Lake Petit Dam
File Review Notes

Piedmont Geotechnical Consultants letter of May 29, 1997 by Karl Myers. On page 3 under Historical Information, the dam is approximately 125 feet tall and designed with a 3.5 upstream slope and a 2.5 downstream slope. However, it is noted later on under item #1 on number 3 of review of safe dams file, including the phase one report dated July 24, 1979, that the surveyed cross section of the dam is depicted with downstream slope sections ranging from 1.9 to 2.1. Berms were noted somewhere to the number of berms from the original design drawings. However, the spacing vertically between the berms as well the width of the individual berms varies from top to bottom on the downstream slope. It was noted that in 1976, ABS plastic drain outlets were provided on the lower berms to address seepage. Mr Myers' letter also noted "the only other piece of significant information provided was a letter dated March 31, 1980 from Mr. Tom Roberts of Baldwin & Cranston responding to a letter dated February 14, 1980 from the Safe Dams Program questioning the downstream slope configuration. Apparently the design 2.5 horizontal to 1 vertical slope verses the average of about 2 horizontal to 1 vertical depicted on the phase one cross section was the discrepancy noted that Safe Dam requested the original designer consider. This particular letter from the original designer indicates that the average slope with the sections between berms was very close to the 2.5 horizonal to 1 vertical original design based on their then recent field survey measurements. Information concerning the final resolution of this issue was not provided to us." Mr. Myers' letter on page 4 also notes that a Mr. White and a Mr. Ledbetter met with him and that Mr. White was able to locate the original design drawings and a copy was made while visiting the site. The three monitoring wells that had previously been installed prior to this episode of concern about the dam were cleaned out and monitored on this date of inspection by Mr. Myers. They were noted W1, W2, and W3. W1 was the well on the upper most downstream berm, W2 on the second from the crest, and W3 on the third berm from the crest. Water was measured in W1 at the depth of 9.4 feet below the ground surface and W2 was measured at a total depth 14.9 feet where a slight amount of wet mud was encountered. W3 had water at the depth of 1.4 feet below the ground surface with the bottomless hole about 10.4 feet. Total of six berms exist on this dam including the roadway "berm" at the downstream toe of the dam. Mr. Myers noted an apparent seepage was exiting from the face of the slope section between berms four and five counting from the top down, which is between the two berms that have a concrete line ditches. In the preliminary stability analysis run by Karl Myers, he notes that they assumed drained effective soil strength parameters of cohesion equals zero and internal friction equals 32 degrees. These have been selected to represent the typical where above average values for the parameters obtained thru extensive laboratory testing performed in conjunction with number of new Category I dams designed in the state over the past 10 to 15 years. Karl used a seismic of .19. His calculations give a minimum safety factor of approximately 1.8 for steady state. This exceeds the 1.5 required. Did obtain a 1.1 for the seismic that is for deep circles involving the entire downstream slope of the dam. Repeating the process, I used the assumed as built configuration and the elevated phreatic surface. Analysis resulted in minimum safety factor of 1.1 for steady state seepage without earthquake and .7 with earthquake. Once again these failure circles are deep and involve the entire downstream slope.

Now looking at the August 18, 1997 letter from Piedmont Geotech. Still is some question as the what the downstream slope is. It appears that the property owners were going to do two cross sections. If that is the case, question that data. It needs to be a licenced surveyor. Inspection on October 7, 1997 by Ed and Simmons notes that the lower exploratory holes complete and piezometers are in. Hole is 90 feet deep, penetrated random fill, rocky material, etc. The hole in the crest is 130 feet or more. Drilling is about 60 feet down using rotary mud drilling and pushing for split spoon sampling. Samples show wood, twiggs, top soil in them. Cohesive material that is type not great fill material in the "core" area.

February 2, 1998 letter that I did to Mr. Ledbetter summarizing a meeting held on January 27, 1998. One of the points used some basic assumptions that appears the dam currently has a study state safety factor of around 1.28 and seismic of .75. Possibility of an outside firm, Geotech Systems Engineering with Professor Glen Ricks from Georgia Tech participating in doing a site specific study was discussed. It appears that the .15 would be the best they could obtain. Further from that I learned that .18 was the best they would be able to get.

March 2, 1998 I gave Karl approval to use conservative value for strength parameters for the borrow material. This was going to be for the downstream berm. I allowed them to use the current idealized piece of metric levels and the user value of 30 degrees fiction angle for the existing material.

Letter of May 7, 1998 to Troy Ledbetter from Crantson, Robertson and Whitehurst talking about the site specific field work indicates that the dam is founded on weathered rock. The seismic consultant report said it is unlikely that further studies are improved on the .18G acceleration factor.

Karl Myers letter of February 3, 1998 to Jordan, Jones & Goulding as a preliminary project update. On page 2 continuing on page 3, Karl indicates that JJ&G did a survey and that the dam essentially is depicted on the original design drawings and not the steeper section on phase one inspection. Therefore, that is saying the downstream slope generally is a 2.5 to 1. That 2.5 to 1 is between the berms. In Karl's letter, they did a steady state seepage condition, no earthquake loading, stability printout with the as-built geometry that being a 2.5 to 1 downstream slope, and the varying metric levels that they indicated by the additional two borings. They assumed strength parameters of cohesion equals zero and a friction angle equals 30 degrees for the existing embankment materials. Results give a calculated minimum safety factor for the massive global stability failure of 1.28, approximately 1.3. This is below the 1.5 that is required. Second printout involves the same geometry, same strength parameters, and same presemeric levels in the introduction of .19 seismic coefficient. This analysis indicates a minimum safety factor for massive global stability failure of .75. This is below the 1.1 minimum safety factor currently required and also indicates a failure condition. Additional analysis using a .11G seismic, the as-built geometry and the highest strength parameters typically determined for compacted embankment fill material in the geology gave acceptable stability factors. However, getting a .11G is unlikely as noted in Karl's letter. On page 5 of this letter under the section Soil Strength Parameters, Karl notes that considerable difficulty was encountered with hitting rocky material that damaged the undisturbed samples. It goes on to note further that we have retrieved and archived in a moist room approximately 6 to 8 samples that are potentially suitable for testing. However until these material are extruded from the sampling tubes, their actual condition can not be determined. Karl further notes "My experience on a number of projects involving both new and existing earthen embankments dams in this state would indicated that the broadest typical range of effective strength parameters were reasonably well to properly compacted embankment fills was from approximately 28 degrees to 35 degrees with essentially no cohesion. The 28 degree value is fairly uncommon and extremely low except for more poorly compacted materials. The 34 to 35 degree range has been obtained on a few occasions for very well compacted fills on a limited number of projects. Therefore, the more typical range is probably 30 to 32 degrees."