



April 15, 2011

**Mr. Eric Goetz**  
Secretary  
Indian Lake Improvement Association  
210 Indianside Road  
Oakland, MI 48363

RE: Indian Lake Dam – Remediation Investigation & Alternatives Evaluation  
FILE: 15348/PDS No.24581

Dear Mr. Goetz,

O'Brien & Gere is pleased to provide the Indian Lake Improvement Association (ILIA) with this proposal for professional engineering investigation and design services. This proposal has been developed based on an initial site visit and meeting with you and other members of the ILIA Board on February 15, 2011 as well as subsequent phone conversations and a follow up site visit.

#### **PROJECT UNDERSTANDING**

---

The Indian Lake dam is a nearly 80 year old slab and buttress dam with gravity spillway. It is classified as a low hazard structure under the Michigan Department of Environmental Quality's (MDEQ) Part 315 rules. As such, the structure requires a professional engineering inspection every five years, the last of which was performed in 2008 by another consultant.

The 2008 inspection concluded that the dam was in "poor" condition and recommended that the "bay" adjacent to the spillway to the North should be investigated to remediate visible seepage through the face of the dam. Subsequent to this diagnosis, the inspecting consultant proposed an investigation utilizing ground penetrating radar (GPR) to evaluate the condition and spacing of rebar within the dam as the possible basis for future remediation efforts. The GPR investigation was never undertaken.

#### **BASIS OF PROPOSAL**

---

The investigation and remediation approach described in this proposal is based on the ILIA Board's desire to implement a "long term" solution. Based on review of previous inspection reports and current observations of conditions at the site, O'Brien & Gere's opinion is that there is limited value in investigating the condition of the existing reinforcing steel because the observed rust staining strongly suggests that the reinforcement is likely severely deteriorated. Moreover, there are no documented stability analyses of the structure. Therefore, it is unknown if the dam meets current stability criteria, regardless of the condition of the reinforcing.

#### **SCOPE OF SERVICES**

---

O'Brien & Gere proposes that the project be separated into three major tasks: Foundation Investigation, Stability Analysis and Alternatives Evaluation. These three tasks are described in detail below.

##### **TASK 1 – FOUNDATION INVESTIGATION**

*Objective: To document existing dam and foundation conditions for use in future stability analyses and design efforts.*

No original construction documents of the dam are known to exist. As a result, the main focus of the work described under Task 1 will be to characterize the existing dam and foundation conditions. To complete Task 1, O'Brien & Gere proposes the following:

- Subcontract the drilling services of a capable drilling subcontractor such as Boart Longyear (Boart) to conduct concrete coring and geotechnical borings.
- Core suitable (approximately 4" – 6" diameter) holes through the top deck of the dam to provide access for a drill rig auger to conduct borings in the space between buttress walls. (Based on a March 16, 2011 site visit by O'Brien & Gere and Boart, the slopes leading down to the areas between the buttress walls are too steep for direct access under the deck with a rig.)
- Conduct up to four geotechnical borings. Two locations will be established on the top of the dam in an attempt to intercept suspected concrete footings or a continuous foundation. Two additional locations will be established on the flat areas adjacent to the ends of the top deck.
- Conduct up to two hand-dug test pits at the ends of the buttress walls in an effort to find and obtain measurements of the foundation footings.
- Provide the services of a knowledgeable professional geologist to log subsurface lithology and collect soil samples, as needed.
- Subcontract the geotechnical laboratory services of CTI & Associates to conduct analyses of concrete cores and selected soil samples. The concrete cores obtained from the top deck will be subjected to compressive strength and density testing. Based on the observed subsurface conditions, selected soil samples may be tested for: gradation, Atterberg limits, density and/or natural moisture content.
- Provide the services of a knowledgeable field engineer to collect field measurements such as: dimensions of exposed elements of the dam, depth measurements of upstream mudline, and downstream ground profile as measured from the deck.

## **TASK 2 – STABILITY ANALYSIS**

Objective: To evaluate the global stability of the spillway and non-overtopping sections based on the findings of Task 1.

Similar to Task 1, Task 2 is driven by the absence of original documentation and design information on the dam. In accordance with standard dam safety practice, stability analyses should be conducted as a basis for engineering design going forward. To complete Task 2, O'Brien & Gere proposes the following:

- Utilize soil boring data, laboratory data, and field measurements obtained in Task 1 to assign engineering properties to the dam and its foundation.
- Calculate global overturning and sliding factors of safety, assuming the individual structural elements are capable of withstanding stresses and transmitting external loadings to the foundation. Depending on the observed soil conditions and foundation configuration, a structural analysis software package may be used.
- Evaluate the calculated factors of safety against prevailing MDEQ Part 315 and/or United States Army Corps of Engineers (USACE) factors of safety.

## **TASK 3 – ALTERNATIVES EVALUATION**

Objective: To identify and evaluate options to remediate observed deficiencies and bring the structure into compliance with current dam safety standards.

Task 3 will consist of developing the project scope and concept level cost estimates for remediation alternatives. Upon completion of Task 3, ILIA will have up to two alternatives to select from, either of which could comprise the basis of a detailed design. To complete Task 3, O'Brien & Gere proposes the following:

- Utilize information from Tasks 1 and 2 to develop up to two economical and technically feasible options for rehabilitation

- Review applicable USACE and MDEQ rules that may apply to the future dam remediation project and include consideration for these in the proposed projects
- Prepare plan and section sketches (using AutoCAD) of the two proposed remediation alternatives
- Prepare conceptual level (+/- 30% ) cost estimates to design and construct the proposed solutions
- Complete a comparative analysis of the alternatives
- Compile a detailed report presenting the alternatives, cost estimates, evaluation and recommendations
  - » Data such as soil boring logs, photographs, laboratory results, stability calculations, etc. will be incorporated as appendices to the report and referenced as needed.

### ASSUMPTIONS

---

The following assumptions and clarifications apply to the above outlined scope of work:

- Task 1 – Geotechnical boring holes will be filled to existing grade with the coring spoils material and/or bentonite, as needed.
- Task 1 – Coring holes through the top deck of the dam will be covered with a thin steel plate fastened over the hole utilizing Tapcon® type concrete screws or similar.
- Task 1 – Coring holes through the buttress walls will be filled using a Quikrete ® type product or similar and smoothed to match the existing surface.
- Task 1 – The test pits will be backfilled with the excavated spoils.
- Task 1 – The measurements that will be taken of the dam and surrounding features are intended to provide information for basic engineering calculations only and are not intended as a topographic survey. A full topographic survey by a licensed professional surveyor will be needed for final design, but is not included as part of this project.
- Task 2 – Lake levels (such as the Spillway Design Flood [SDF] elevation) used for stability analyses will be obtained from the MDEQ and/or previous inspection reports. Hydrologic and hydraulic analyses of the watershed, dam, reservoir and spillway are not included as part of this project.
- Task 3 – The intent of this project is to develop and evaluate options for remediation of the dam. As such, detailed design and the preparation of bidding and construction documents are not included in the scope of this project.

### FEE & TERMS

---

O'Brien & Gere will provide the above scope of services for a lump sum fee of \$43,600, as broken down in the following table.

Description	Fee	Notes
<b>Task 1 – Foundation Investigation</b>	\$24,500	\$12,320 is subcontracted geotechnical drilling and laboratory services
<b>Task 2 – Stability Analysis</b>	\$5,900	-
<b>Task 3 – Alternatives Analysis</b>	\$13,200	-
<b>Total</b>	\$43,600	

- Payment for work by ILIA will be made within 30 days after the date of monthly invoices by O'Brien & Gere. Invoiced amounts will be based on percent complete of the respective tasks.
- Additionally, O'Brien & Gere requests an up-front payment of \$12,320 by ILIA when written authorization by ILIA is issued to cover the costs of subcontractors. Work will be performed in accordance with the attached O'Brien & Gere's standard Terms and Conditions.

**SCHEDULE**

O'Brien & Gere will require two weeks of project coordination for scheduling of subcontractors and can begin work at the completion of these two weeks. In total, the project is estimated to take thirteen weeks to complete as shown in the following project schedule.

ID	Task Name	Duration	w-1	w1	w2	w3	w4	w5	w6	w7	w8	w9	w10	w11	w12	w13
1	Order to Proceed/Receipt of Retainer	0 days		▲												
2	Project Coordination	10 days		■	■											
3	Task 1 - Field Effort	4 days				■	■									
4	Task 1 - Lab/Analysis/Rvw/Rpt	16 days					■	■	■	■						
5	Task 2 - Stability Analysis	15 days								■	■	■	■	■		
6	Task 3 - Alternatives Analysis	20 days											■	■	■	■

**CLOSING**

O'Brien & Gere appreciates the opportunity to provide dam engineering services to ILIA and hopes this proposal is met with your favorable review. If this proposal and the terms are acceptable to ILIA, please sign below and return at your earliest convenience.

If you have any questions or concerns, please do not hesitate to contact Jason Huber at (248) 477-5701 at your earliest convenience.

Very truly yours,

**O'BRIEN & GERE ENGINEERS, INC.**



Robert Bowers, P.E.  
 Vice President

Accepted By:

**INDIAN LAKE IMPROVEMENT ASSOCIATION**

\_\_\_\_\_  
 (Signed)

\_\_\_\_\_  
 (Title)

\_\_\_\_\_  
 (Date)

Attachment: Terms and Conditions

cc: Don King – ILIA President  
 Cliff Scholz – ILIA Vice President  
 Scott Cormier, P.E. – O'Brien & Gere  
 Steve Snider, P.E. – O'Brien & Gere  
 Jason Huber, P.E. – O'Brien & Gere