



– MURPHY POND DAM –
VISUAL INSPECTION REPORT



Dam Name: Murphy Pond Dam

CTDEEP ID#: 15902

Owner: Town of Wethersfield

Town: Wethersfield, Connecticut

Consultant: GZA GeoEnvironmental, Inc.

Date of Inspection: September 27, 2016





Proactive by Design

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION
MANAGEMENT

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October 9, 2017
GZA File No. 05.0045906.00

Mr. Derrick Gregor, P.E.
Town Engineer, Town of Wethersfield
505 Silas Deane Highway
Wethersfield, Connecticut 06109

Re: Visual Inspection Report
Murphy Pond Dam
CTDEEP # 15902

Dear Mr. Gregor:

In accordance with our proposal dated August 28, 2015 and our Notice to Proceed dated July 21, 2016 attached to the Town of Wethersfield Purchase Order Number: 20166877-000, GZA GeoEnvironmental, Inc. (GZA) has completed a visual inspection of the Murphy Pond Dam located in Wethersfield, Connecticut.

Our site visit was performed on September 27, 2016 by Matthew A. Taylor, P.E., David M. Barstow, P.E., and Anthony Trani of GZA GeoEnvironmental, Inc. (GZA) as well as Don Moisa of Town of Wethersfield. At the time of the inspection, the weather was cloudy with a temperature of approximately 65° Fahrenheit.

The purpose of our efforts was to assess the current condition of the dam and to prepare an updated, formal Regulatory Inspection of the dam in accordance with the State of Connecticut Department of Energy and Environmental Protection (CTDEEP) Dam Safety Regulation 22a-409, pertaining to inspection frequency. Our services and report are subject to the Limitations found in **Appendix D**.

Based on our visual inspection, the dam was found to be in **POOR** condition due primarily to the extensive vegetation and general lack of maintenance. Refer to **Appendix A** for the condition rating definitions as per the Connecticut Dam Safety regulations. The deficiencies at the dam observed during the visual inspection include but are not limited to:

1. Damage to the top of the drop-inlet, primary spillway which consists of an asphalt-coated corrugated metal pipe riser;
2. Possible seepage on the right side of the primary spillway outlet pipe on the downstream slope of the embankment dam;
3. Scour and undercutting of the auxiliary spillway grouted riprap outlet where the auxiliary spillway discharges to the downstream channel;
4. Unknown operability and inaccessibility of the low-level outlet;
5. An approximate 6-foot diameter area of depressed and bare soil within the auxiliary spillway channel which could result in concentrated erosion if the spillway is activated;
6. Areas of bare soil on the auxiliary spillway dike;
7. Heavy brush and mature tree growth on the crest, upstream and downstream slopes of the dam embankment, and in the auxiliary spillway approach and discharge areas; and

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8. Possible need to increase the CT DEEP Hazard Classification for the dam.

Murphy Pond Dam is currently classified by the Connecticut Department of Energy and Environmental Protection (CTDEEP) as **Class A (Low)** Hazard Potential. There are several residences on Carriage Hill Drive which are downstream of the dam along Goff Brook. The house at 81 Carriage Hill Drive is located approximately 70 feet from the auxiliary spillway dike crest. The house at 51 Carriage Hill Drive is located approximately 50 feet from the auxiliary spillway dike crest and about 200 feet downstream from the dam embankment. Additionally, a bridge that carries Griswold Road over Goff Brook is about 1,500 feet downstream of the dam. Based on a cursory review, it appears possible that if the Murphy Pond Dam were to fail, water from the impoundment would flow down Goff Brook and potentially damage the downstream residences and Griswold Road and bridge.

Additionally, the following dams are also located downstream and could be impacted by the breaching of Murphy Pond Dam:

- Griswold Pond Dam (Hazard Class A - Low Hazard Potential) is located approximately 1,960 feet downstream;
- Mill Wood Park Pond Dam (Hazard Class A - Low Hazard Potential) is located approximately 4,750 feet downstream; and
- Bell Pond Dam (Hazard Class BB-Moderate Hazard Potential) is located about 1.2 miles downstream.

According to the State of Connecticut Regulation of the Department of Environmental Protection concerning Dam Safety Inspection and Classification (Section 22a-409-2):

“Where a dam is so located that its failure would likely cause a downstream dam to fail, the hazard classification of such dam shall be at least as great as that of the downstream dam”.

Based on a limited review of aerial photography and regional topographic information, it appears that a potential failure of Murphy Pond Dam could potentially result in the “domino” failure of the downstream dams.

It is unclear how extensive the damage could be from an uncontrolled dam breach. The dam design appears to be a Soil Conservation Service flood control dam; however, it was apparently built as part of residential subdivision project. Therefore, the intended function of the dam may or may not be for flood control.

Based on our review of the available data, it appears raising the hazard class from **Class A (Low)** Hazard Potential to **Class BB (Moderate)** Hazard Potential or possibly a **Class B (Significant)** Hazard Potential dam may be warranted. An updated hydrologic and hydraulic (H&H) evaluation and dam break analysis are recommended to determine the functionality of the dam and the impacts of a hypothetical dam failure. These analyses will be used to determine the need for the dam as well as to establish the appropriate hazard class for the dam.

It should be noted that the condition of the dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. Impoundment levels greater than or lower than the time of inspection may create conditions which were undetectable during this visual inspection. The condition of the dam reported herein is based on observations of field conditions at the time of inspection and the data available to the inspection team. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can unsafe conditions be detected.



A further discussion of our evaluation and recommended actions are presented in the Inspection Report. The report includes: (a) CTDEEP Dam Inspection Form; (b) Limitations; and (c) Photo Log and Photo Location Plan.

GZA GeoEnvironmental, Inc. will submit one bound color copy of the final inspection report to the Inland Water Resources Division of CTDEEP. An electronic copy of the complete report in unlocked, searchable PDF format, using the latest CTDEEP prescribed format will also be sent to the CTDEEP.

We are happy to have been able to assist you with this inspection. Please contact the undersigned if you have any questions or comments regarding the content of this Inspection Report.

Sincerely,

GZA GeoEnvironmental, Inc.

A handwritten signature in blue ink, appearing to read "D Barstow".

David M. Barstow, P.E.
Sr. Project Manager

A handwritten signature in blue ink, appearing to read "Peter H. Baril".

Peter H. Baril, P.E.
Consultant/Reviewer

A handwritten signature in blue ink, appearing to read "MATaylor".

Matthew A. Taylor, P.E.
Principal-in-Charge

Enclosures:

CTDEEP Dam Inspection Report Form

Appendices

- A. Overall Dam Condition Selection Standards
- B. Hazard Classification of Dams
- C. Photo Location Plan and Photo Log with Site Sketch
- D. Limitations
- E. Historic Drawings



Connecticut Department of
 Energy & Environmental Protection
 Bureau of Water Protection & Land Reuse
 Inland Water Resources Division



DAM SAFETY PROGRAM DAM INSPECTION REPORT FORM – FOR REGULATORY INSPECTION

Please complete this form in accordance with the instructions (DEEP-DAM-INST-002).

Part I: Summary of Dam Inspection

| | | | |
|---|---|---|--|
| Dam Name: | Murphy Pond Dam | Inspection Date(s): | 9/27/2016 |
| Alternate Dam Name(s): | --- | CT Dam ID #: | 15902 |
| Location (Municipality): | Wethersfield | Temperature / Weather: | ~65°F /Cloudy |
| Registered?: Yes or No If yes, provide the 9 digit registration number found on the notification letter. | Yes – Number Unknown | Pool Level: See Instructions | 0.1 feet below principal spillway |
| Emergency Action Plan?: Yes or No If Yes, see instructions | No | Impoundment Use: use options listed in instructions | Recreation |
| Hydraulic and Hydrologic Analysis?: Yes or No If Yes, see instructions | Yes - See Other Information in Part II | Stability Analysis?: Yes or No If Yes, see instructions | No |
| Overall Condition: (refer to Appendix A located at the end of this form) Poor | | | |

| Persons present at the inspection <i>(select the tab button in the last cell to the right to create another row)</i> | | |
|---|----------------------------------|-----------------------------------|
| Name | Title/Position | Representing |
| Matthew Taylor, P.E. | Associate Principal | GZA GeoEnvironmental, Inc. |
| David Barstow, P.E. | Project Manager | GZA GeoEnvironmental, Inc. |
| Anthony Trani | Assistant Project Manager | GZA GeoEnvironmental, Inc. |
| Don Moisa | Operations Coordinator | Town Of Wethersfield |

Owners and Operators: If there is more than one owner or operator, copy the empty table below for each owner or operator and paste right below the previous table, then complete the information for each

*By providing this e-mail address you are agreeing to receive official correspondence from DEEP, at this electronic address, concerning the subject report. Please remember to check your security settings to be sure you can receive e-mails from "ct.gov" addresses. Also, please notify DEEP if your e-mail address changes by email via deep.damsafety@ct.gov.

Indicate if Owner or Operator: Owner

Name: Town of Wethersfield (Contact: Jeff Bridges, Town Manager)

Mailing Address: 505 Silas Deane Highway

City/Town: Wethersfield

State: CT

Zip Code: 06109

Phone: (860) 721-2801

ext.: ---

Emergency Phone: ---

***E-mail: jeff.bridges@wethersfieldct.gov**

Part II: General Dam Information

General Description: Murphy Pond Dam is an earthen embankment dam with a maximum height of about 14 feet and a total length of approximately 270 feet. The embankment is approximately 100-feet long and the auxiliary spillway is approximately 170-feet wide and located on the right side of the embankment where it ties into apparent high natural ground. Existing topography serve as the left abutment for the embankment dam. The crest of the embankment dam is estimated to be about 6- to 8-feet wide. The right half of the embankment crest is maintained grass and the left half of the embankment crest is covered with thick brush and vegetation. The upstream and downstream embankment slopes are also covered with thick brush and mature trees. The downstream embankment slope is about 2 horizontal to 1 vertical (2H:1V) and the upstream embankment slope is about 3H:1V.

The primary spillway consists of a 6-foot diameter, asphalt-coated, corrugated metal pipe (ACCMP) drop-inlet which discharges to a 4-foot diameter ACCMP through the embankment. The drop-inlet spillway has an 18-inch thick concrete base at the bottom of the 6-foot diameter ACCMP. There is a steel trash rack over the primary spillway.

Based on the Dam Construction Plans, the low-level outlet consists of a 12-inch diameter ACCMP that discharges into the upstream side of the primary spillway and is controlled with a plug. The low-level outlet does not have a valve as a control mechanism. The plug type and operability are unknown.

The auxiliary spillway is located at the right abutment of the earthen embankment dam and consists of an erodible, broad-crested, grass-lined channel and transitions to grouted riprap at the auxiliary spillway discharge. The auxiliary spillway narrows from about 170-feet wide at the approach area to 130-feet wide near the discharge. The primary and auxiliary spillways discharge to Goff Brook.

We understand that the impoundment is currently used for recreation. However, the dam design is a typical Soil Conservation Service flood control dam. It is unclear at this time if the dam serves as a flood control structure.

| | | | |
|---|--|--|--|
| Hazard Classification: | A | Dam Height (ft): | 14+/- |
| Dam Length (ft): | 270 (Total embankment and auxiliary spillway length) | Spillway Length (ft): | Primary: 6 (72-inch-diameter ACCMP) Auxiliary: 170 |
| Spillway Type: | Primary – Drop-inlet Auxiliary – Broad-crested, erodible, grass-lined channel | Normal Freeboard (ft): | 1.0 |
| Drainage Area (square miles): | 2.5 | Impoundment Area (at principal spillway crest, in acres): | 2.3 |
| Watercourse(s): Spillway discharges to northward flowing Goff Brook. | | | |

OTHER INFORMATION: The information presented in the table above was obtained from:

- A Connecticut Department of Energy and Environmental Protection (CTDEEP) Dam Registration Form;
- A plan entitled, "Proposed Dam for Liberty Homes, Inc., Fox Hill Road, Wethersfield, Connecticut", by Mozzochi Associates, dated October 2, 1957 and revised 10/17/57, 8/24/71 and 10/11/71;
- Drawing No, A-57-90 (Dam Construction Plan, dated October 1957); and
- Direct observation by GZA.

Elevations included in this inspection report are based on the Dam Construction Plan, dated October 1957, which reference the Metropolitan District Commission Datum.

Based on the available information on file at the CTDEEP and the Town of Wethersfield, Murphy Pond Dam was constructed in the late 1950s for the Liberty Homes Development. As previously indicated, the dam design is a typical Soil Conservation Service flood control dam design. The October 1957 Dam Construction Plan provides the plan view and sections for the Murphy Pond Dam construction (refer to Appendix E – Historic Drawings for the plan). We assume Murphy Pond Dam was constructed in general accordance with the October 1957 Dam Construction Plan.

In a letter from Mr. John Mozzochi (Mozzochi Associates), dated October 21, 1957 to Mr. Henry Buck (Consulting Engineer), the October 1957 Dam Construction Plan was modified prior to dam construction to increase the spillway capacity. The drop-inlet spillway was moved into the pond so the full circumference of the 6-foot diameter ACCMP was available to act as a spillway and the width of the auxiliary spillway (sodded spillway) was increased to 170-feet wide. The letter indicated the drop-inlet spillway had an estimated capacity of 150 cubic feet per second (cfs) and the auxiliary spillway had an estimated capacity of 480 cfs for the 100-year flood event. The modified plan and calculations were not provided with the October 1957 letter.

Several deficiencies of the dam were reported by Water Resources Commission during their dam inspections on July 30, 1970 and October 6, 1970. The Water Resources Commission presented a letter to the Dam Owner (Mr. Charles LaDolce), dated November 25, 1970 indicating that the following deficiencies were noted (summarized and abbreviated by GZA): 1) Debris observed in and around the drop-inlet spillway; 2) Trees on the embankment or within 25 feet of the dam; and 3) Inadequate emergency spillway capacity to pass the flood flow. The Water Resources Commission letter ordered the Dam Owner to: 1) Drain the pond; 2) Inform the Commission as to what measures are planned to repair or remove the dam; 3) Submit plans and specifications for the repairs or removal; and 4) Complete the repair or removal work on or before June 1, 1971.

A January 1971 letter from the Commissioner of the Water Resources Commission (Mr. John Curry) to the Attorney General for the State of Connecticut (Mr. Robert Killian) noted the deficiencies identified in the Water Resources Commission letter, dated November 25, 1970 (above). Additionally, the January 1971 letter reported that a house had been constructed downstream of the auxiliary spillway and property damage was caused to the house (51 Carriage Hill Drive) after a very heavy rain event. The January 1971 letter concluded that the pond had not been drained and the repairs had not been completed as ordered in the November 1970 letter by the Water Resources Commission. The January 1971 letter requested legal action against the Dam Owner to either remove or repair the dam.

An August 24, 1971 letter, from Mozzochi Associates (Mr. John Luchs Jr.) to Levine, Katz, Goldstein & Epstein (Attorney Theodore Epstein), noted that Mozzochi had performed additional hydraulic and hydrologic calculations for the proposed dam repairs to correct the issues identified in the November 1970 letter by the Water Resources Commission. The August 1971 letter estimated the following: a maximum pond water surface elevation of El. 110 feet for the 100-year flood event, an existing top of dam elevation of El. 111 feet, and a peak design inflow of 1,350 cfs. Based on the calculations, Mozzochi Associates recommended the following:

- 1) Raise the top of dam to El. 112 feet;
- 2) Regrade the auxiliary spillway to the grades on the Dam Construction Plan, dated October 1957 and revised November 2, 1971;
- 3) Place additional riprap on the steep downstream slope of the auxiliary spillway near the discharge to the downstream channel; and
- 4) Place a restrictive covenant on the land records so that the emergency spillway cannot be altered.

The calculations and Dam Construction Plan, revised November 1971 were not provided in the August 24, 1971 letter.

The dam repairs were performed and in a February 1973 letter from the CT Superintendent of Dam Maintenance (Mr. Victor Galgowski), a Certificate of Approval was issued for the dam repairs performed to correct the issues identified above. According to the letter, the Dam Construction Plan, dated October 1957 and revised November 2, 1971 was used for the dam repairs.

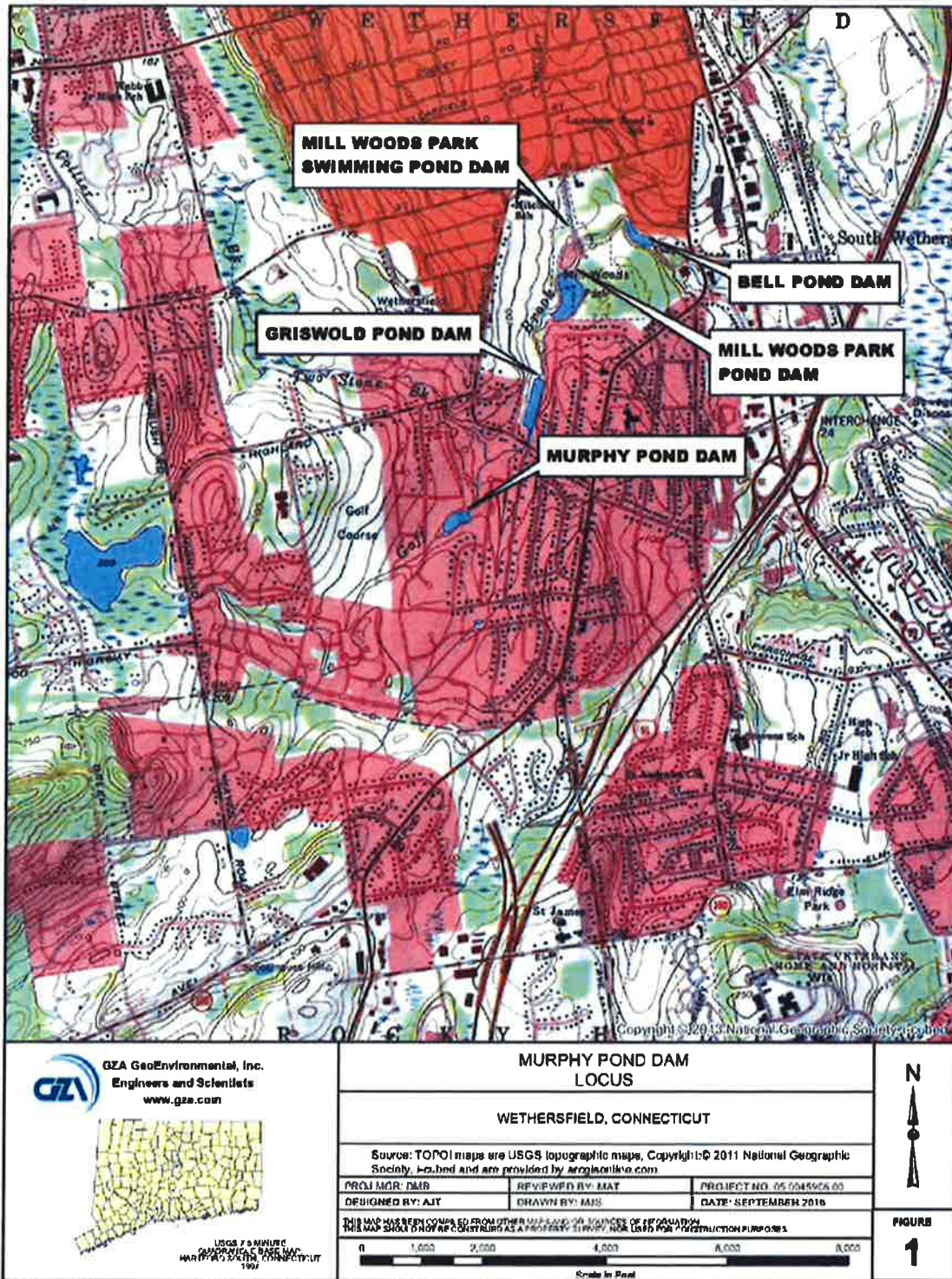
Based on a CTDEEP Certificate of Dam Registration form, dated September 13, 2001, Murphy Pond Dam was registered by the Town of Wethersfield. It is not clear when dam ownership was transferred to the Town of Wethersfield.

References

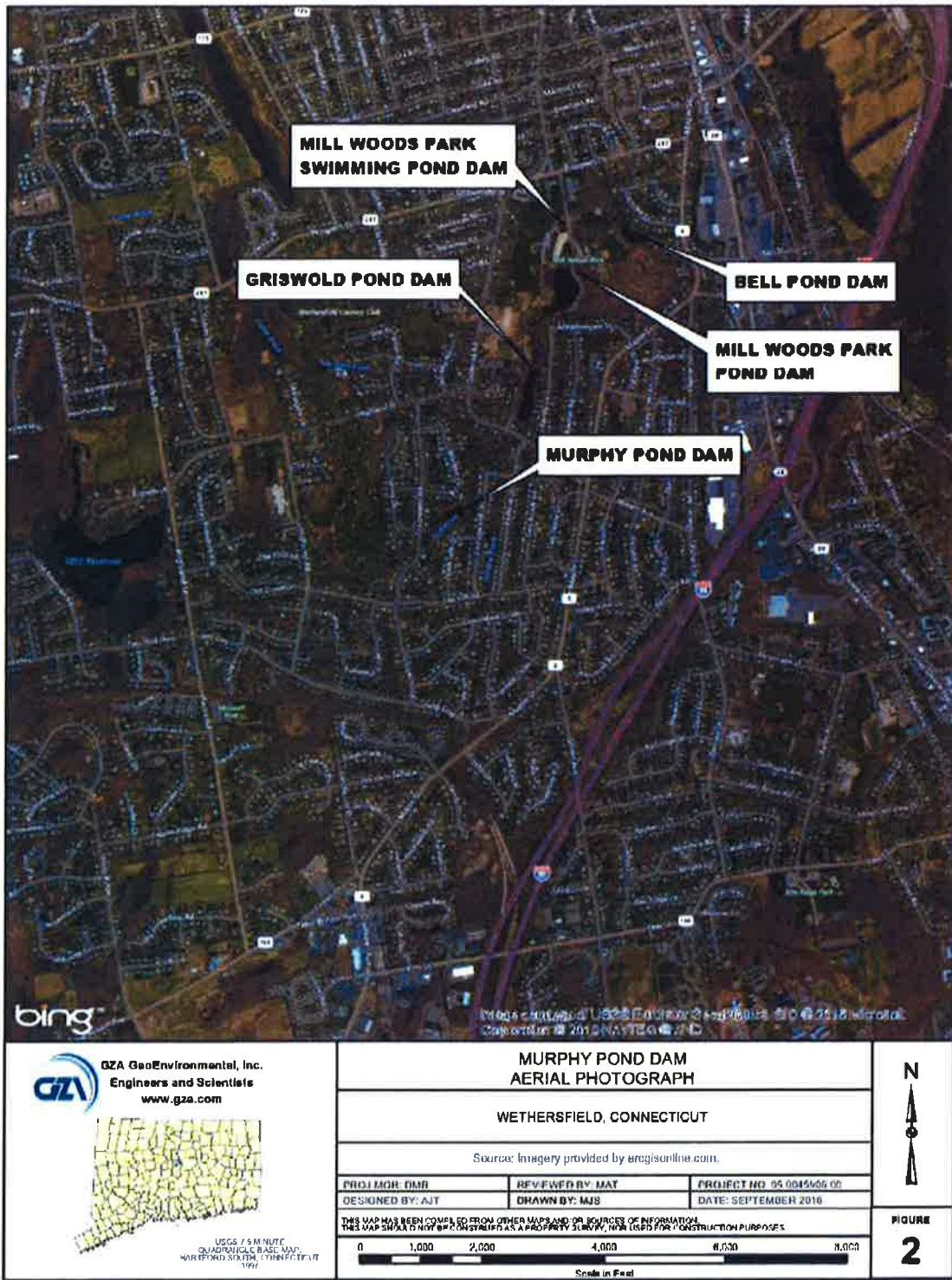
"Proposed Dam for Liberty Homes, Inc., Fox Hill Road, Wethersfield, Connecticut", by Mozzochi Associates, dated October 2, 1957 and revised 10/17/57, 8/24/71 and 10/11/71, Drawing No, A-57-90

"Goff Brook Ponds Study, Town of Wethersfield, Connecticut", by DeCarlo & Doll, Inc., dated April 2007

Part III: Aerial Photo/Location Map



© 2016 GZA GeoEnvironmental, Inc. J1 15/09 10:59:04:006 h01 Town of Wethersfield/008 00 00/002/murphy Pond.mxd, 12/9/2016, 1:09:49 PM, pax:103041



Part IV: Dam/Embankment/Dike Information

Number of Dam/Embankments/Dikes: (1) One

Dam/Embankment/Dike Name (see instructions): Murphy Pond Dam

General Description: The earthen embankment is approximately 100-feet-long and existing topography functions as the left abutment and right abutment. The crest of the embankment dam is estimated to be about 6- to 8-feet wide. The right half of the embankment crest is maintained grass and the left half of the embankment crest is covered with thick brush and vegetation. The upstream and downstream embankment slopes are also covered with thick brush and mature trees. The downstream embankment slope is about 2 horizontal to 1 vertical (2H:1V) and the upstream embankment slope is about 3H:1V.

General Condition: Poor

Concrete Condition: N/A

Stone Masonry: N/A

Settlement/Alignment/Movement: None observed – Vision was obscured by the thick vegetation on the upstream slope, downstream slope, and left half of the crest

Seepage/Foundation Drainage: Evidence of minor seepage was observed to the right of the primary spillway outlet pipe on the downstream slope. The ground surface next to the pipe was observed to be wet. Vision was obscured by the thick vegetation on the upstream slope, downstream slope, and left half of the crest.

Riprap: 6- to 24-inch diameter riprap was observed on the downstream slope near the primary spillway outlet pipe.

Erosion/Burrows: Minor erosion was observed on the downstream slope by the apparent seepage near the outlet pipe.

Vegetative Cover: The upstream slope, downstream slope, and left half of the crest were covered with thick brush and mature trees. Trees with a diameter up to 24-inches were observed on the downstream slope. The right half of the embankment crest was covered with maintained grass.

Other: N/A

Photos/Graphics/Sketches: See Parts XIII and XIV below.

Part V: Principal Spillway, Training Walls, Apron

Number of Principal Spillways: (1) One

Spillway Type (see instructions): Drop-Inlet

General Description: The primary spillway consists of a 6-foot diameter, asphalt-coated, corrugated metal pipe (ACCMP) drop-inlet which discharges to a 4-foot diameter ACCMP through the embankment. The drop-inlet spillway has an 18-inch thick concrete base at the bottom of the 6-foot diameter ACCMP riser. There is a steel trash rack over the drop-inlet spillway opening.

General Condition: Poor – due to the condition of the ACCMP at the spillway.

Concrete Condition: Good

Stone Masonry: N/A

Settlement/Alignment/Movement: None observed. Water was flowing into inlet limiting observation of entire spillway.

Cracks: Damage was observed at the top of the drop-inlet spillway. The top of the pipe has a vertical tear approximately 6-inches long. The tear is located on the left downstream side of the pipe. The pipe has folded inward and water flows through the damaged area.

Scouring/Undermining: None observed. Water was flowing into the inlet which limited observation of entire spillway.

Seepage/Foundation Drainage: None observed. Water was flowing into the inlet which limited observation of entire spillway.

Other: Minor stick and grass debris was observed on the trash rack.

Photos/Graphics/Sketches: See Parts XIII and XIV below.

Part VI: Auxiliary Spillway, Training Walls, Apron

Number of Auxiliary Spillways: (1) One

Auxiliary Spillway Type (see instructions): Broad-Crested, Erodible Channel

General Description: The auxiliary spillway consists of a broad-crested erodible channel and is located to the right of the right abutment of the earthen embankment. The auxiliary spillway channel is approximately 190-feet long along the center line and has two sections, identified by GZA, as the upstream channel and the discharge area. The upstream channel is approximately 140-feet long and elevations range from El. 109 feet at the crest to El. 108 feet at the transition to the discharge area. The surface consists of maintained grass. The discharge area is approximately 40-feet long and the surface consists of grouted riprap. The discharge area slopes from the upstream channel at El. 108 feet to El. 100 feet at the auxiliary spillway discharge to the downstream channel of the primary spillway (Goff Brook). The auxiliary spillway discharge area slope is approximately 4H:1V. The auxiliary spillway crest is approximately 1 foot above the primary spillway inlet according to the Dam Construction Plan, dated October 1957. The reservoir level was about 1-foot below the auxiliary spillway crest.

The auxiliary spillway dike is an approximately 300-foot-long earthen embankment. The upstream and downstream embankment slopes and crest are covered with maintained grass. The upstream and downstream auxiliary spillway dike embankment slopes are about 2 horizontal to 1 vertical (2H:1V).

General Condition: Fair

Concrete Condition: N/A

Stone Masonry: N/A

Settlement/Alignment/Movement: None observed

Cracks: N/A

Scouring/Undermining: The toe of the auxiliary spillway grouted riprap slope was undermined (from 6 to 36-inches) due to scour along the downstream channel of the primary spillway.

Vegetative Cover: Maintained grass was observed within the upstream channel of the auxiliary spillway. The upstream approach channel was observed to be partially obstructed with brush and mature trees. The right side of the discharge area slope was partially covered with sparse brush and vine ground cover. The left side of the discharge area slope was covered with thick brush and vegetation. There were occasional patches of bare earth (likely from mowing) on the dike crest and slopes. An approximate 6-foot diameter area of bare soil was observed in the maintained grass area of the auxiliary spillway upstream channel. The area is located about 50 feet downstream from the auxiliary spillway approach channel. The ground surface was covered with sand and gravel with sparse vegetation and the area was slightly depressed.

Riprap: The auxiliary spillway discharge area consists of grouted riprap which is in satisfactory condition.

Seepage/Foundation Drainage: None observed

Other: Two houses are located downstream of the auxiliary spillway dike. The house at 81 Carriage Hill Drive is located approximately 70 feet from the auxiliary spillway dike crest and the house at 51 Carriage Hill Drive is located approximately 50 feet from the auxiliary spillway dike crest.

Photos/Graphics/Sketches: See Parts XIII and XIV below.

Part VII: Downstream Channel

Number of Downstream Channels: (1) One

Channel Name (see instructions), include Watercourse Name: Discharge Channel (Combined)

General Description: Discharge channel (which includes the confluence of the primary and auxiliary spillway channels) consists of a riprap lined channel with bedrock outcroppings and transitions to the natural channel of Goff Brook. The discharge channel flows north towards Griswold Pond.

General Condition: Satisfactory

Scouring: Scour was observed along the toe of the auxiliary spillway grouted riprap discharge area slope. The toe of the lower portion of the auxiliary spillway discharge area was undermined up to 36 inches.

Debris: None observed

Riprap: 6- to 24-inch diameter riprap observed in the downstream channel.

Other: N/A

Photos/Graphics/Sketches: See Parts XIII and XIV below.

Part VIII: Intake Structure(s)

Number of Intake Structures: (1) One

Intake Structure Type (see instructions): Low-level outlet

General Description: The low-level outlet consists of 12-inch-diameter, asphalt-coated, corrugated metal pipe (ACCMP) located on the upstream side of the drop-inlet primary spillway. The low-level outlet discharges into the primary drop-inlet spillway. The Dam Construction Plan, dated October 1957 indicate that the low-level outlet is controlled with a plug. The low-level outlet was submerged at the time of the inspection and the operability of the plug is unknown.

General Condition: Not observed, intake structure submerged.

Concrete Condition: N/A

Stone Masonry: N/A

Settlement/Alignment/Movement: Not observed, intake structure submerged.

Cracks: Not observed, intake structure submerged

Other: N/A

Photos/Graphics/Sketches: See Parts XIII and XIV below.

Part IX: Outlet Structure(s)

Number of Outlet Structures: (1) One

Outlet Structure Type (see instructions): No Structure, Spillway Pipe Only

General Description: The primary spillway outlet pipe consists of a 4-foot-diameter ACCMP that extends through the embankment dam and discharges into the downstream channel (Goff Brook).

General Condition: Fair, however, an internal pipe inspection was not performed.

Concrete Condition: N/A

Stone Masonry: N/A

Settlement/Alignment/Movement: None observed

Scouring/Undermining: None observed

Other: Possible minor seepage observed to the right and below the outlet. The embankment was wet and no flow was observed.

Photos/Graphics/Sketches: See Parts XIII and XIV below.

Part X: Miscellaneous Features

List miscellaneous features: Murphy Pond Dam is on the west side of Carriage Hill Drive. The house at 81 Carriage Hill Drive is located approximately 70 feet from the auxiliary spillway dike crest. The house at 51 Carriage Hill Drive is located approximately 50 feet from the auxiliary spillway dike crest and about 200 feet downstream from the dam embankment. The dam is accessed through a Town-owned field on Carriage Hill Drive. The dam impounds Goff Brook. Griswold Pond is located about 1,700 feet downstream of Murphy Pond Dam.

Photos/Graphics/Sketches: See Parts XIII and XIV below.

Part XI: Downstream Hazard Classification Reassessment

Downstream Hazard Classification: *(provide recommendation for the hazard class based on the Dam Safety regulation. See Instructions and [Appendix B.](#))*

Murphy Pond Dam is currently classified by the Connecticut Department of Energy and Environmental Protection (CTDEEP) as **Class A (Low)** Hazard Potential. There are several residences on Carriage Hill Drive which are downstream of the dam along Goff Brook. The house at 81 Carriage Hill Drive is located approximately 70 feet from the auxiliary spillway dike crest. The house at 51 Carriage Hill Drive is located approximately 50 feet from the auxiliary spillway dike crest and about 200 feet downstream from the dam embankment. Additionally, a bridge that carries Griswold Road over Goff Brook is about 1,500 feet downstream of the dam. Based on a cursory review, it appears possible that if the Murphy Pond Dam were to fail, water from the impoundment would flow down Goff Brook and potentially damage the downstream residences and Griswold Road and bridge.

Additionally, the following dams are also located downstream and could be impacted by the breaching of Murphy Pond Dam:

- Griswold Pond Dam (Hazard Class A - Low Hazard Potential) is located approximately 1,960 feet downstream;
- Mill Wood Park Pond Dam (Hazard Class A - Low Hazard Potential) is located approximately 4,750 feet downstream; and
- Bell Pond Dam (Hazard Class BB-Moderate Hazard Potential) is located about 1.2 miles downstream.

According to the State of Connecticut Regulation of the Department of Environmental Protection concerning Dam Safety Inspection and Classification (Section 22a-409-2):

"Where a dam is so located that its failure would likely cause a downstream dam to fail, the hazard classification of such dam shall be at least as great as that of the downstream dam".

Based on a limited review of aerial photography and regional topographic information, it appears that a potential failure of Murphy Pond Dam could potentially result in the "domino" failure of the downstream dams.

It is unclear how extensive the damage could be from an uncontrolled dam breach. The dam design appears to be a Soil Conservation Service flood control dam; however, it was apparently built as part of residential subdivision project. Therefore, the intended function of the dam may or may not be for flood control.

Based on our review of the available data, it appears raising the hazard class from **Class A (Low)** Hazard Potential to **Class BB (Moderate)** Hazard Potential or possibly a **Class B (Significant)** Hazard Potential dam may be warranted. An updated H&H and dam break analysis is recommended to determine the functionality of the dam and the impacts of a hypothetical dam failure. These analyses will be used to determine the need for the dam as well as to determine the appropriate hazard class for the dam.

Part XII: Recommendations *(See instructions for identifying recommendations)*

Recommendations: The following recommendations and remedial measures generally describe the recommended approach to address the current deficiencies at the dam. Prior to undertaking any maintenance, repairs or remedial measures, the applicability of dam safety and environmental permits should be considered.

1. Perform additional research to obtain the basis of design for the dam. If unavailable, perform a preliminary hydraulic and hydrologic analysis to determine the functionality and need for the dam (i.e. is it providing needed flood control benefits). Include a preliminary dam breach analysis to determine hypothetical dam breach impacts and proceed with hazard class modifications as appropriate.
2. Perform an assessment of the need for the dam. Evaluate the needs and desires of the Town and stakeholders for the dam. Items to consider are: flood control benefits (if any), public desires/expectations, and a cost comparison of the dam repair vs. dam removal options. Provide a recommended approach for the dam rehabilitation or removal.
3. If dam rehabilitation is recommended, design, permit and execute repairs to address the deficiencies as described above.
4. If dam removal is selected, design, permit and execute the dam removal.

Recurrent Maintenance Recommendations:

GZA recommends the following recurrent maintenance-level activities that can be undertaken by Owner and do not require engineering design or a dam safety permit.

1. Cut the vegetation/brush and remove trees smaller than 3-inch diameter on the dam embankment (crest and upstream and downstream slopes) and the auxiliary spillway inlet and outlet.
2. Continue to maintain the grass on the right half of the dam embankment crest and auxiliary spillway.
3. Monitor seepage near the primary spillway outlet structure. Engage an engineer if conditions change.
4. Fill, compact, reseed and maintain grass within the bare areas located within the auxiliary spillway channel and dike.

Dam Repairs

GZA recommends the following repairs that can be undertaken by the Owner and requires Professional Engineer oversight and a dam safety permit.

1. Design, permit and construct the dam rehabilitation or dam removal depending on the results of the evaluation recommended above.

Part XIII: Photographs/Graphics *(see instructions and [Appendix C](#))*

Refer to Appendix C for Photographic Log

Part XIV: Sketches

Refer to Appendix C and E for a Site Sketch.

Part XV: Professional Engineer Certification

The following certification must be signed by a Professional Engineer

"I hereby certify that the information provided in this report has been examined by me and found to be true and correct in my professional judgment."



10/6/17

Signature of Professional Engineer

Date

Matthew A. Taylor

Associate Principal

26480

Printed Name of Professional Engineer

Title

CT P.E. Number


GZA GeoEnvironmental, Inc
Name of Firm

Affix P.E. Stamp Here



Part XVI: Owner Signature

The following statement must be signed by the Owner(s) of the subject Dam.

| | |
|---|-----------------------|
| "The information provided in this report has been examined by me." | |
|  | 9/22/2017 |
| Signature of Owner | Date |
| Jeff Bridges (Town of Wethersfield) | Town Manager |
| Name of Owner (print or type) | Title (if applicable) |
| | |
| Signature of Owner | Date |
| | |
| Name of Owner (print or type) | Title (if applicable) |
| | |
| Signature of Owner | Date |
| | |
| Name of Owner (print or type) | Title (if applicable) |
| | |
| Signature of Owner | Date |
| | |
| Name of Owner (print or type) | Title (if applicable) |
| | |

Note: Mail the completed inspection report to:

DAM SAFETY PROGRAM
INLAND WATER RESOURCES DIVISION
CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106

In addition, please send this completed report converted to Adobe portable document format (pdf) including a scan of the signature page via email to: DEEP.DamSafety@ct.gov

APPENDIX A

OVERALL DAM CONDITION SELECTION STANDARDS

Appendix A: Overall Dam Condition Selection Standards

| Condition | Definition |
|-----------------------|--|
| Good | Through file research and after a thorough visual inspection it has been determined that the dam is well maintained and no existing dam safety deficiencies are recognized. Only continued routine maintenance is required. |
| Satisfactory | Through file research and after a thorough visual inspection it has been determined that no significant deficiencies are recognized. Only minor maintenance is required and only minor flaws are noted. |
| Fair | Through file research and after a thorough visual inspection it has been determined that there are no critical deficiencies with the dam that would require engineering analysis with the following exception: the engineer may recommend that a hydrologic and hydraulic analysis be conducted due to the lack of adequate freeboard and/or the lack of spillway capacity documentation. A condition exists at the dam that may require some sort of additional monitoring. |
| Poor | Through file research and after a thorough visual inspection it has been determined that deficiencies are recognized that require engineering analysis and/or remedial action. |
| Unsatisfactory | Through file research and after a thorough visual inspection it has been determined that a deficiency is recognized that requires immediate or emergency action. Administrative/Enforcement action may be required as determined by the Dam Safety Program. Reservoir level restrictions may be necessary until the problem is resolved. |

APPENDIX B

HAZARD CLASSIFICATION OF DAMS

Appendix B - Hazard Classification of Dams

I. A Class AA dam is a negligible hazard potential dam which, if it were to fail, would result in the following:

- (i) no measurable damage to roadways;
- (ii) no measurable damage to land and structures;
- (iii) negligible economic loss.

II. A Class A dam is a low hazard potential dam which, if it were to fail, would result in any of the following:

- (i) damage to agricultural land;
- (ii) damage to unimproved roadways (less than 100 ADT);
- (iii) minimal economic loss.

III. A Class BB dam is a moderate hazard potential dam which, if it were to fail, would result in any of the following:

- (i) damage to normally unoccupied storage structures;
- (ii) damage to low volume roadways (less than 500 ADT);
- (iii) moderate economic loss.

IV. A Class B dam is a significant hazard potential dam which, if it were to fail, would result in any of the following:

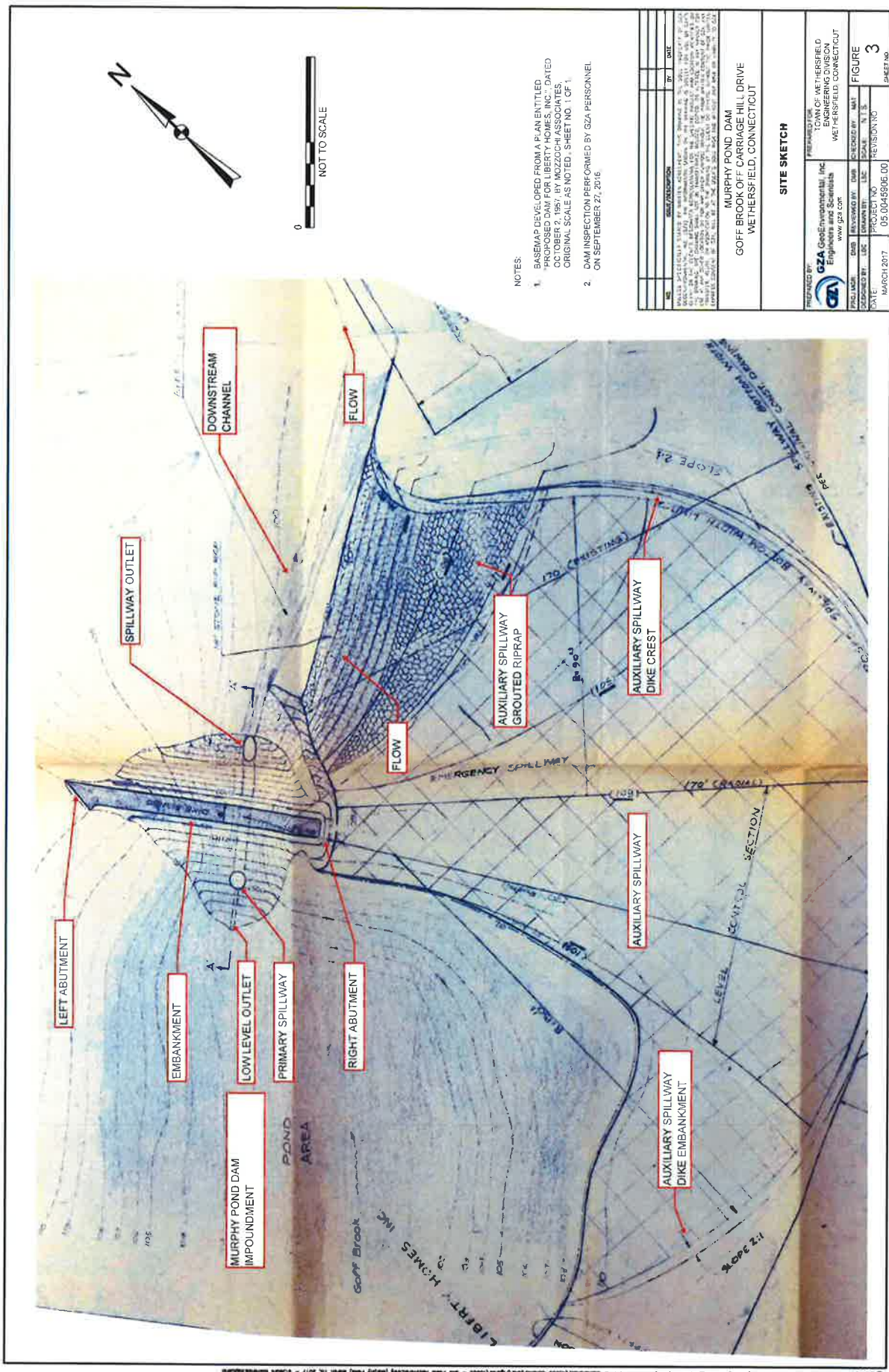
- (i) possible loss of life;
- (ii) minor damage to habitable structures, residences, hospitals, convalescent homes, schools, etc;
- (iii) damage to or interruption of the use of service of utilities;
- (iv) damage to primary roadways (less than 1500 ADT) and railroads;
- (v) significant economic loss.

V. A Class C dam is a high hazard potential dam which, if it were to fail, would result in any of the following:

- (i) probable loss of life;
- (ii) major damage to habitable structures, residences, hospitals, convalescent homes, schools, etc;
- (iii) damage to main highways (greater than 1500 ADT);
- (iv) great economic loss.

APPENDIX C

PHOTO LOCATION PLAN AND PHOTO LOG WITH SITE SKETCH



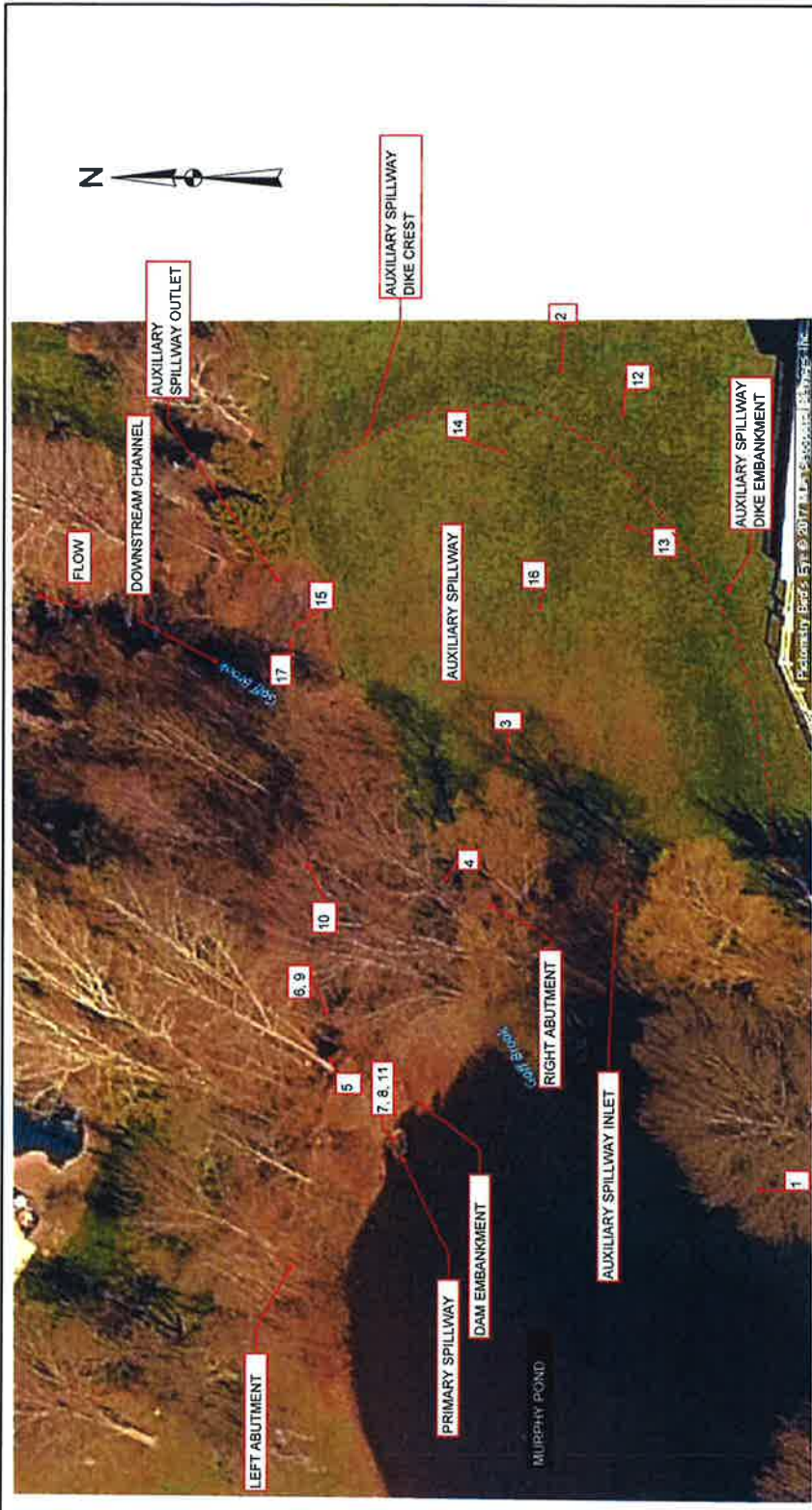
- NOTES:
1. BASEMAP DEVELOPED FROM A PLAN ENTITLED "PROPOSED DAM FOR LIBERTY HOMES, INC.", DATED OCTOBER 2, 1987, BY MOZZOCHI ASSOCIATES, ORIGINAL SCALE AS NOTED, SHEET NO. 1 OF 1.
 2. DAM INSPECTION PERFORMED BY GZA PERSONNEL ON SEPTEMBER 27, 2016.

| NO. | DATE/REVISION | BY | DATE |
|-----|---------------|----|------|
| | | | |
| | | | |

PREPARED BY: **GZA** GeoEnvironmental, Inc.
 ENGINEERS AND SCIENTISTS
 www.gza.com
 PROJECT NO: 0510045806.00
 DATE: MARCH 2017
 SHEET NO: 3
 SHEET NO: 3

MURPHY POND DAM
 GOFF BROOK OFF CARRIAGE HILL DRIVE
 WETHERSFIELD, CONNECTICUT

SITE SKETCH



LEGEND

APPROXIMATE LOCATION / ORIENTATION OF PHOTOGRAPH WITH NUMBER IDENTIFICATION

1

NOTES:

1. AERIAL VIEW AND BASEMAP CREATED USING IMAGERY OBTAINED FROM BING MAPS ON MARCH 15, 2017.
2. DAM INSPECTION PERFORMED BY GZA PERSONNEL ON SEPTEMBER 27, 2016.

| NO. | DESCRIPTION | BY | DATE |
|-----|-------------|----|------|
| | | | |
| | | | |

MURPHY POND DAM
GOFF BROOK OFF CARRIAGE HILL DRIVE
WETHERSFIELD, CONNECTICUT

PHOTO LOCATION PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

TOWN OF WETHERSFIELD
WETHERSFIELD, CONNECTICUT

| | |
|--------------|----------------|
| PROJECT NO. | 05-004-5905-00 |
| DATE | MARCH 2017 |
| DESIGNED BY | DMB |
| CHECKED BY | DMB |
| APPROVED BY | DMB |
| PROJECT NO. | 05-004-5905-00 |
| REVISION NO. | 4 |

FIGURE



Client Name:
Town of Wethersfield

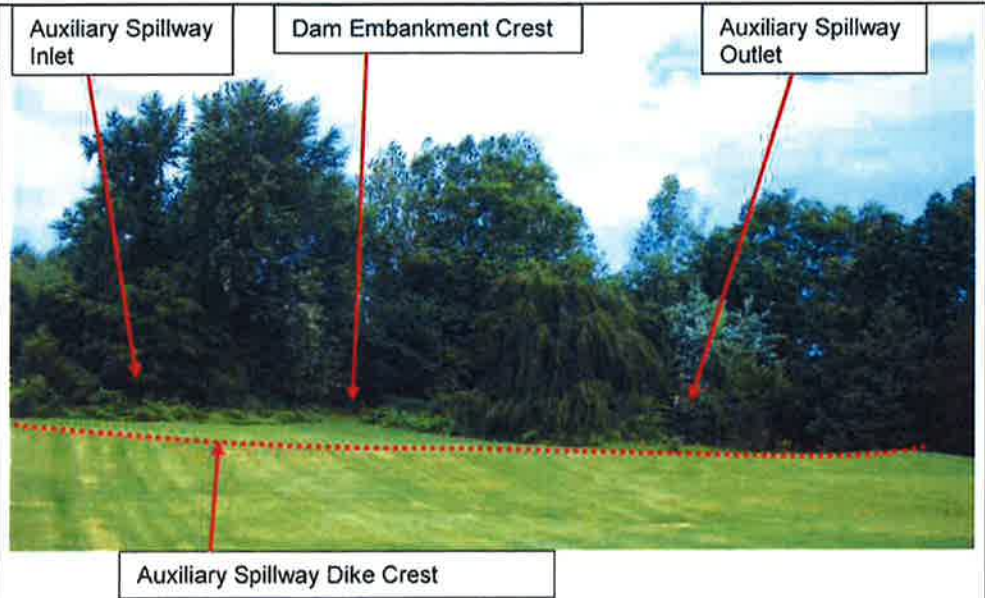
Site Location:
Murphy Pond Dam, Wethersfield, CT

Project No.:
05.0045906.00

| | |
|--|-------------------------|
| Photo No.: 01 | Date: 9/27/16 |
| Direction Photo Taken: Northerly | |
| Photographer: D. Barstow | |
| Description: Overview of dam looking downstream from the right bank of the reservoir. Note the thick brush and mature trees growing on the embankment. | |





| | |
|--|-------------------------|
| Photo No.: 02 | Date: 9/27/16 |
| Direction Photo Taken: Westerly | |
| Photographer: D. Barstow | |
| Description: Overview of the auxiliary spillway and dam embankment looking towards the right dam abutment from the upstream area of the auxiliary spillway. Note mature tree growth and thick brush on the auxiliary spillway inlet and outlet and the dam embankment. | |





| | | |
|---|--|--------------------------------------|
| Client Name: Town of Wethersfield | Site Location: Murphy Pond Dam, Wethersfield, CT | Project No.: 05.0045906.00 |
|---|--|--------------------------------------|


| | | | |
|---|-------------------------|--|-----------------------------|
| Photo No.: 03 | Date: 9/27/16 | Auxiliary Spillway Inlet | Dam Embankment Crest |
| Direction Photo Taken: Westerly | |  | |
| Photographer: D. Barstow | | | |
| Description: Overview of auxiliary spillway and crest of embankment looking towards the dam embankment from the auxiliary spillway. Note mature trees and thick vegetation on the upstream and downstream slopes of the embankment. | | | |

| | | | |
|--|-------------------------|--|------------------------------|
| Photo No.: 04 | Date: 9/27/16 | Embankment Crest | Left Abutment Contact |
| Direction Photo Taken: Northwesterly | |  | |
| Photographer: D. Barstow | | | |
| Description: Overview of embankment crest from the right abutment contact looking towards the left abutment contact. Note the thick brush and mature trees on left half of the crest and on the up and downstream embankment slopes. | | | |



| | | |
|---|--|--------------------------------------|
| Client Name: Town of Wethersfield | Site Location: Murphy Pond Dam, Wethersfield, CT | Project No.: 05.0045906.00 |
|---|--|--------------------------------------|

| | | |
|---|-------------------------|--|
| Photo No.: 05 | Date: 9/27/16 |  |
| Direction Photo Taken: Northeasterly | | |
| Photographer: D. Barstow | | |
| Description: Overview of downstream slope from the embankment crest looking toward the downstream channel. Note the erodible surface and thick brush. | | |

| | | | |
|---|-------------------------|--|------------------|
| Photo No.: 06 | Date: 9/27/16 |  | |
| Direction Photo Taken: Southwesterly | | | |
| Photographer: D. Barstow | | | |
| Description: Overview of the primary spillway outlet from the downstream channel looking upstream. Note apparent seepage to the right of the outlet pipe. | | | |
| | | <table border="1"><tr><td>Possible Seepage</td></tr></table> | Possible Seepage |
| Possible Seepage | | | |



| | | |
|---|--|--------------------------------------|
| Client Name: Town of Wethersfield | Site Location: Murphy Pond Dam, Wethersfield, CT | Project No.: 05.0045906.00 |
|---|--|--------------------------------------|

| | | |
|---|-------------------------|--|
| Photo No.: 07 | Date: 9/27/16 |  |
| Direction Photo Taken: Southwesterly | | |
| Photographer: D. Barstow | | |
| Description: Overview of primary spillway and trash rack from the upstream embankment slope looking upstream. Note damage to the top of the primary spillway. The top of the pipe has a vertical tear approx. 6-inches deep. The pipe has folded inward and water flows through the damaged area. | | |

Damaged Spillway Section


| | | |
|---|-------------------------|--|
| Photo No.: 08 | Date: 9/27/16 |  |
| Direction Photo Taken: Southwesterly | | |
| Photographer: D. Barstow | | |
| Description: Primary spillway (60-inch ACCMP, drop-inlet) looking upstream from the upstream toe of embankment. Note damage to the top of the primary spillway. | | |

Damaged Spillway Section



| | | |
|---|--|--------------------------------------|
| Client Name: Town of Wethersfield | Site Location: Murphy Pond Dam, Wethersfield, CT | Project No.: 05.0045906.00 |
|---|--|--------------------------------------|

| | | |
|--|-------------------------|---|
| Photo No.: 09 | Date: 9/27/16 |  |
| Direction Photo Taken: Southwesterly | | |
| Photographer: D. Barstow | | |
| Description: Minor seepage observed on downstream slope of embankment to the right of the primary spillway outlet pipe looking upstream from the downstream channel. Note: no flow was observed at the time of inspection. The area was observed to be wet. | | <div data-bbox="893 898 1091 940" data-label="Caption"><p>Minor Seepage</p></div> <div data-bbox="1133 898 1479 940" data-label="Caption"><p>Primary Spillway Outlet Pipe</p></div> |

| | | |
|---|-------------------------|--|
| Photo No.: 10 | Date: 9/27/16 |  |
| Direction Photo Taken: Northeasterly | | |
| Photographer: D. Barstow | | |
| Description: Overview of downstream channel looking downstream from the toe of the auxiliary spillway outlet channel. | | |



Client Name:
Town of Wethersfield

Site Location:
Murphy Pond Dam, Wethersfield, CT

Project No.:
05.0045906.00

Photo No.:
11

Date:
9/27/16

Direction Photo Taken:
Southwesterly

Photographer:
D. Barstow

Description:
Overview of the impoundment from the upstream slope of embankment looking upstream.



Primary Spillway

Photo No.:
12

Date:
9/27/16

Direction Photo Taken:
Westerly

Photographer:
D. Barstow

Description:
Overview of the auxiliary spillway inlet located upstream of the dam embankment looking from upstream of the auxiliary spillway dike towards the auxiliary spillway inlet. Note the thick brush and mature trees at the auxiliary spillway inlet.

Auxiliary Spillway Inlet

Dam Embankment Crest



Auxiliary Spillway Dike



| | | |
|---|--|--------------------------------------|
| Client Name: Town of Wethersfield | Site Location: Murphy Pond Dam, Wethersfield, CT | Project No.: 05.0045906.00 |
|---|--|--------------------------------------|

| | | | |
|---|-------------------------|----------------------------------|--------------------------------|
| Photo No.: 13 | Date: 9/27/16 | Auxiliary Spillway Outlet | 51 Carriage Hill Drive |
| Direction Photo Taken: Northerly | | | |
| Photographer: D. Barstow | | | |
| Description: Overview of the auxiliary spillway, dike and outlet looking downstream towards the outlet. | | | |
| | | Auxiliary Spillway | Auxiliary Spillway Dike |

| | | | |
|---|-------------------------|--------------------------------|---------------------------|
| Photo No.: 14 | Date: 9/27/16 | 81 Carriage Hill Drive | |
| Direction Photo Taken: Southerly | | | |
| Photographer: D. Barstow | | | |
| Description: Overview of the auxiliary spillway earthen dike looking upstream from the crest of dike. Note patches of bare earth (likely from mowing) on the dike crest and slopes. | | | |
| | | Auxiliary Spillway Dike | Auxiliary Spillway |



Client Name:
Town of Wethersfield

Site Location:
Murphy Pond Dam, Wethersfield, CT

Project No.:
05.0045906.00

Photo No.: 15
Date: 9/27/16

Direction Photo Taken:
Northwesterly

Photographer:
D. Barstow

Description:

Overview of the grouted riprap at the auxiliary spillway channel outlet to the downstream channel looking from towards the downstream channel from upstream. Note the sparse brush and ground cover growing in the auxiliary spillway.



Photo No.: 16
Date: 9/27/16

Direction Photo Taken:
Westerly

Photographer:
D. Barstow

Description:

Overview of depressed area in auxiliary spillway. The area appears to be a former excavation. Note the sparse vegetations and exposed sand and gravel at the ground surface.





Client Name:

Town of Wethersfield

Site Location:

Murphy Pond Dam, Wethersfield, CT

Project No.:

05.0045906.00

Photo No.:
17

Date:
9/27/16

Direction Photo Taken:
easterly

Photographer:
D. Barstow

Description:

Scour along the right side of the downstream channel at the toe of the auxiliary spillway grouted riprap slope, looking downstream from the downstream channel.



APPENDIX D

LIMITATIONS



USE OF REPORT

1. GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of the University of Connecticut (Client) for Murphy Pond Dam and for the stated purpose(s) and location(s) identified in the Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. Our findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).
3. Our services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

SUBSURFACE CONDITIONS

4. If presented, the generalized soil profile(s) and description, along with the conclusions and recommendations provided in our Report, are based in part on widely-spaced subsurface explorations by GZA and/or others, with a limited number of soil and/or rock samples and groundwater /piezometers data and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.
5. Water level readings have been made in test holes (as described in the Report), monitoring wells and piezometers, at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the groundwater and piezometer levels, however, occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, reservoir and tailwater levels, the presence of subsurface utilities, and/or natural or artificially induced perturbations.

GENERAL

6. The observations described in this report were made under the conditions stated therein. The conclusions presented were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the Client.
7. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein available to GZA at the time of the evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.
8. Any GZA hydrologic analysis presented herein is for the rainfall volumes and distributions stated herein. For storm conditions other than those analyzed, the response of the site's spillway, impoundment, and drainage network has not been evaluated.



9. Observations were made of the site and of structures on the site as indicated within the report. Where access to portions of the structure or site, or to structures on the site was unavailable or limited, GZA renders no opinion as to the condition of that portion of the site or structure. In particular, it is noted that water levels in the impoundment and elsewhere and/or flow over the spillway may have limited GZA's ability to make observations of underwater portions of the structure. Excessive vegetation, when present, also inhibits observations.
10. In reviewing this Report, it should be realized that the reported condition of the dam is based on observations of field conditions during the course of this study along with data made available to GZA. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued inspection and care can there be any chance that unsafe conditions be detected.

COMPLIANCE WITH CODES AND REGULATIONS

11. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.
12. This scope of work does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

COST ESTIMATES

13. Unless otherwise stated, our cost estimates are for comparative, or general planning purposes. These estimates may involve approximate quantity evaluations and may not be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over the labor and material costs required to plan and execute the anticipated work, our estimates were made using our experience and readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

ADDITIONAL SERVICES

14. It is recommended that GZA be retained to provide services during any future: site observations, explorations, evaluations, design, implementation activities, construction and/or implementation of remedial measures recommended in this Report. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

APPENDIX E
HISTORIC DRAWINGS

