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November 8, 2024

Mrs. Thersea Perron
Town Administrator – Glover, Vermont
51 Bean Hill Road
Glover, Vermont 05839

Re: Proposal for Alternatives Analyses Study
Shadow Lake Dam (State ID No. 81.02)
Glover, Vermont

Dear Mrs. Perron,

Weston & Sampson Engineers, Inc. (Weston & Sampson) is pleased to provide you with this proposal to conduct an Alternatives Analyses Study for Shadow Lake Dam in Glover, Vermont. The dam is owned by the Town of Glover (the Town). Our understanding of the dam and services requested are based on our review of a September 30, 2024 Request for Proposal (RFP) prepared by the Town, a January 30, 2023 Hydrologic and Hydraulic (H&H) Assessment Report prepared by DuBois & King, Inc. (D&K), and July 26 and September 17, 2024 Site Visit Reports prepared by the Vermont Dam Safety Program (DSP), and on conditions observed during our October 24, 2024 site visit.

DAM DESCRIPTION

Shadow Lake Dam is an approximately 129-foot long, 12-foot tall earthen embankment with primary and auxiliary spillways. The dam was constructed in approximately 1929 and is located at the east end of Shadow Lake. Residential properties surround the lake, which is used for recreational purposes. The dam is classified as a SIGNIFICANT hazard potential structure.

The primary spillway is located in a gatehouse structure at the right side of the dam and includes a concrete weir with provisions for timber stoplogs above the weir. Flow over the weir and stoplogs discharges into a 36-inch reinforced concrete pipe (RCP) that empties into ramped concrete discharge channel and eventually a stone-lined channel with dry set stone walls on both sides. A face mounted slide gate is located on the upstream side of the RCP. The concrete auxiliary spillway is located at the left side of the dam and is spanned by a timber-framed pedestrian bridge. The training and discharge walls of the auxiliary spillway are comprised of reinforced concrete. The discharge channel of the auxiliary spillway is stoned-lined immediately downstream of the spillway and is grass-lined until it meets the discharge channel of the primary spillway.

The upstream face of the dam is lined with a granite block wall. The downstream embankment slope is variably inclined and is mostly grass surfaced. Based on our observations, the slope is inclined as steep as approximately 2H:1V. The composition of the embankment and the presence of any drains are not known.

RECENT DAM DEFICIENCES AND VERMONT DSP ORDERS

According to our review of the July and September 2024 Vermont DSP Site Visit Reports, a sinkhole on the dam crest that was previously identified in July 2023 increased in size considerably after heavy rainfall and flooding on July 10 and 11, 2024. The Vermont DSP measured the sinkhole as approximately 5-foot in diameter by 5-feet deep at the time of their July 2024 visit to the dam. Active flow was observed below the base of the auxiliary spillway at the time of the visit. We understand that Town staff visited the dam prior to the July 2024 Vermont DSP visit and observed active flow in the sinkhole.

Based on conditions observed in July 2024, the Vermont VSP recommended drawdown of the lake by a minimum of 2 feet and that an engineer experienced in dam safety evaluate an appropriate temporary repair of the sinkhole.

The Vermont DSP completed a follow-up visit to the dam in September 2024 and observed that temporary repair of the sinkhole included backfilling with crushed stone and filter fabric up to the ground surface, as recommended by an engineer retained by the Town. The Vermont DSP also observed the presence of a new sinkhole on the upstream side of the granite block wall measuring approximately 1.5 feet long by 2 feet deep. The Vermont DSP recommended that temporary repair of the new sinkhole include the same approach as the previous sinkhole repair. Active flow below the base of the auxiliary spillway was not observed by the Vermont DSP during this visit.

The Vermont DSP downgraded the condition of the dam to UNSATISFACTORY due to the potential of the sinkholes to cause internal erosion and stability issues with the dam. The Vermont DSP also ordered that the lake level remain in a minimum 2-foot drawdown condition until rehabilitation construction can be completed for the dam.

According to Vermont DSP regulations and an Inflow Design Flood (IDF) completed by D&K as part of their January 23, 2023 H&H assessment, the design storm for the dam in the 1,000 year event. The D&K H&H assessment indicates that the dam overtops by 0.2 feet during the design storm event. VT DSP regulations require a minimum of 1.5 feet of freeboard during the design storm event to be considered hydraulically adequate; therefore, the dam is considered to be hydraulically inadequate. Modifications to the primary and/or auxiliary spillways will likely be necessary so that the dam can pass the design storm with a minimum of 1.5 feet of freeboard.

The D&K H&H Assessment Report included spillway modification alternatives that would allow the dam to safely pass the design storm with at least 1.5 feet of freeboard. Each of the alternatives, however, would significantly increase flood depths and velocities at downstream structures. We understand that these increases would likely not be acceptable to State Agencies, including Vermont Floodplains.

The tasks included in our scope of services presented below for the alternatives analyses study are intended to provide the Town with rehabilitation alternatives that will bring the dam into compliance with current VT DSP regulations while not increasing downstream impacts and that will allow the Town to bring Shadow Lake to normal levels.

As an alternative to completing all tasks under one contract, the Town could initially elect to complete a select number of tasks (Tasks 1 and 6, below) that would provide the Town with conceptual spillway modification alternatives that would allow the dam to safely pass the design storm while not significantly changing downstream impacts. This initial information would be useful in providing the Town with high-level, budget costs that could be expected for spillway modification construction. Completion of remaining tasks would be required to fully evaluate

dam rehabilitation alternatives and provide existing conditions information which would be the basis for engineering solutions that would bring the dam into compliance with current VT DSP regulations and that will allow the Town to bring Shadow Lake to normal levels.

SCOPE OF SERVICES

1. **Information Review:** Review existing information on Shadow Lake Dam available from the Town and the Vermont DSP.

2. **Dam Observations:** Dam safety and structural engineers will complete visual observations of the dam and document observed conditions. We assume only one visit to the dam will be needed.

3. **Wetland Delineation:** Delineate the extent of wetland resource areas along the upstream and downstream sides of the dam. Flags will be hung so that their locations can be included in the site survey. The delineation will be completed and documented in accordance with the Vermont Department of Environmental Conservation (VTDEC) Wetland Rules. Wetland delineation work will be completed during non-winter months, under suitable conditions (e.g. no snow cover or ice).

4. **Survey and Base Plan:** Conduct a topographic survey at the dam and areas within 20 feet of the dam and create a base plan of existing conditions. The plan will be suitable for use in developing plans for dam rehabilitation permitting and design.

   The survey will be tied into the North American Vertical Datum of 1988 (NAVD88) and the VT State Plane Coordinate System using GPS-based technology. We will also establish up to two temporary survey benchmarks that can be used by the contractor during construction. Property line surveying is not included in our scope of services. Survey work will be completed during non-winter months, under suitable conditions (e.g. no snow cover or ice).

5. **Field Explorations:** Complete borings at the dam to collect information on embankment and foundation soils and groundwater. This information will be used to evaluate embankment stability and seepage conditions.

   Weston & Sampson will retain the services of a drilling subcontractor to complete up to two (2) borings at the dam to depths up to 30 feet or refusal, whichever is encountered shallower. Groundwater monitoring well installation and rock core sampling are not planned. We assume that the borings can be completed in one 8-hour workday. We also assume that the Town will provide access and right of way entry for the borings. Weston & Sampson staff will mark the boring locations, observe the borings in the field, and prepare boring logs.

   The drilling subcontractor will contact DIGSAFE to mark below-grade public utilities following marking of the borings. As this service is limited to public utilities, we will need the Town to mark any private utilities in the boring areas. Weston & Sampson does not accept responsibility for disruptions to underground structures or utilities that have not been marked or have been marked incorrectly.

   The borings will be backfilled with concrete or bentonite chips. Restoration of areas disturbed as a result of our fieldwork beyond backfilling is not included. Excess drill cuttings will be disposed on-site. Permits, bonds,

environmental services, special drilling methods, decontamination, off-site cutting/soil disposal, and snow clearing are not included.

6. Hydrologic and Hydraulic Analyses: The January 30, 2023 D&K H&H Assessment Report included a detailed summary of H&H modeling and evaluations of existing conditions and three proposed alternative dam geometries under various design storms and dam failure scenarios. We understand from the 2023 study that while the three dam rehabilitation alternatives developed at that time improved the hydraulic capacity of the dam, potentially bringing it into compliance with Vermont DSP requirements, all three alternatives increased total and peak downstream discharge and had significant impacts to flood depths and velocities at downstream structures. The magnitudes of these increases and impacts would likely not be unacceptable to state regulatory agencies

   Weston & Sampson will use the existing models developed by D&K, as a starting point, to evaluate up to five new spillway and/or dam modification alternatives that would allow the dam to safely pass the design storm event without increasing downstream hazards.

   Given the steep terrain and relative lack of significant floodplain storage, in conceptualizing and evaluating the alternatives, we assume that downstream hazards are not increased if peak discharge from the dam is not increased above and beyond existing conditions during any design storm. We will evaluate those hazards based on the critical elevations identified for each structure in the 2023 report, and assume no additional downstream survey is required. We also assume that the HEC-HMS and HEC-RAS models developed in support of the 2023 study will be available to us, in full working order, and developed in a manner consistent with VT DSP requirements and professional standards.

7. Engineering Analyses: Evaluate data collected during the field activities described above and conduct engineering analyses to assess the dam's existing embankment stability and seepage conditions. These analyses will be used to support rehabilitation alternatives, including the need for any drainage/seepage collection systems and structural improvements.

8. Alternative Analyses and Conceptual Design: Based on the results of Tasks 1 through 7, above, identify and evaluate alternatives for dam rehabilitation and prepare a conceptual design of the recommended alternatives with estimated range of construction costs for review by and discussion with the Town. We will attend up to one remote meeting with the Town to discuss alternatives. It is anticipated that the conceptual designs will include sketches illustrating soil embankment repair and modifications, stone masonry wall repair options, as well as identification of other repair requirements and permitting issues that may affect the cost of, and approach to design, permitting, and construction.

9. Report Preparation: Document the results of the fieldwork, analyses, and conceptual designs in an Alternatives Analyses Report. The report will be submitted to the Town in draft form for discussion of the alternative analyses, conceptual design and anticipated schedule and costs for completing the design, permitting and construction. We will finalize the report following input by the Town.

ESTIMATED PROJECT COSTS AND PROJECT SCHEDULE

We propose to complete the proposed scope of services described above for a lump sum fee as summarized below:

Task	Fee
Task 1 – Information Review	$6,700
Task 2 – Dam Observations	$7,000
Task 3 – Wetland Delineation	$3,350
Task 4 – Survey and Base Plan	$5,250
Task 5 – Field Explorations	$9,000
Task 6 – Hydrologic & Hydraulic Analyses	$13,500
Task 7 – Engineering Analyses	$5,600
Task 8 – Alternatives Analyses and Conceptual Design	$10,000
Task 9 – Report Preparation	$9,100
	Total = $69,500

As discussed above, the Town could elect to initially complete Tasks 1 and 6. Our lump sum fee for these tasks is as follows:

Task	Fee
Task 1 – Information Review	$6,700
Task 6 – Hydrologic & Hydraulic Analyses	$13,500
	Total = $20,200

Weston & Sampson is prepared to initiate work on this project immediately upon receipt of an executed agreement. Weston & Sampson agrees to provide services for the estimated duration of work.

AUTHORIZATION

We can prepare a contract for execution by the Town of Glover and Weston & Sampson for the project approach selected by the Town. Thank you for inviting us to submit this proposal. We look forward to working with you on this project.

If you have any questions, please contact me at (603) 263-9499 or striket@wseinc.com.

Very truly yours,

WESTON & SAMPSON ENGINEERS, INC.

Thomas Strike, PE
Geotechnical Team Leader

John A. Figurelli, PG, LEP
Vice President

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