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02 May 2024

Kate Betsill
Environmental Engineer
Safe Dams Program
Georgia Department of Natural Resources
2 Martin Luther King, Jr. Drive
Atlanta, Georgia 30334

Subject: Lake Petit Dam Permit Application
Stability Analyses Comment Response
Pickens County
Permit #112-009-00462

Dear Ms. Betsill:

Big Canoe Property Owners Association (POA) and its consultant Geosyntec Consultants, Inc. (Geosyntec) received the Safe Dams Program (SDP) comments on the Appendix A Stability Analyses from the April 2023 permit application for Lake Petit Dam (Dam) in your letters dated 10 August 2023 and 02 April 2024. For continuity and clarity, we have listed each set of your Stability Analyses comments from these two letters below, along with our responses.

The April 2023 permit application was revised and submitted to the SDP in March 2024 (Revision 1) to explicitly remove the portion of the original application related to the stability of the Dam (i.e., Appendix A). A revised version of the Stability Analyses of Lake Petit Dam is being developed based on these comments and will be submitted to the SDP by 22 May 2024. The revised information will provide a compiled source for documentation on the stability of the Dam for future reference.

Section A: Stability and Seepage Analyses (August 2023 comments)

1. Because the Program lacks expertise in seismic analysis, we are planning to have an outside review done for this portion of the permit documents. When the outside review is complete, the Program will send additional comments to be addressed.

   Geosyntec – The independent review of the seismic analysis was completed by Schnabel Engineering, and comments were provided to Geosyntec by the SDP on 02 April 2024. Section B of this letter addresses the additional comments.

2. Please explain why the downstream saprolite layer is more permeable than the upstream saprolite layer and why this is appropriate.

   Geosyntec – Based on historic geotechnical explorations, the saprolite at Lake Petit Dam consists of silt and sands weathered from metamorphic Gneiss and Schist. A distinction in the hydraulic conductivity was modeled between the saprolite downstream of the core and the saprolite upstream of the core to capture the influence of an upstream excavation and

cutoff trench depicted on Sheet No. 4 of 9 from the 1971 As-Built Construction Drawings. The cutoff trench is not explicitly modeled in the geometry; however, the influence of the cutoff trench and upstream excavation was modeled by assigning a relatively lower vertical and horizontal hydraulic conductivity of $3.3x10^{-9}$ feet per second (ft/s) for the saprolite upstream of the core relative to $1.6x10^{-6}$ ft/s downstream.

3. Please explain in more detail the reasoning in assuming the head at the upstream end of the trench drain is equal to the normal pool elevation (1635.5). Is this reasonable given the seepage analysis showing head of 1550-1560?

   Geosyntec – The trench drain (referred to as the Internal Drain System in the Geosyntec's Appendix A calculation package) was modeled with a head elevation (El.) equal to 1,535.0 ft, not El. 1,635.5. The drain includes collector pipes with discharge downstream of the toe near the outlet works for the low-level outlet. This boundary was selected based on a calibration of the seepage model and engineering judgement, in which the total head was varied to account for efficiency in the internal drain until reaching a reasonable representation of the seepage model based on the target values shown in Table 1 of the Stability Analyses of Lake Petit Dam. Based on the evaluation of construction records and the sensitivity analyses, we believe the drain is likely functioning and a strong gradient exists within the dam towards the drain. As referenced, the surrounding phreatic line is near approximate El. 1,560, so the capacity of the drain is likely governed by the hydraulic conductivity of the surrounding clay embankment (i.e., strong gradients exist close to the drain, but most seepage bypasses the drain and exits downstream). Cross-Section A-A used for the seepage and stability analyses intersects the Internal Drain System at approximately the location presented in Figure 2 of the Stability Analyses of Lake Petit Dam. The seepage model was run using the normal pool with El. 1,635.5 ft.

4. Why were no boring logs for P-2, P-4, P-6, P-7, L-3, L-4, L-5, and G-3 included? What tests were run on samples from these boreholes?

   Geosyntec – Geosyntec will update Attachment 2 of the Stability Analyses of Lake Petit Dam to contain boring logs for P-2, P-4, P-6, P-7, and G-3. Subsurface observations collected from borings P-2, P-4, P-6, and P-7 conducted in 1998 by Piedmont Geotechnical Consultants, and G-3 conducted by Geosyntec in 1998 were used to model the lithology of the dam. The effective and undrained shear strength parameters used for the stability analyses were selected from laboratory tests conducted on samples collected from borings G-1B, G-2, G-3, G-4, and G-5 in the geotechnical investigation by Geosyntec in 1998. No laboratory data was available for the Piedmont Geotechnical Consultants borings. The laboratory data for G-3 was included in the original calculation package submittal and includes triaxial compression testing.

   Borings L-3, L-4, and L-5 conducted in 1974 by Law Engineering were shallow augured borings (approximately 20 ft) intended for installation of temporary piezometers at the time. No boring logs or laboratory results from these investigations are available.

5. Figure 2-1 on page 106 should have a legend for the dots which appear to be boring sample points and the upstream end of the trench drain. The downstream end of the trench drain, on which the downstream boundary condition is based, should be more clearly shown.

   Geosyntec – Geosyntec will update Figure 2-1 in the revised version of the Stability Analyses of Lake Petit Dam to include a legend which calls out the points, which are approximate location of piezometric instruments, and the location where Cross-Section A-A used for the seepage and stability analyses intersects the Internal Drain System.

Section B: Seismic Stability Analyses (April 2024 comments)

1. Assess the susceptibility and potential for triggering liquefaction and cyclic softening and evaluate their impact on dam stability if they are deemed likely to occur. This is important because liquefaction and cyclic softening are significant mechanisms for large seismic slope displacement that are not captured in the pseudostatic or simplified seismic slope displacement analyses. This assessment, if not previously done, could be accomplished as a "screening level" evaluation.

   Geosyntec – Geosyntec used the available shear wave velocity profiles and index properties of soils at the Dam in our April 2023 permit application to estimate the likelihood of liquefaction and cyclic softening.

   Based on screening-level procedures described by Boulanger and Idriss (2008), Bray and Sancio (2004), and Andrus and Stokoe (2000), liquefaction and cyclic softening are unlikely to occur.

   A detailed description of the data and methodology used to reach this conclusion will be provided in the revised version of the Stability Analyses of Lake Petit Dam.

2. Assess potential for seismic densification or post-liquefaction reconsolidation settlement, neither of which is captured in the pseudostatic or simplified seismic slope displacement analyses. This assessment, if not previously done, could be accomplished as a "screening level" evaluation.

   Geosyntec – Because the potential for liquefaction and cyclic softening are screened out for the Dam, significant seismic densification and post-liquefaction reconsolidation settlement are not anticipated to be of concern; however, potential deformations can still occur as some excess pore water pressure would be generated during an earthquake, which would temporarily reduce the strength of the materials producing permanent deformation at the Dam. Under the assumption that the entire soil mass may exhibit strength reduction, Geosyntec has estimated that a conservative 2 ft of settlement could occur at the crest of the Dam using a procedure described by Ishihara and Yoshimine (1992). This screening level evaluation is used to demonstrate that Lake Petit Dam could maintain a freeboard larger

than the minimum acceptable freeboard of 3 ft according to the SDP in the event of seismic-induced deformations.

A detailed description of the data and methodology used to reach this conclusion will be provided in the revised version of the Stability Analyses of Lake Petit Dam.

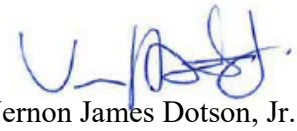
3. Verify the dam can tolerate up to 60 cm (2 feet) of permanent seismic displacement at the 2475-year return period hazard level (i.e., consistent with Geosyntec's assumption in developing their design-level analysis with k_s of 0.054) or provide an alternate allowable seismic slope displacement.

   Geosyntec – Based on correspondence with the SDP on 10 April 2024, Geosyntec understands this comment to be in reference to the available freeboard for the Dam and that the design earthquake and design storm events should not be considered to occur simultaneously. The current freeboard of the Dam is approximately 11.5 ft (crest at approximately El. 1,647.0 ft and normal pool at El. 1,635.5 ft). With 2 ft of permanent displacement, the freeboard would be 9.5 feet, which is considerably larger than the minimum allowable freeboard of 3 ft established by the SDP.

A revised version of the Stability Analyses of Lake Petit Dam is being developed based on your comments and our responses above and will be submitted to the SDP by 22 May 2024.

On behalf of Big Canoe POA, Geosyntec thanks you for your review and comments in finalizing this portion of the Permit Application. Please contact the undersigned, at 423.385.2316, if you have any questions.

Sincerely,



Vernon James Dotson, Jr., P.E. (GA, AL. NC, TN)
Senior Principal Engineer and Engineer of Record
Geosyntec Consultants, Inc.

cc: Scott Auer, Big Canoe Property Owners Association
Wesley MacDonald, P.E., Geosyntec Consultants, Inc.