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# PIEDMONT
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August 18, 1997

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**Jordan, Jones & Goulding, Inc.**
2000 Clearview Avenue, NE
Atlanta, GA 30340

Attention: Mr. John W. Britton, P.E.
Project Manager

Subject: Proposal for Subsurface Exploration and
Geotechnical Engineering Evaluation
**Lake Petit Dam**
Big Canoe, Georgia
PGC Project No. 97089
PGC Proposal No. P7275

Dear John:

As requested by the Property Owner's Association (POA) of Big Canoe, Georgia, Piedmont Geotechnical Consultants, Inc. is pleased to submit this proposal for the subsurface exploration and geotechnical engineering evaluation of the subject project. As you are aware, our firm has assisted you with the preliminary geotechnical engineering evaluation of this project. This preliminary study was prompted primarily by seepage related observations at this dam, and was culminated in our report of May 29, 1997 (revised June 6, 1997) under this same project number. The most significant finding of that preliminary evaluation was not the concern specifically related to seepage; but rather, concerns related to the adequacy of safety factors associated with stability of the downstream slope due to an apparent high or elevated phreatic surface. A sequenced approached to additional evaluations was recommended.

Since that earlier report was issued, additional information has been provided by the original designer, and has been reviewed. Without going into all the details at this time, suffice it to say that the additional data does not alleviate our concerns about the potentially low safety factors related to slope stability. To some extent, the documentation from the early years of this dam's existence actually heighten the concerns expressed previously in our preliminary report. These issues were discussed in more detail during a meeting at the POA offices at Big Canoe on August 11, 1997. In attendance were representatives from POA, the Georgia Safe Dams Program, JJ&G, and PGC. The apparent elevated phreatic surface initiated our concerns related to stability. Our preliminary evaluation utilized assumed strength parameters for the embankment fill materials, the most recent information available concerning the downstream slope configuration obtained from the Phase I Inspection Report performed in 1979, and a phreatic surface determined from limited shallow

observation wells on the face of the downstream slope, and the exposed seepage that is occurring on the lower portions of the embankment. Our preliminary stability assessment indicated that safety factors considerably below those normally accepted for a project of this type may exist for both steady-state seepage conditions, and steady-state seepage with current Category I seismic design criteria.

At present, the preliminary evaluation we performed, combined with the more recent information obtained from the original designer, leaves some question about the following items:

1. An accurate profile of the existing downstream slope.

2. Accurate strength parameters of the appropriate type for use in evaluation of the downstream slope. These would include the originally designed clayey core zone materials, as well as the downstream shell materials.

3. An accurate determination of the phreatic surface conditions within various portions of the downstream slope.

We understand that as part of this supplemental evaluation, that your firm will assess Item No. 1 above by providing at least two cross-sections of the downstream slope. This may also include a detailed topographic survey of the entire downstream slope area for possible subsequent modifications to the dam. Our supplemental study is primarily being driven by Item No. 3 above. As discussed in more detail in our previous report, and during the meeting of August 11, 1997, the most significant change to the preliminary stability assessment performed to-date would occur if the shallow phreatic surface demonstrated by the currently available information only impacts the upper portions of the downstream slope. That is, if the central and lower sections of the embankment actually have water pressures lower than represented by the shallow phreatic surface, stability safety factors may be improved. The primary intent of this subsurface exploration and geotechnical engineering evaluation outlined in this proposal will be to attempt to determine the variations in phreatic elevation for various zones within the embankment, and to also provide samples for possible laboratory testing in conjunction with Item No. 2 above.

Our preliminary geotechnical evaluation report generally suggested at least a single line of borings performed at the crest of the dam and on each of the downstream berms (a total of at least eight locations) to resolve the phreatic surface issue. However, we also indicated that input from the Georgia Safe Dams Program was required prior to finalizing the approach that should be undertaken. Based on the meeting of August 11, 1997, a hybrid approach has been agreed to. This would involve initially installing two of the eight locations, to see if any actual variations in the phreatic surface exist with depth. If these initial two locations show promise, the remaining six locations would be completed to help assure that the model used in subsequent evaluations is correct. However, if these initial two locations show that the phreatic surface profile is essentially the same throughout the depth of the downstream slope, the other six locations would be eliminated, thereby significantly reducing the costs associated with this evaluation phase. In addition, the initial two locations would be used to provide samples for subsequent laboratory testing to better establish the strength parameters for more detailed stability evaluation. As a result, three separate work items exist under

this phase of geotechnical study as follows:

1. Install multiple piezometers in two borings, located at the crest of the dam and on the second berm down from the top of the dam. The bulk of the undisturbed samples would be obtained from these borings.

2. Install the six remaining locations, including an additional hole at the crest, and on each of the remaining berms of the downstream slope, including the downstream toe area. Multiple piezometers will be installed in these borings as well.

3. Perform sufficient laboratory testing to accurately model the strength parameters of the various zones of the dam.

As indicated above, the minimum scope to be completed will likely include Item Nos. 1 and 3. Item No. 2 may be eliminated if the initial work task shows indications that an elevated phreatic surface extends throughout the various zones of the embankment. Regardless of the work items completed, it is intended that the culmination of this study will be to accurately define our opinion of the current safety factors associated with the downstream slope stability. This will be made in conjunction with the work items we will include, as well as the survey information provided by your firm. If the safety factors relative to stability are determined to be sufficient as a result of this study, we envision that this would be the completion of the engineering evaluations with the exception of specifically addressing the deficiencies noted by the Safe Dams Program. This study would include addressing those deficiencies that remain. If however this phase of evaluation determines that the downstream slope does not have sufficient safety factors relative to stability, an additional phase of effort will be needed to work in conjunction with your firm to determine the most feasible means of correcting this deficiency. We have generally discussed such items as slope flattening, stabilization berms, grouting, slurry walls, and upstream clayey blankets. The best approach to dealing with any stability deficiency, and the design details required will be provided as a supplemental phase of work, and are not included in this particular study. This current phase of study could be expanded somewhat to address the impact of various options on the stability safety factors. This can be discussed with you further at the appropriate time.

The attached exhibit details our estimated scope of services and budget requirements for these various work tasks. Task 1 results in a total estimated budget of $17,698.00, Task 2 a budget of $27,796.00 and Task 3 a budget of $7,775.00. The engineering services provided and indicated as Task 4 generally results for any combination of the first three tasks. Therefore the complete study, if required, would result in a maximum budget estimate of approximately $71,269.00. This estimate is actually a worst case scenario assuming that Tasks 1,2 and 3 will be completed. The Task 4 amount would be added to any combination of the other three tasks to finalize the evaluation process. At the completion of our study, a professional engineering report would be issued describing our findings, evaluations, and geotechnical conclusions and recommendations.

The actual invoicing on this project would be based on the actual services provided in conjunction with the attached Fee Schedule. However, we would not exceed any preauthorized budget amount without your prior review and authorization to do so. We have not included in these budget estimates any difficult access considerations, nor the need for traffic control on the crest of the dam. We anticipate that Big Canoe can provide suitable equipment for accessing the downstream berms utilizing an all terrain drill rig, and that we should be able to close one lane of the crest road during drilling on the crest. We have not included any costs associated with these additional efforts.

As we have discussed during the August 11, 1997 meeting, the field evaluation outlined in this proposal is anticipated to be extremely challenging due to the complexity of the drilling required, the height of the embankment and the fact that the lake is currently impounded essentially to normal pool elevation. Part of the delay in providing this proposal to you has been in researching the best approach to utilize for this evaluation process, and to locate and receive a commitment from what we feel to be the most experienced drilling subcontractors locally available. It must be understood that we will utilize the best available approaches and care in executing these work tasks. However, we can not be responsible for any damage which occurs to this dam as a result of the field exploration work. In addition, it must be understood that a totally different approach may ultimately be required to complete the outlined study. That is, if the drilling techniques anticipated prove unable to adequately install the instrumentation planned, which may be impacted by the types of materials to be penetrated (assumptions have had to be made) and the impact of working against the full reservoir head in this process, other approaches may be required. These may ultimately require that the lake be drained to allow for safe installation of the required instrumentation. The obvious drawback of this approach will be that the lake would then need to be reimpounded to properly assess the phreatic levels within the embankment. This would be a very time consuming process. If this supplemental evaluation process proves inordinantly difficult, or poses unnecessary risk to the integrity of the dam, we will terminate the field exploration, abandon any holes that are partially completed, and meet with you and the client to discuss the impacts of this situation. It may become necessary to assume that the elevated phreatic surface indicated by the shallow wells has to be utilized in subsequent evaluations, and this supplemental study would then essentially reduce to establishing appropriate strength parameters, your survey of the downstream slope configuration, more detailed evaluations, and the likely conclusion that the current embankment configuration is not adequately stable. This may result in a somewhat more conservative approach to remediating this dam; however, it may be the only practical approach.

I have tried to briefly summarize some of the concerns expressed in the August 11, 1997 meeting, the information available to-date, and where we ultimately see this study leading. Should you have any questions concerning this outlined approach, or any of the services to be provided by our firm, please do not hesitate to contact me. If you find this proposal acceptable, we ask that you execute the attached Agreement for Services to provide us with formal authorization and proper invoicing instructions. We remain available to meet with you and POA to further discuss this approach, if requested. We are prepared to commence this study as soon as authorization is received, and we can coordinate the field exploration effort with our selected subcontractor.

Respectfully submitted,

Piedmont Geotechnical Consultants, Inc.

Karl W. Myers, P.E.
Senior Consultant
Registered Georgia 11280

KWM/njm

Attachments: Exhibit I
Fee Schedule
General Conditions
Agreement for Services

cc: Mr. Tom Woosley, P.E. - Georgia Safe Dams Program