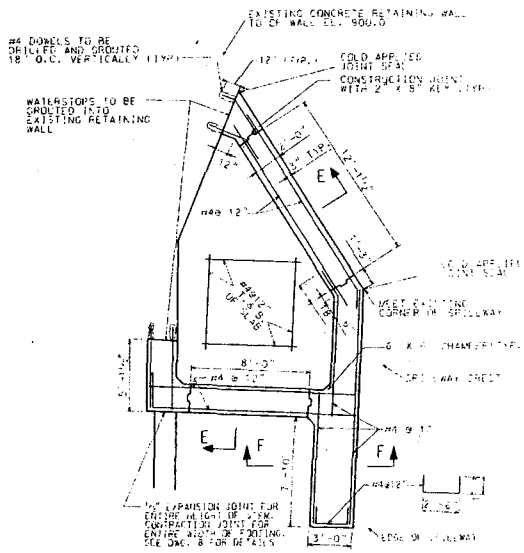
DESIGNED	JCW
DRAWN	JCW
CHECKED	GJB
APPROVED	EWB

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

REPAIRS TO SHAKER MILL DAM

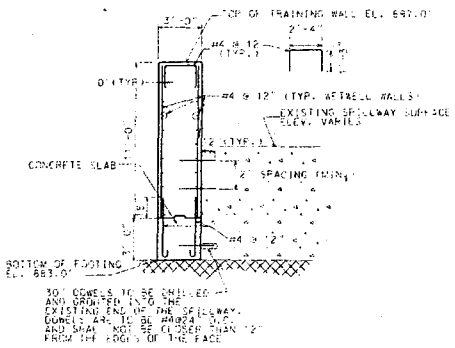
RETAINING WALLS

DATE	8/31/94
JOB NO.	1437
SHEET NO.	4 OF 11



WETWELL PLAN
REINFORCEMENT DESIGN

SCALE: 1/4" = 1'-0"

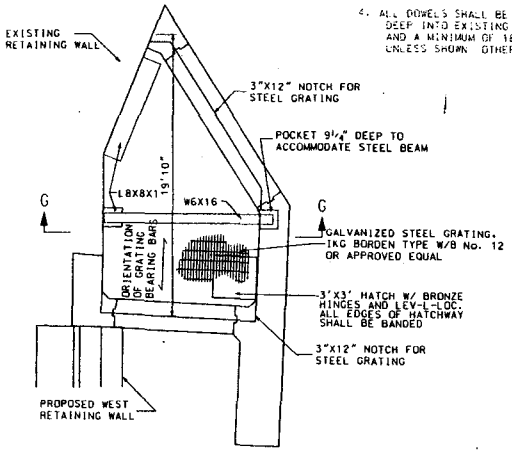


SECTION F-F
TRAINING WALL CROSS SECTION
REINFORCEMENT DESIGN

SCALE: 1/4"=1'0"

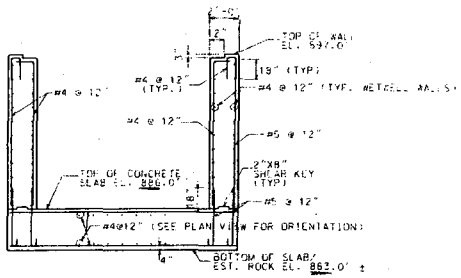
NOTES:

1. CONTRACTOR SHALL PROVIDE ALL FINAL DIMENSIONS TO STEEL GRATING MANUFACTURER, PRIOR TO FABRICATION.
2. ALL STEEL TO BE GALVANIZED, ASTM A123
3. GRATING SURFACE TO BE SERRATED.
4. ALL DOWELS SHALL BE A MINIMUM OF 12" DEEP INTO EXISTING SPILLWAYOF WALLS AND A MINIMUM OF 18" O.C. VERTICALLY UNLESS SHOWN OTHERWISE ON PLAN.



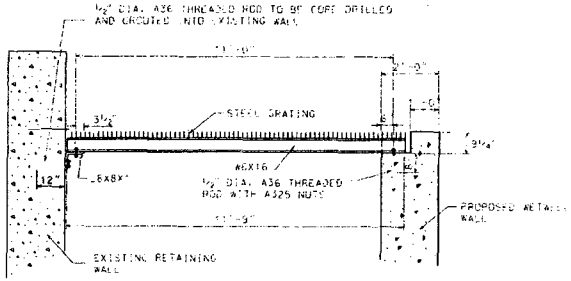
STEEL GRATING FOR WETWELL
PLAN VIEW

SCALE: 1/4"=1'



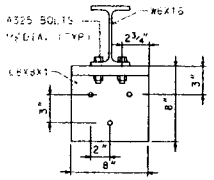
SECTION E-E
WETWELL CROSS SECTION
REINFORCEMENT DESIGN

SCALE: 1/4"=1'0"



WETWELL GRATING SUPPORT BEAM
SECTION G-G

SCALE: 1/2"=1'



SUPPORT BEAM
CONNECTION DETAIL

SCALE: 2"=1'

REVISIONS		
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Goodkind & O'Dea, Inc.
A DEWBERRY AND DAVIS COMPANY
BOSTON MASSACHUSETTS

P.E. DATE

DESIGNED	JCW/GJB
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CHECKED	GJB/JCW
APPROVED	EWB

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

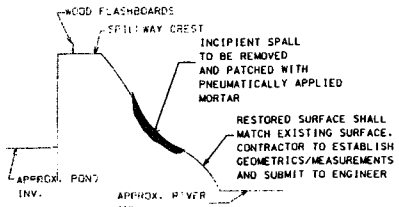
REPAIRS TO SHAKER MILL DAM

WET WELL CONSTRUCTION

DATE	8/31/94
JOB NO.	1437
SHEET NO.	5 OF 11

NOTES:

1. SEE SHEET 8 FOR DETAIL OF PATCH REPAIR



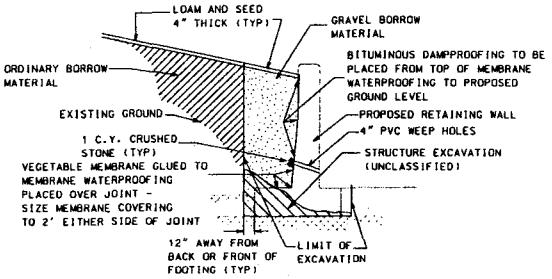
SPILLWAY CROSS SECTION H-H

SCALE: 3/16" = 1'

NOTES:

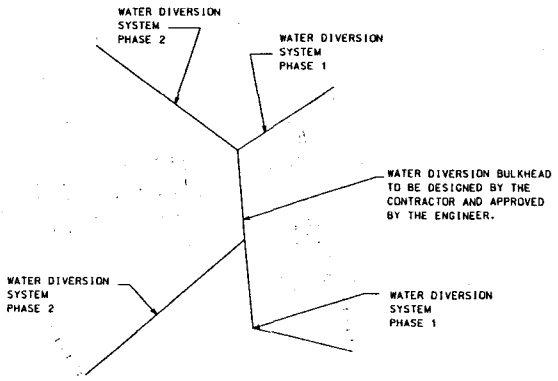
1. SUITABLE MATERIAL TAKEN FROM THE STRUCTURE EXCAVATION MAY BE USED AS ORDINARY BORROW AS SPECIFIED BY THE ENGINEER.

2. CONTRACTOR SHALL LOAM AND SEED ANY AREA THAT IS FILLED WITH EITHER GRAVEL OR ORDINARY BORROW AS A RESULT OF THE CONTRUCTION OF THE RETAINING WALLS.



PAY ITEM DETAIL CROSS SECTION

SCALE: 3/16" = 1'



COFFERDAM LAYOUT PLAN

SCALE: 3/32" = 1'

NOTE:

1. TIMBER FLASHBOARD MAY BE REMOVED, IF NEEDED TO FACILITATE WATER DIVERSION SYSTEM. CONTRACTOR SHALL OBTAIN ALL NECESSARY ENVIRONMENTAL PERMITS

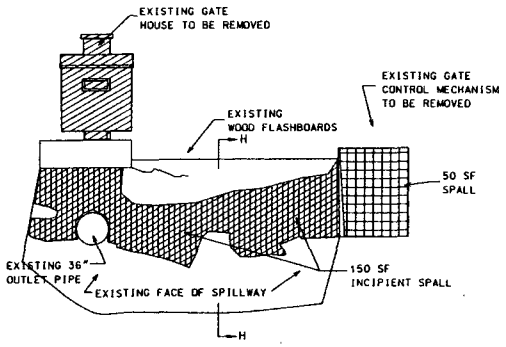
2. CONTRACTOR SHALL USE 9' AND 5' HIGH PORTABLE COFFERDAMS ON THE UPSTREAM AND DOWNSTREAM SIDES RESPECTIVELY.

3. THE CONTRACTOR MAY, BY APPROVAL OF THE ENGINEER, USE OTHER WATER DIVERSION TECHNIQUES, SUCH AS SANDBAGS, ON THE DOWN STREAM SIDE OF THE SPILLWAY.

4. ALL DEWATERING DISCHARGES SHALL CONFORM TO ENVIRONMENTAL REQUIREMENTS. SEE SUPPLEMENTAL GENERAL CONDITIONS.

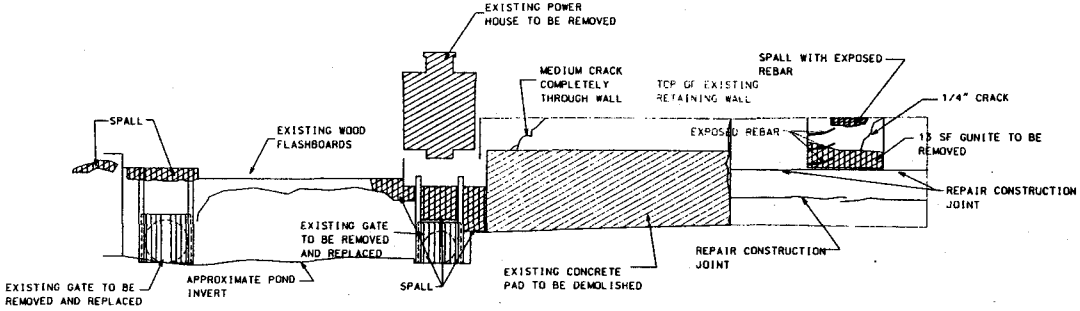
LEGEND:

- STRUCTURES TO BE DEMOLISHED
- CONCRETE SPALLS TO BE REPAIRED
- WATER DIVERSION SYSTEM
- EXISTING CRACKS TO BE REPAIRED



DOWNSTREAM ELEVATION FACE OF SPILLWAY

SCALE: 3/16" = 1'



DEVELOPED UPSTREAM ELEVATION

SCALE: 3/16" = 1'

NOTE:

1. THE EXTENT OF THE SPALLS AND CRACKS IS BASED ON A PHYSICAL INSPECTION OF THE SPILLWAY DATED 11/5/92 AND QUANTITIES ARE APPROXIMATE ONLY.

2. THE UPSTREAM AND DOWNSTREAM PERIMETERS OF OUTLET PIPES SHALL BE PRESSURE GROUTED TO CONTROL SEEPAGE.

REVISIONS		
NO.	DESCRIPTION	DATE

Goodkind & O'Dea, Inc.
BOSTON, MASSACHUSETTS
DATE

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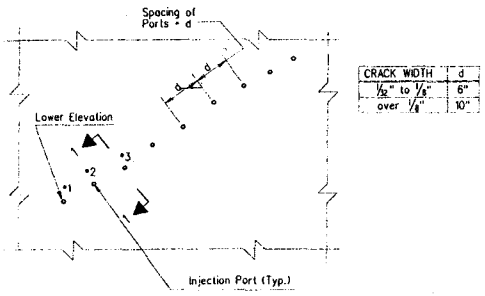
CHECKED	EWB
APPROVED	EWB

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

REPAIRS TO SHAKER MILL DAM

CONCRETE REPAIR AND WATER DIVERSION LOCATION PLAN

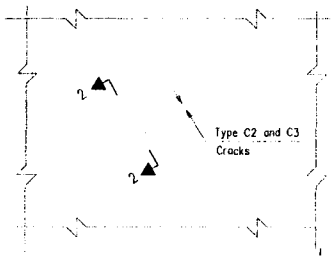
DATE	8/31/94
JOB NO.	1437
SHEET NO.	6 OF 11



TYPE C1 CONCRETE CRACK REPAIR DETAIL

(1/32" to 3/16" Wide)

Not to Scale



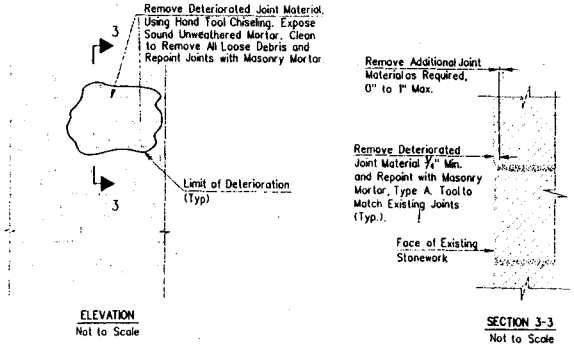
TYPE C2 CONCRETE CRACK REPAIR DETAIL

(Over 3/16" to 1/2" Wide)

TYPE C3 CONCRETE CRACK REPAIR DETAIL

(Over 1/2" Wide)

Not to Scale



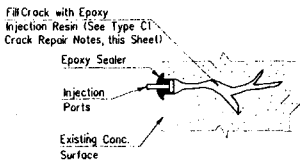
ELEVATION

Not to Scale

SECTION 3-3

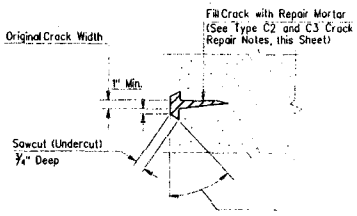
Not to Scale

STONE MASONRY REPAIR



SECTION 1-1

Not to Scale



SECTION 2-2

Not to Scale

MASONRY REPAIR NOTES:

1. Masonry repairs shallbe performed in accordance with Specificotion and as approved by the Engineer.
2. Upon completion of the brick and stone masonry repairs, but not prior to 72 hours, a water repellent product shall be applied as follows:
   a. Check that the surfaces to receive the water repellent product are clean and free of oil, grease or foreign substances.
   b. Apply the water repellent product, HYDROZO "Clear-16" or approved equal, allowing a minimum of 12" rundown onto adjacent surfaces to assure maximum saturation of substrate.

TYPE C1 CRACK REPAIR (1/32" TO 3/16" WIDE) NOTES:

1. CRACK REPAIR SHALL BE PERFORMED IN ACCORDANCE WITH SPECIFICATIONS
2. THE EPOXY INJECTION RESIN SHALL BE NITOBOND ULV, AS MANUFACTURED BY FOSROC, INC., OR APPROVED EQUAL. THE EPOXY INJECTION RESIN SHALL CONFORM TO THE REQUIREMENTS OF ASTM C881, TYPE I, GRADE 1, CLASS B OR C.
3. THE EPOXY SEALER SHALL BE NITOBOND EPOXY GEL AS MANUFACTURED BY FOSROC, INC., OR APPROVED EQUAL.
4. CONTRACTOR SHALL TAKE TEST CORE SAMPLES FOR QUALITY ASSURANCE. COST OF TAKING TEST CORE SAMPLES SHALL BE INCLUDED IN THE UNIT PRICE FOR TYPE C1 CRACK REPAIR. CONTRACTOR SHALL TAKE 4 CORES, EACH 1-INCH IN DIAMETER, AT RANDOM LOCATIONS AS DIRECTED BY THE ENGINEER.

TYPE C2 CRACK REPAIR (OVER 3/16" TO 1/2" WIDE) AND TYPE C3 CRACK REPAIR (OVER 1/2" WIDE) NOTES:

1. SAWCUT ALONG THE EDGES OF THE CRACK TO BE REPAIRED 1/4" DEEP AS INDICATED IN SECTION 2-2.
2. REMOVE CONCRETE BETWEEN SAWCUTS.
3. CLEAN CONCRETE SURFACES TO BE REPAIRED IN ACCORDANCE WITH SPECIFICATIONS .
4. PLACE THE REPAIR MORTAR INTO THE CRACK IN ACCORDANCE WITH SPECIFICATIONS .
5. TYPE C2 REPAIR MORTAR SHALL BE NITOBOND 881-43, AS MANUFACTURED BY FOSROC, INC., OR APPROVED EQUAL.
   TYPE C3 REPAIR MORTAR SHALL BE RENDERROC HB, AS MANUFACTURED BY FOSROC, INC., OR APPROVED EQUAL.

REVISIONS		
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Goodkind & O'Dea, Inc.

NEWBERRY AND DAVIS COMPANY

BOSTON, MASSACHUSETTS

DATE

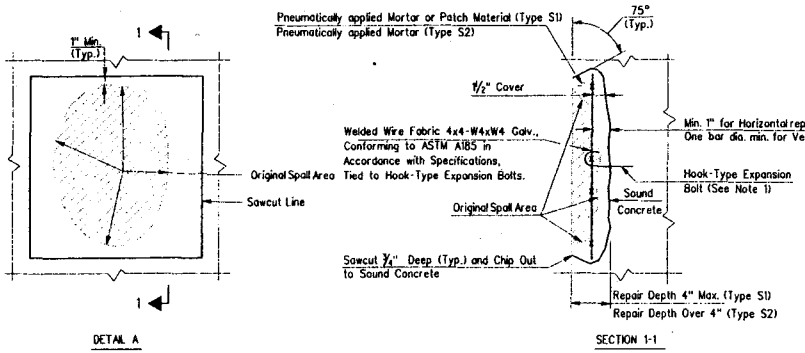
DESIGNED	DMH
DRAWN	DMH
CHECKED	EWB
APPROVED	EWB

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

REPAIRS TO SHAKER MILL DAM

STRUCTURAL REPAIR DETAILS I

DATE	8/31/94
JOB NO.	1437
SHEET NO.	7 OF 11



DETAIL A

SECTION 1-1

TYPE S1 CONCRETE SPALL REPAIR
TYPE S2 CONCRETE SPALL REPAIR

Not to Scale

GENERAL NOTES FOR CONCRETE SPALL REPAIR:

1. SAWCUT THE EDGES OF THE AREA TO BE REPAIRED ¼" DEEP AS SHOWN ON THE REPAIR DETAILS, THIS DRAWING.
2. REMOVE ALL UNSOUND AND DETERIORATED CONCRETE.
3. CLEAN CONCRETE SURFACES TO BE REPAIRED BY DRY ABRASIVE BLASTING IN ACCORDANCE WITH SPECIFICATIONS.
4. PROVIDE WELDED WIRE FABRIC AS SHOWN ON THE REPAIR DETAIL.
5. PROVIDE FORMS TO ATTAIN ORIGINAL PLUMB OR LEVEL SURFACES.

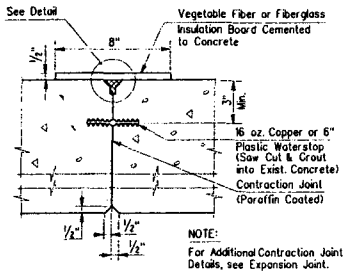
6.A. TYPE S1:
SATURATE SPALL AREA WITH WATER, APPLY SLURRY COAT AND PLACE CONCRETE PATCH MATERIAL IN ACCORDANCE WITH THE SPECIFICATIONS.

B. TYPE S2:
SATURATE SPALL AREA WITH WATER AND COAT WITH A NEAT PORTLAND CEMENT PASTE AND FILL CAVITY WITH CLASS B CONCRETE, IN ACCORDANCE WITH SPECIFICATIONS.

7. CONTRACTOR HAS THE OPTION TO USE PNEUMATICALLY APPLIED MORTAR OR PATCH MATERIALS (AS DESCRIBED IN THE SPEC.) FOR SMALL SPALL AREAS.

NOTES:

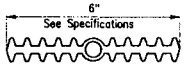
1. Provide ¼" Dia. x 2½" long Hook-Type Expansion Bolts Manufactured by CEB Corp., Chicago, Illinois or Approved Equal at 9" O/C, Horizontal and Vertical, or a Minimum of 2 Anchors per Square Foot of Repair Area. Expansion Bolts shall be Securely Fastened to the Sound Concrete in Accordance with the Manufacturer's Written Instructions. Install Expansion Bolts prior to Abrasive Blasting. Expansion Bolt Installation Procedure shall be Submitted to the Engineer for Approval.



NOTE:
For Additional Contraction Joint Details, see Expansion Joint.

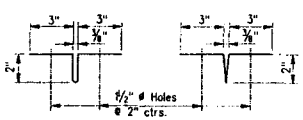
CONTRACTION JOINT

Scale: 2"=1'-0"



DETAIL OF PLASTIC WATERSTOP

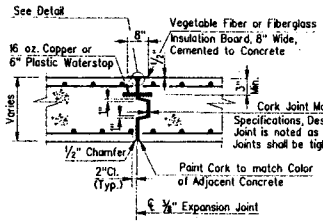
Half Size



EXP. CONTR.

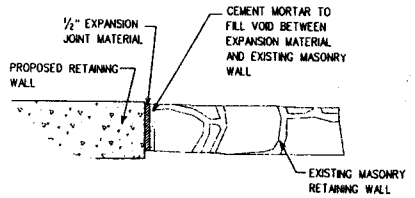
16 OZ. COPPER WATERSTOP 10" WIDE

Scale: 3"=1'-0"



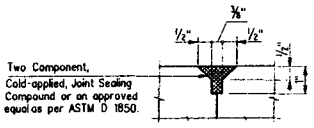
EXPANSION JOINT

Scale : ½" = 1'-0"



PROPOSED RETAINING WALL/ EXISTING MASONRY WALL CONNECTION

PLAN
SCALE: NTS



DETAIL A

Half Size

ARCHITECTURAL NOTES:

1. Grooves shall be continuous. Any objectionable irregularity shall be corrected to the satisfaction of the Engineer.
2. All exposed edges and corners shall be chamfered ½" x ½", unless shown or noted otherwise.

REVISIONS			
NO.	DESCRIPTION	DATE	

Goodkind & O'Dea, Inc.
A DEWBERRY AND DAVIS COMPANY
BOSTON MASSACHUSETTS
DATE

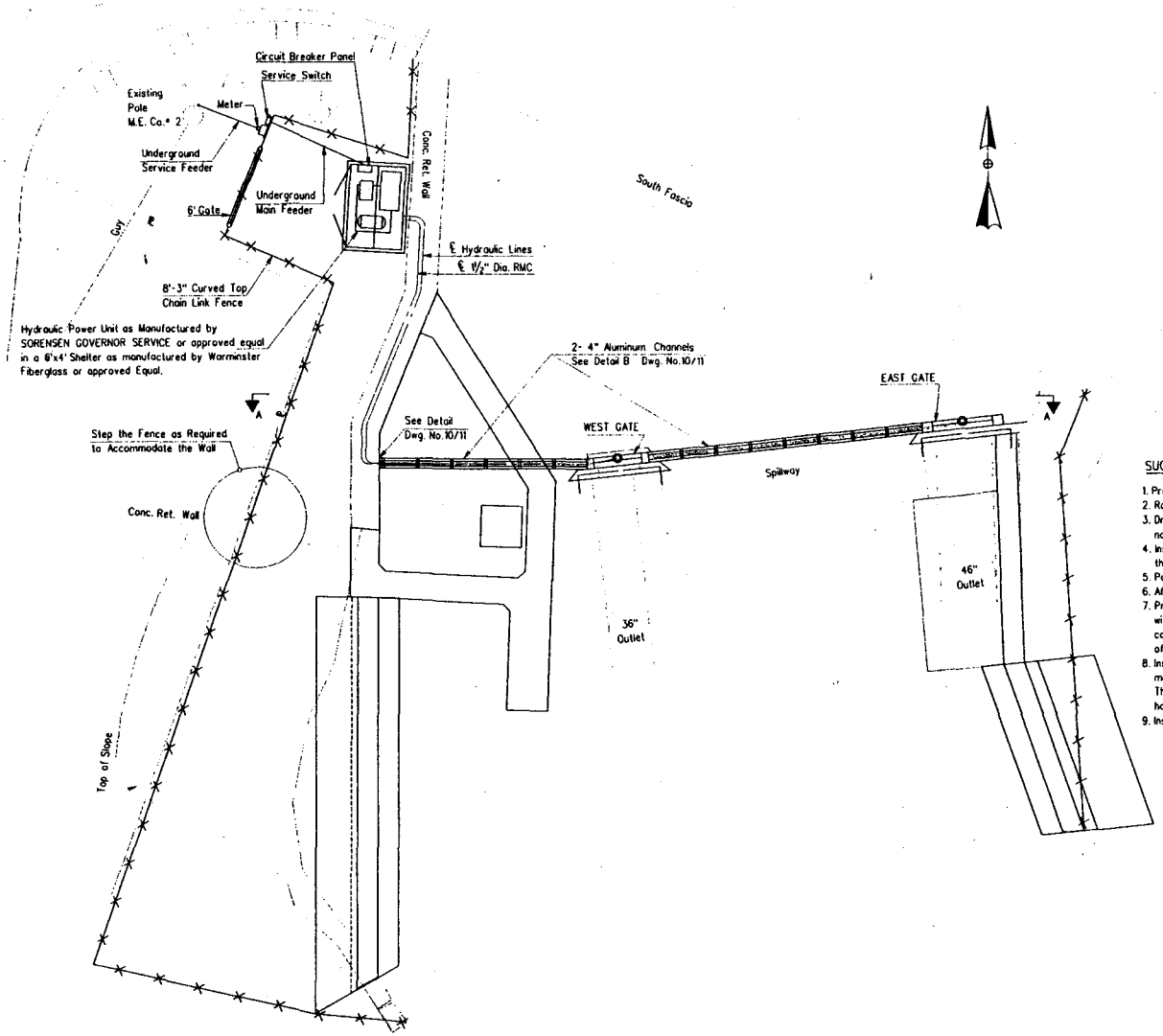
DESIGNED	DMH
DRAWN	DMH
CHECKED	EWB
APPROVED	EWB

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

REPAIRS TO SHAKER MILL DAM

STRUCTURAL REPAIR DETAILS II

DATE	8/31/94
JOB NO.	1437
SHEET NO.	8 OF 11



PROPOSED GATES AND HYDRAULIC POWER UNIT

Scale : ¼" = 1'-0"

SUGGESTED INSTALLATION SEQUENCE

1. Pressure wash the exposed concrete face of the dam. Make repairs as required.
2. Roughen the entire surface where new concrete facing will be installed.
3. Drill the 1½" diameter holes as shown in the plan, install the reinforcement and grout using an epoxy based non-shrink grout (as manufactured by "Five Star" or approved equal).
4. Install an extension pipe to the existing outlet pipe by welding it to the existing. Contractor to verify in field the size and wall thickness of the existing pipe.
5. Pour the concrete facing to provide a plumb face of the concrete for gate frame assembly.
6. After a seven day curing period proceed with gate installation in accordance with manufacturer's specifications.
7. Providing the gate was correctly installed (can be smoothly operated in manual mode), attach one aluminum channel with the bottom spacer plates installed. Attach the hydraulic tube clamps and the 1½" diameter rigid metallic conduit on top of existing concrete wall as shown using ⅝" diameter anchors with a minimum embedded length of 5". Hold-down brackets for conduit shall not exceed 3 feet spacing.
8. Install the hydraulic lines and control cables. These shall be tied togheter with PVC ties spaced at 2 feet maximum. For the segments running on top of the wall, ties may be omitted.
   The control cable and hydraulic lines crossing the westerly gate shall be attached to the gate's upstream horizontal channel ensuring that no interference with any movable parts.
9. Install the other aluminum channel and top spacer plates as shown on this drawing.

REFERENCES:

1. For Water Gate Installation Details, see Dwg. No. 10/11
2. For Electrical Service Diagram, see Dwg. No. 11/11
3. For Chain Link Fence Detail, see Dwg. No.10/11
4. For Hydraulic Shelter Foundation, see Dwg. No 10/11

REVISIONS		
NO.	DESCRIPTION	DATE

Goodkind & O'Dea, Inc.
ENGINEERS AND DAVIS COMPANY
BOSTON MASSACHUSETTS
P.E. MA
DATE

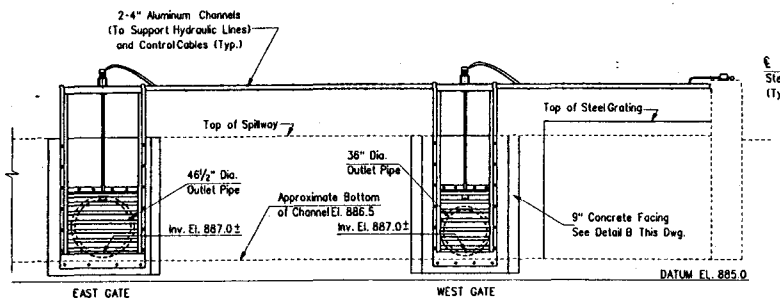
DESIGNED	V.M.
DRAWN	V.M.
CHECKED	P.B.
APPROVED	E.W.B.

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

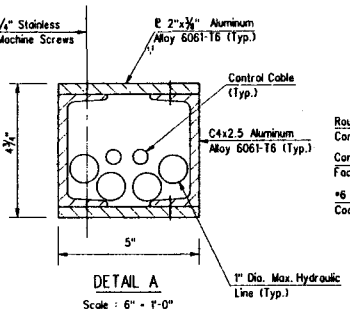
REPAIRS TO SHAKER MILL DAM

GATES
GENERAL PLAN

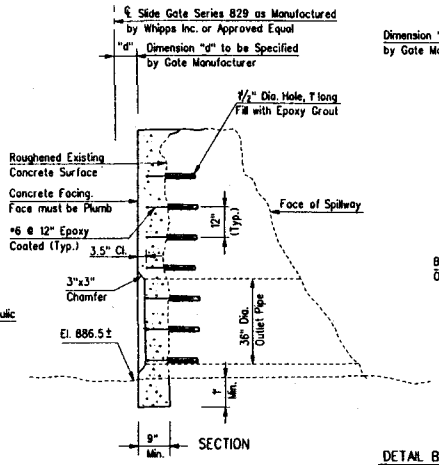
DATE: 06/30/1994
JOB NO.
SHEET NO. 9/11



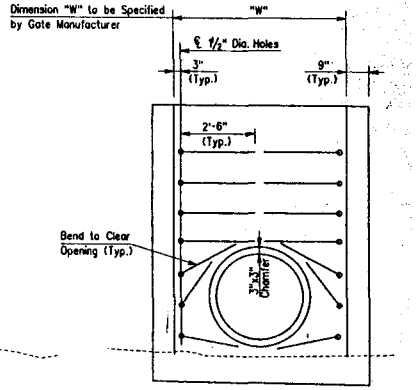
UPSTREAM DEVELOPED ELEVATION
(View A-A)
Scale : ¼" = 1'-0"



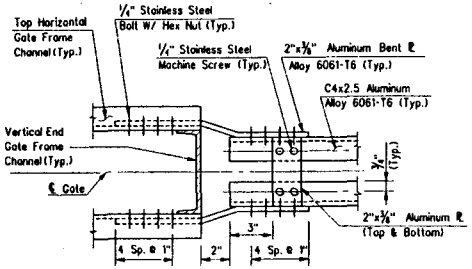
DETAIL A
Scale : 6" = 1'-0"



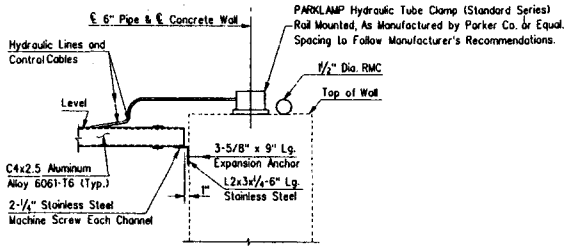
DETAIL B
Scale : ½" = 1'-0"



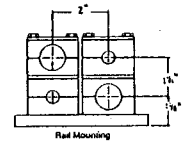
NOTE: 36" Outlet Pipe shown, the other similar
FRONT VIEW



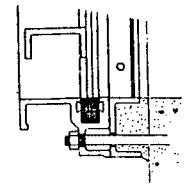
ALUMINUM CHANNEL CONNECTION DETAIL
(TOP VIEW)
Scale : 3" = 1'-0"



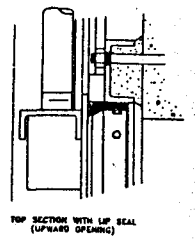
ALUMINUM CHANNEL CONNECTION DETAIL
(CONCRETE WALL CONNECTION)
Scale : 1" = 1'-0"

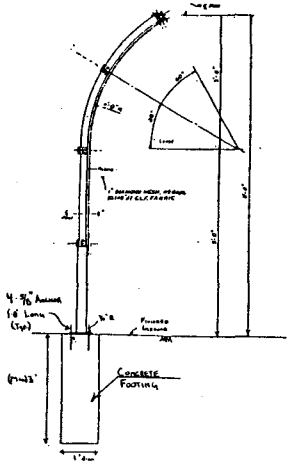


HYDRAULIC TUBE CLAMP
N.T.S.

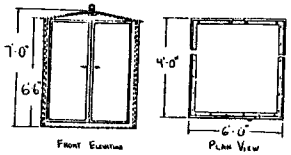


SLIDE GATE SECTIONS
N.T.S.

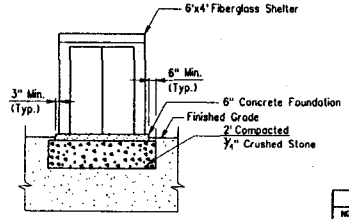




CHAIN LINK FENCE DETAIL
N.T.S.



FIBERGLASS SHELTER
N.T.S.



SHELTER FOUNDATION DETAIL
Scale : ¼" = 1'-0"

FIBERGLASS SHELTER NOTES:

Fiberglass shelter shall be model No. WFS1006 as manufactured by "Warminster Fiberglass" Southampton, PA or approved equal, installed with the following optional equipment:

- Double Door Assembly with stop chains and brackets to hold doors open;
- Exhaust Fan - 7" with Gravity Shutter, 135 CFM Dayton 2C634 including fiberglass canopy with insect screen, H-O-A and Thermostat control;
- Fluorescent Lamp 2 bulb 48" with acrylic lens;
- Duplex Switch Box - 2 Toggle (inside) and Duplex Outlet;
- Heater - 120V, 1300-1500 W, with Thermostat including mounting (channel, outlet and brackets);
- Circuit Breaker panel 100A Murray LC008AS or approved equal including 6 -1 pole breakers (total 8 spaces) including mounting channel - galvanized steel Powerstrut P500 or approved equal;
- Electrical wiring in flexible, liquid tight, PVC coated galvanized steel Anaconda conduit type EF:
- Fan and switch
- Lamp and switch
- Duplex outlet
- Heater

REFERENCES:

1. For Electrical Details, see Dwg. No. 11/11

REVISIONS		
NO.	DESCRIPTION	DATE

Goodkind & O'Dea, Inc.
A Gannett Fleming and Davis Company
BOSTON MASSACHUSETTS
P.E. MASSACHUSETTS No.
DATE

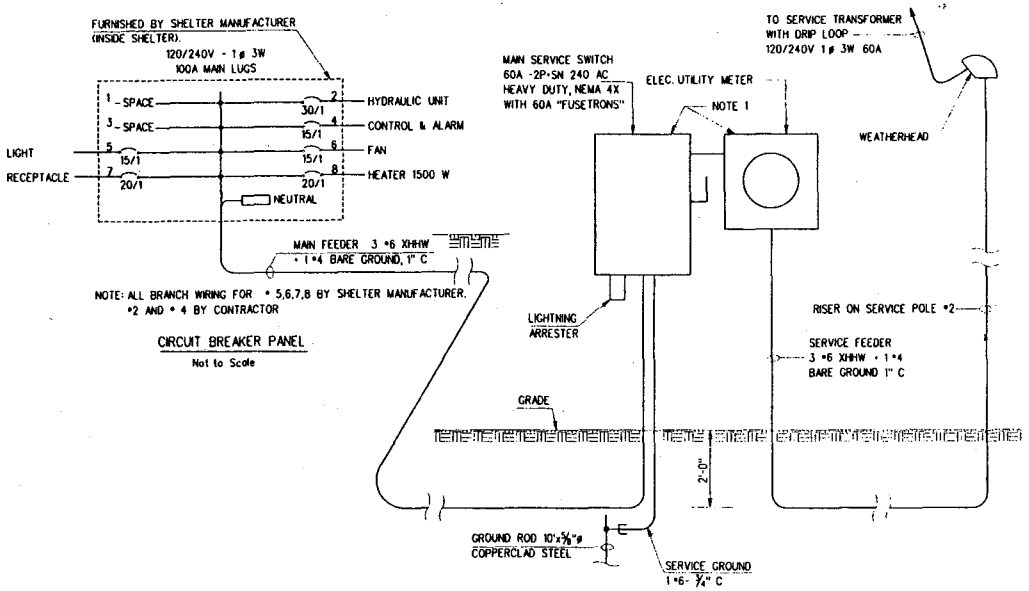
DESIGNED	V M
DRAWN	V M
CHECKED	P B
APPROVED	E W B

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

REPAIRS TO SHAKER MILL DAM

GATES
UPSTREAM DEVELOPED ELEVATION AND DETAILS

DATE 06/30/1994
JOB NO.
SHEET NO. 10/11



NOTES :

1. Electrical Service to Conform to the Standards and Requirements of the M.E. Co. Meter and Service Switch shall be Mounted on a Frame of Heavy-Duty Galvanized Steel "Unistrut" with Concrete Base, Top of Equipment at 5'-6" above grade. Provide Heavy-Duty Brass Padlock with Three Keys for Switch.
2. Work shall be performed by a qualified electrician in accordance with the N.E.C. and all applicable state and local codes and ordinances and O.S.H.A.
3. Materials and equipment shall be new and in perfect condition and shall conform to applicable A.N.S.I. standards, including, U.L., I.E.E.E., and N.E.M.A.
4. For service feeder, from service pole to panel in shelter, conduit shall be rigid steel, heavy-wall, hot dipped galvanized. Installation shall be heavy-duty, and watertight. Use 2-hole straps on pole. Underground portion shall be coated with asphaltic compound or "TAPECOAT", and shall be minimum of 2 feet below grade. Wires shall be copper conductors, Type XHHW, stranded.
5. Cables from shelter to gate position sensors shall be #16 stranded copper, multiconductor cable by A.I.W. or approved equal. Conductor insulation shall be Type THWN, with neoprene jacket. Number of conductors shall be as required by gate vendor, and shall include one ground conductor, and 2 spare conductors for each gate.
6. Contractor shall provide appropriate grounding for systems, enclosures, and exposed metal parts in accordance with N.E.C. Article 250, including but not limited to:
   a) Service neutral
   b) Panel and hydraulic unit
   c) Fence posts and fence gates
   d) Hydraulic piping and supports, and hydraulic gates.

WARNING: Grounding of hydraulic gates and hydraulic system shall be heavy enough for lightning protection (not just electric system grounding).

REVISIONS			Goodkind & O'Dea, Inc.	DESIGNED	COMMONWEALTH OF MASSACHUSETTS	DATE
NO.	DESCRIPTION	DATE	BOSTON MASSACHUSETTS	V M	DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	06/30/1994
				DRAWN V M	REPAIRS TO SHAKER MILL DAM	JOB NO.
			P.E. No. [illegible] DATE	CHECKED P B	GATES	SHEET NO.
				APPROVED E W B	ELECTRICAL DETAILS	11/11

APPENDIX D
Definitions

COMMON DAM SAFETY DEFINITIONS

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

Orientation

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

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

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

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

Dam Components

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

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

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

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

Appurtenant Works – Shall mean structures, either in dams or separate therefrom, including but not 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 (and properly documented) 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 failure.

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

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

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

Height of Dam (Structural Height) – 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 lowest point on the crest of the dam.

Hydraulic Height – means the height to which water rises behind a dam and the difference between the lowest point in the original streambed at the axis of the dam and the maximum controllable water surface.

Maximum Water Storage Elevation – means the maximum elevation of water surface which can be contained by the dam without overtopping the embankment section.

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.

Maximum Storage Capacity – The volume of water contained in the impoundment at maximum water storage elevation.

Normal Storage Capacity – The volume of water contained in the impoundment at normal water storage elevation.

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.

* Structural deficiencies include but are not limited to the following:

- Excessive uncontrolled seepage (e.g., upwelling of water, evidence of fines movement, flowing water, erosion, etc.)
- Missing riprap with resulting erosion of slope
- Sinkholes, particularly behind retaining walls and above outlet pipes, possibly indicating loss of soil due to piping, rather than animal burrows
- Excessive vegetation and tree growth, particularly if it obscures features of the dam and the dam cannot be fully inspected
- Deterioration of concrete structures (e.g., exposed rebar, tilted walls, large cracks with or without seepage, excessive spalling, etc.)
- Inoperable outlets (gates and valves that have not been operated for many years or are broken)