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July 12, 2007

Trustees of Lake Tishomingo
C/O Ms. Clarue Holland
8625 Moran Place
St. Louis, MO 63114

Re: July 6, 2007 Site Visit

To Whom It May Concern:

At the request of the Board and the Dam Committee, the undersigned met with several people at the site on the afternoon of July 6, 2007. This meeting was requested to inspect the dam, its present condition, the presence of seepage and performance of the seepage control measures, and to answer questions posed by the committee. This letter will briefly summarize my observations and response to questions.

Field inspection Observations:

1. Spillway Leakage - It was pointed out that while the lake is approximately within 4 feet of full pool, there is always some water in the low spots of the spillway discharge channel. I observed a slight flow in the spillway channel about 100 feet downstream of the spillway with the lake about 10 inches below full pool. I commented that there have been several known and probably more cuts through the spillway to lower the lake for whatever reason in the past. These repairs may have consisted of just placing fills with limited compaction in the scar. Some slight seepage should be expected in those conditions.

A complete nearly watertight repair will involve excavation of all the soil fills in the spillway approach cut and replacement with a concrete bulkhead. A planned drainway can be included in that bulkhead for annual lakeshore maintenance.

2. Phase I seepage interceptor outlet — My recollection was that the phase I seepage collector pipe was directed to the left (looking downstream) of the power pole located in the left half of the valley. It did not extend all the way to the creek that is parallel to the toe of the dam. We could not locate it during the site visit.

3. Saturated field - The field in the left side of the valley downstream of the dam had standing seepage water in it. This area has always been wet since our initial experience with the dam.

It is my opinion that this is seepage traveling under the dam and exiting in the old creek channel. Since the seepage is not exiting at the toe of the dam it does not pose any immediate risk to the dam.

4. Right Abutment Seepage Interceptor Performance — The recent measurements of the outflow indicate that the interceptor flow is about 300 gallons per minute (gpm), this has increased from the approximately 50 gpm when the system was installed in the late 1980's. Increased seepage with time is common in areas with carbonate bedrock. This

occurs because the seepage areas are enlarging as the rock is being dissolved in the presence of the flowing water. It is also possible that the asphalt grout material is being extruded and the passageways are increasing in size as the asphaltic grout is being pushed out of the flow paths.

The discharge water from the interceptor is clear. Discussion with our geologist who was at the site when the interceptor was built indicates that an open ended pipe was inserted in the crevice found in the right abutment that was producing flow at that time. The pipe was sealed into the crevice with hydraulic cement and led to the interceptor manhole, Inspection of the manhole indicates that there is no seepage through any of the pre-cast segment joints, indicating that the seepage interception system is not being overwhelmed by the present flow.

5. Hillside Pipes - I was shown a collection of about 5 vertical pipes in the hillside downstream of the haul road alignment. These were old 3 to 4 inch diameter steel pipes, that are typical of those used in field grouting operations. These may have been part of the 1g60's grouting procedures.

6. Top of Dam - Walking along the top of dam it was noted that there were several small zones of upstream edge settlement. This is moat likely a loss of the top soils into the rip-rap voids along the upstream slope. These could also be some localized slips in the rip-rap. We recommend filling the settlement areas with soil to recreate a plane surface so that rainfall does not concentrate in the depression and start an erosion channel.
After the field Inspection we met at the community center to discuss findings and answer additional questions

Additional Questions:
1. Use a Standpipe — It has been suggested that the seepage water be directed to a standpipe instead of the downstream discharge point. A standpipe is just a pressure equalization device that would not allow any flow. The water would rise to an elevation in the standpipe that is equal to the energy or pressure gradient of the seepage. This would create a hydraulic pressure within the embankment that will eventually form an uncontrolled exit point of the water's choosing. Stopping the flow is NOT recommended.

2. Interceptor Capacity — Eventually the interceptor system could be overwhelmed by the seepage rates if these flows continue to increase I have calculated that the seepage interceptor system should be able to safely collect flows of about 1350 gallons per minute. The present flow of 300 gpm is not overtaxing the system.

3. Pump back — It was asked if the seepage discharge can be pumped back into the lake. There is no compelling reason to prevent recycling the water. The present flow rate of 300 gpm would require a pump with a theoretical horsepower of 11, assuming about 70 percent efficiency. The power usage is estimated at 10 kilowatts per hour.

4. Grouting - We understand that you have been talking with Mr. Dave Taylor about the possibility of grouting the leak again. This is always a possibility, and we would recommend Mr. Taylor as the contractor most likely to achieve success. I would recommend that a planning budget of about $50,000 be used until you can obtain an estimate from Mr. Taylor.

You have asked how to locate the old grout pipes. The pipe on the top of the dam shown

in the repair plans near baseline station 5+40 is thought to be one of the original grouting pipes. This pipe should be able to be located relative to the baseline if the two reference points on the baseline can be located. The attached sketch shows the only known tie to the pin at station 0+00. The baseline was set along the downstream crest line. The other pin location at station 8+36 is about 24 feet from a utility pole. If that pole is still there, a little digging and a metal detector should be able to find both of the baseline reference points Once the baseline is established, the grout pipe should be easy to locate. Our notes indicate that Metropolitan Engineering did the field surveying for the plan preparation. They may have better notes for re-establishing the base line.

5. Siphon - It has been suggested that a permanent siphon be installed through the spillway, probably as a ready made means of lowering the lake when needed. I commented that it may be possible to lay the siphon in the spillway channel and concrete over it. It is my opinion that a 10 or 12 inch siphon pipe can be put in the narrow erosion channel without compromising the spillway capacity. It should be installed in a new trench within the first 100 feet ± of the spillway, because of the relatively flat slope in that part of the spillway outlet channel.

If a siphon is installed, we recommend that a valved vacuum break port be included in the top of the siphon to assure that the siphon does not self-start during a flood event

6. Leak Detection — The zone of leakage can be either located or localized using geophysical testing methods. The most likely method of succeeding is acoustic emissions monitoring. This will require drilling holes and using sensitive listening and recording devices lowered into the holes. This is a tool that can be used by the grouting contractor to either plan his operation or verify the apparent success of the finished product. The success of acoustic measurements can be compromised if the background noise is too great

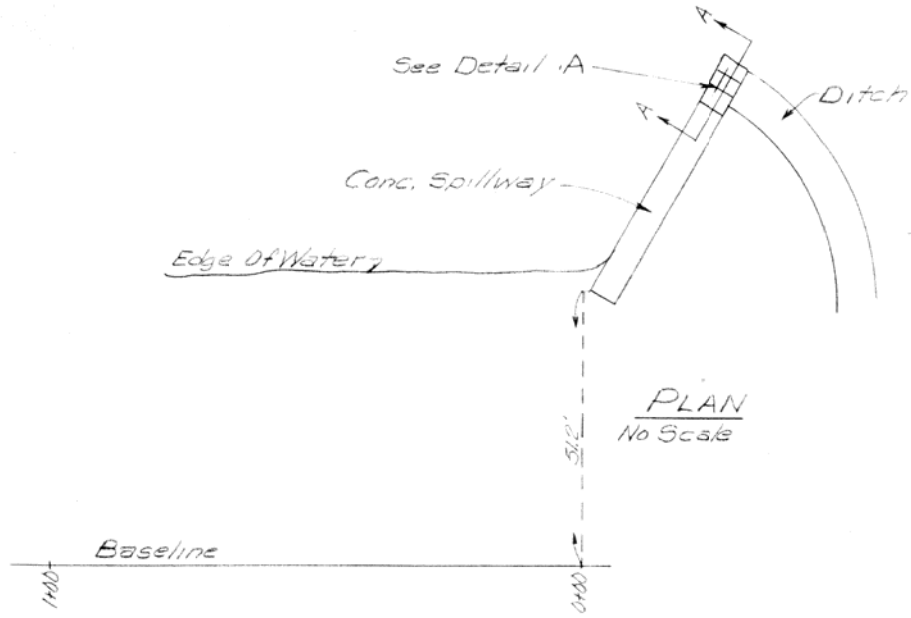
Another possibility is incremental lowering of the lake and searching for vortex formation at leak entry points. This is only successful if there is a concentrated leak point. Personal discussion with the original developer indicated that they tried this in the early life of the dam when the leak was originally discovered. He stated that there was some indication of water loss in the first cove on the right aide of the lake, but he was not more specific.

7. Local Boat anchoring — you asked about any anchoring damage to the upstream face rip-rap. The top 10 feet of rip-rap under water is the moat important. With a slope of 3 horizontal to 1 vertical that means no anchoring closer than 30 feet to the waters edge should be allowed. I would recommend that you state 50 feet, or about 4 boat lengths as an easily identifiable method of “measurement’ to the average boater.

That covers my notes of our meeting. If you have any questions, please feel free to contact us at your convenience.

Sincerely,

Donald S. Eskridge, PE
Principal



PLAN
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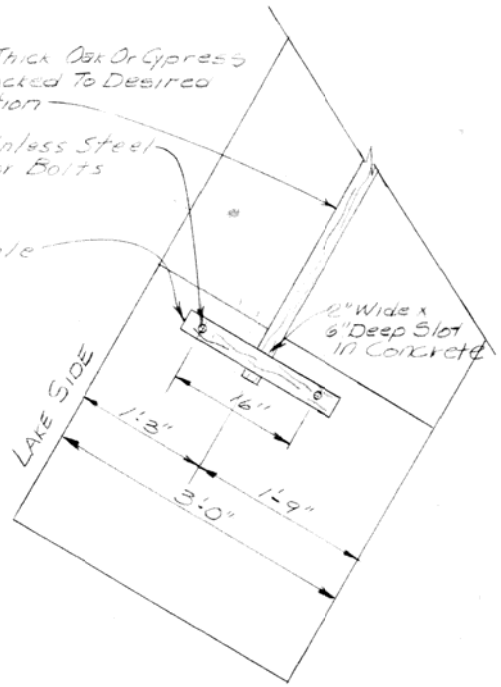

DETAIL A
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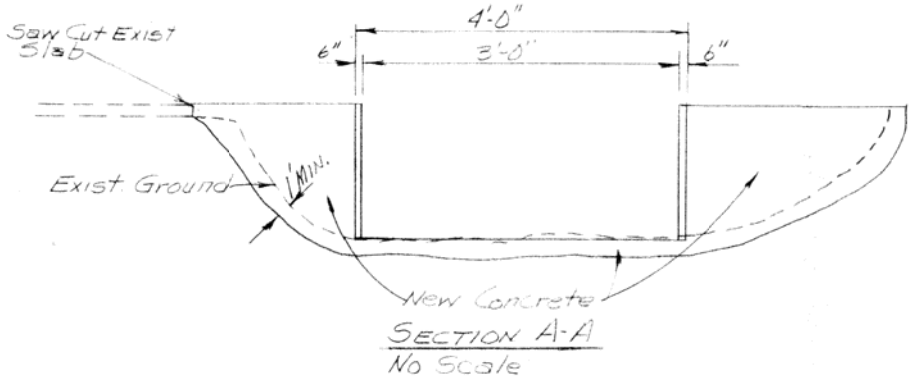

SECTION A-A
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LAKE TISHIMINGO
SPILLWAY DETAILS

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