VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Water Investment Division
Dam Safety Program
1 National Life Drive, Davis 3
Montpelier, VT 05620
Phone: 802-622-4093

MEMORANDUM

TO:	Town of Glover – Dam Owner
FROM:	Benjamin Green, P.E., Vermont Dam Safety Program (DSP) – Dam Safety Engineer Steven Hanna, DSP – Dam Safety Engineer Andrew Sampsell, P.E., DSP - Dam Safety Engineer
DATE:	July 26, 2024
SUBJECT:	July 2024 Flood Inspection and Recommendations Shadow Lake Dam (State ID No. 81.02), Glover, Vermont SIGNIFICANT Hazard Potential

Remnants of Hurricane Beryl caused high rainfall and flooding in areas of central and northern Vermont on July 10 and 11, 2024. Based on publicly available rain gage data, approximately 5 inches of rain fell in the Glover area, resulting in widespread flooding and damage to infrastructure. At Shadow Lake, reservoir levels rose above normal and activated the auxiliary spillway.

Steven Hanna and Andrew Sampsell of the DSP inspected Shadow Lake Dam on July 19, 2024. At the time of the inspection, lake levels has receded to a few inches below the auxiliary spillway crest. The dam was last inspected by the DSP on July 18, 2023, following the July 2023 flood event. The last formal periodic inspection of the dam was conducted on June 28, 2023, and the dam was rated in POOR condition. The following are two notable changes from the previous inspections (see photographs below)

1. The sinkhole along the dam crest identified in the July 18, 2023 Rapid Inspection has increased considerably in size and depth. The sinkhole was measured to be approximately 5 feet in diameter and 5 feet deep. The owner was present during the inspection and noted that they were able to see active flow within the sinkhole during a previous site visit. It is therefore likely that the sinkhole extends into the dam embankment beyond what is visible. In addition to the sinkhole located on the dam crest, the owner showed the DSP a depression along the upstream face of the masonry block wall in close vicinity to the dam crest sinkhole. The owner indicated that the depression may be a location where water was seepage past the upstream masonry wall. It was noted that the masonry block wall has numerous additional un-mortared joints/gaps for water to seep through. The owner also pointed out that the sinkhole appeared to be expanding towards the direction of the bottom of the concrete auxiliary spillway. Historically, seepage flows have been observed at the base of this spillway. While it could not be confirmed that these two locations are directly connected, seepage flow was again observed below the base of the auxiliary spillway at the time of the inspection. The observed seepage was warm to the touch indicating it was likely near surface water from the lake and was flowing through the dam with a short travel time. The seepage did not appear cloudy or to be transporting embankment materials. Due to the location of the seepage, it was not possible to measure the flow rate but it was visually estimated to be 10 to 20 gallons per minute.

2. At the time of the inspection the owner was in the process of removing two timbers from the principal spillway debris rack to allow for increased discharge. This work was completed by the end of the inspection.

Based on the increased severity of the sinkhole in comparison to the previous inspection and the potential for this sinkhole to lead to seepage/internal erosion/stability issues with the dam, the condition of the dam is downgraded to **UNSATISFACTORY**. **Given the UNSATISFACTORY condition of the dam and the increased potential for an adverse issue, the DSP is requesting the owner take the following actions:**

1. Continue to regularly monitor the dam and report any unusual/unsafe conditions to the DSP.

2. Without delay, temporarily lower the water level until the sinkhole and other seepage pathways have been thoroughly investigated and repaired in accordance with an engineered and approved solution.
    - Systematically remove stoplogs to provide a minimum of 2 feet of drawdown in the lake to reduce loading on the dam and reduce seepage pressures in the embankment. This can likely be achieved by removing one stoplog from the principal spillway structure and once the water level has stabilized, additional stoplogs as needed.

3. Prepare an Emergency Action Plan (EAP) using the dam failure flood inundation maps from the hydraulic analysis performed by DuBois & King, Inc. and the standard SIGNIFICANT hazard potential dam template. Provide the EAP to the DSP for review and concurrence and also provide and review the EAP with the Local Emergency Management Director and Incident Commander.

4. Retain an Engineer experienced in the evaluation and design of dams to evaluate the sinkhole, seepage, and stability of the dam. This work should include field investigations to determine the source and severity of seepage, explore the type and consistency of the embankment and foundation soils and rock, and evaluate the seepage and structural stability of the dam. The work should also identify potential repair alternatives for review.

5. Work with the Engineer to develop a plan to improve the condition of the dam and bring it into compliance with current dam safety standards.

    - Review existing studies and past inspection reports to understand deficiencies.
    - Develop alternatives to address the immediate seepage, sinkhole, and stability concerns and additional deficiencies present at the dam.
    - Perform rehabilitation design and apply for approval of the proposed repair and rehabilitation project through the DSP and once approval is obtained, complete the project.

The DSP remains available to discuss the conditions at the dam and this memorandum. I can be reached at 802-622-4093 or Benjamin.green@vermont.gov.

Photo 1: Dam crest, sinkhole, principal spillway derbis rack timber removal (looking towards right abutment).

Photo 2: Dam crest, sink hole (looking towards left abutment).

Photo 3: Sinkhole on dam crest.

Photo 4: Example masonry blocks and gaps between joints upstream of sinkhole location.

Photo 5: Lake level a few inches below auxiliary spillway crest at the time of the inspection.

Photo 6: Water pooled below base of auxilairy spillway.

Photo 7: Seepage flow eminating from stones below base of auxiliary spillway.

Photo 8: Downstream slope standing on right side of dam looking towards left side of dam.