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**MEMORANDUM**

**To:            Technical Advisory Council Members**

**From:        Trevor Clements, Jon Butcher, and Kimberly Brewer**

**Subject:     March 2, 2006 Technical Advisory Council Conference Call Summary**

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A conference call for the Lake Maumelle Technical Advisory Council (TAC) was convened March 2, 2006 at 2:00 p.m. CST. Ten of fourteen members were in attendance, along with three Policy Advisory Council members (see attached attendance record). Trevor Clements moderated the call, and was supported in technical discussion by Jon Butcher and Kimberly Brewer on behalf of Tetra Tech, Inc. (Tt).

Trevor Clements took roll call, and members were asked if it would be OK for CAW to tape the call. There were no objections, so the call was taped. Trevor then reminded TAC members of the context of the call:

- a. We are nearing the end of the second phase of the project, which has involved assessment tool development, baseline analysis, and exploration of management options.
- b. During the last conference call February 2<sup>nd</sup>, the TAC and Tt reviewed several draft white papers on various management topics before they were sent to the Policy Advisory Council and discussed at the February 16 PAC meeting.
- c. Since the last call, the Tt project team has completed the watershed and lake model calibration and validation process, documented the methods and results of the model development, and applied the models for a baseline analysis. The purpose of the baseline analysis is to establish points of reference to guide the watershed management plan development process. By comparing existing conditions in the lake and watershed to future conditions (assuming that no additional management policies or programs are established), the baseline analysis results help us to understand the magnitude of what should be addressed by the management plan to achieve the established goals and objectives.
- d. The call agenda focuses on the baseline analysis and discussion of management targets. A brief amount of time will be spent summarizing the model development, but Tt realizes that TAC members have just received the documentation and that it will take awhile to review it. Tt announced that it would rather give members the next couple of weeks to review, ask questions, and provide comments in a thoughtful manner (comments are to be provided by 3/15/06). Trevor then mentioned that it was Tt's intent to spend more of the call talking about the baseline analysis and management targets.

### **Model Calibration and Validation Overview**

Jon Butcher provided a brief overview of the results of the model calibration and validation results. He covered three components of the modeling framework: the HSPF watershed model, and the two lake models: CEQUAL-W2 and EFDC. For the watershed model, the fit of the calibration and validation runs to observed data was excellent in most cases and met all pre-specified criteria. Some variability should be expected because precipitation across the watershed is not precisely known, but must be interpolated from three point records of daily totals. The watershed loads are linked to the CEQUAL-W2 model, and helped improve the lake model performance over previous efforts. Both lake models are performing quite well, with details outlined in the model documentation.

Carl Stapleton asked what the source of data was for the calibration of the watershed model. Jon indicated that Tt used the USGS data set. The primary calibration point was performance at Williams Junction, with supplemental checks at the tributary stations which had data for approximately six to eight storm events. With regard to applicability to the remainder of the watershed, Jon pointed out that the watershed was split into modeling units that reflected differences in soils, slopes, and precipitation. He also noted that the lake modeling calibration effort provided another check on the watershed loading in that predictions throughout the lake (which reflect the entire watershed loading) matched observed water quality well.

### **Baseline Modeling Analysis Results – Lake Response**

Trevor directed TAC members to look at their Baseline Modeling Analysis preliminary summary memo with attachments. Lake response was to be addressed first, and then the group would look at the loads associated with that response. Trevor directed TAC members' attention to the map on page 1 of Attachment 3. Lake results will be discussed in three zones: Upper, Middle, and Lower. The map shows the subbasins draining to the upper portion of the lake above Highway 10 (upper drainage zone) in a tan color. The middle lake zone would be influenced primarily by the residual coming from the upper lake in addition to the subbasins draining directly to the midlake area (colored in green). The lower lake would be influenced by the upper and middle drainages as well as the direct lower lake drainage (shown in gold).

The first lake response reviewed was for Chlorophyll *a*. Trevor stated that the box plot results representing the three baseline scenarios (existing conditions, future buildout scenario 1 and future buildout scenario 2) indicate significant impacts to lake trophic condition would be expected if the assumed buildout scenarios occurred without additional management planning. He indicated that thresholds suggested by Jacoby and Welch (two renowned limnologists who have written their third edition of a well-respected lake management textbook) provide a basis for interpreting the impacts. They suggest median summer concentrations of 3.5 ug/L as a boundary between oligotrophic and mesotrophic conditions, and 9 ug/L as the boundary between mesotrophic and eutrophic conditions.

Next, it was explained why the graphs for chlorophyll *a* response in the lower lake zone also showed results for scenarios 1A, 1B, 2A and 2B. Scenarios 1 and 2 included among developable property about 1,580 acres in Central Arkansas Water's "Zone 1" area that includes the recently condemned Waterview Estates property and Ridges at Nowlin property, as well as some other smaller properties. Scenarios 1A and 2A rerun baseline scenarios 1 and 2 with those properties removed from development. Trevor noted that Scenarios 1 and 2 did not attempt to replicate any individual development plans for specific properties, rather they reflected the general development assumptions established throughout the watershed for the "Large Lot" and "Higher Density Near the Lake" buildout scenarios. He indicated that this was to stay consistent with the purpose of the baseline analysis of looking at impacts without management that goes beyond the minimum required. Although there is a slight decrease in impacts noted under Scenarios 1A and 2A (when compared to 1 and 2), this is largely due to the wastewater loading assumptions which Trevor noted would be discussed further later in the call.

Munsell McPhillips raised her concern about not representing the fact that the two major developments proposed in CAW's Zone 1 both have agreements and infrastructure to discharge wastewater outside of the watershed, and wanted to know why that wasn't represented that way. Trevor indicated that pumping wastewater out of the watershed involved a management decision specifically aimed at protecting water quality, but not required under current regulations. Thus, while pumping wastewater out of the watershed will be considered under the future management scenarios that are evaluated, it was not assumed for the baseline. By assuming discharge in the watershed, which is allowed by current regulations, the baseline analysis gave us more of a "worst case" response so that we can show stakeholders that it will be important to manage this source (which would not have been as clearly evident if it wasn't modeled this way).

Scenarios 1B and 2B were run to test the sensitivity of the lake response to changes in water supply withdrawal rates, increasing them from existing levels to 90 MGD. The results do indicate some sensitivity to water withdrawal rate. Increased chlorophyll *a* concentrations predicted under the higher withdrawal rate likely reflect algae in water in the mid-lake section being pulled more quickly into the intake area.

Ashley Pope wanted to know if the results are essentially indicating that urban development at these assumed buildout levels would produce very significant impacts in the lake. Trevor indicated "yes," but noted that the level of urban development is not equivalent to that of downtown Little Rock, for example. The scenarios assume higher density than current lots in the watershed, but the assumptions are not as dense as current regulations would allow.

Carl Stapleton acknowledged that these were preliminary results, but asked if trophic-related results could be broken out for the summer critical season. Tetra Tech concurred that this would provide useful information, and that it planned to provide chlorophyll *a* by summer season in the next go around of results graphics.

Munsell McPhillips asked local planners on the TAC if they were comfortable with the assumptions being made for infrastructure and construction practices for all the way to buildout since the expected time-frame was extending beyond 30 years. Ashley Pope and Carl Stapleton indicated that this was the nature of planning and that the project team needed to do the best with what it had to work with for these analyses. Kimberly Brewer added that it was typical for watershed plans to include a buildout analysis, and that often planners look at more of a worst case than what the project team assumed (i.e., worst case was tempered by input from local planners and engineers). Jim McKenzie noted that the date of buildout is relatively immaterial as the area will be depending on the lake for water supply essentially into perpetuity. He indicated that he was comfortable with the assumptions made by Tetra Tech for the purposes of the baseline study.

Trevor quickly went through the remaining lake response results. A similar pattern was noted for Secchi disk response. The substantial decreases in median Secchi depth (indicating less clarity, more turbidity) when comparing the buildout scenarios to existing conditions are primarily tied to two causes: more algae (as indicated by the chlorophyll *a* results) and nonalgal turbidity associated with nonpoint source sediment load. Trevor noted that TOC levels don't respond as dramatically as the other parameters because there is a relatively high TOC associated with a forested watershed (due to the amount of woody/carbon-based material present). However, predicted TOC concentrations are moving in the wrong direction given that current levels are bumping up against the threshold for CAW's treatment system to meet its disinfection byproducts requirements. Finally, Trevor noted that the greater than order of magnitude increases in predicted fecal coliform concentrations at the water supply intake were of concern (even though the median responses remained well below the water quality standard) because they indicate an increased risk of transport for other pathogens that don't die off as easily as fecal coliform and are more difficult to treat (*Cryptosporidium*, for example).

Carl Stapleton asked which data were used for the lake modeling calibration. Jon Butcher responded that data from 1991-1992 were used for the calibration, and that 2002 through September 2004 data were used for validation. Scenarios are compared on the longer and more recent (2002-2004) period.

Reed Green wanted clarification as to whether the upper lake zone referred to the area west of the Highway 10 causeway. He noted that this is hydrologically isolated from the rest of the lake because of the road crossing. Tetra Tech verified that this is true and that the model represents this configuration well. Dr. Butcher also clarified that, while there are more segments with water quality predictions in the lake model, three segments were picked to represent the spectrum of response (upper, middle, and intake). He also noted that model predictions in these segments could be compared to the USGS monitoring stations in the segments.

Ashley Pope wanted to know whether the plan would address existing threats. In particular, she was concerned about spills along the highway crossing. Tetra Tech indicated that for the most part existing threats were minimal (although high fecal coliform concentrations have been monitored in a couple of the smaller tributaries, and it was recommended that state and local agents follow up on these). Trevor indicated that the focus of the plan will be on new development. However, he indicated that the threat of spills will be addressed in the plan as this risk will be expected to increase in the future with increased population and traffic in the watershed.

Regarding the fecal coliform lake response notes, Bruno Kirsch said that he knew we assumed some failure of septic tanks but wanted to know whether a similar assumption was made for discharging package plants. Tetra Tech acknowledged that this was a good point. The team did assume that plants would be operating according to permit requirements, but that periodic upsets, malfunctions, or poor maintenance could result in temporary or longer periods of loading increase and this was not accounted for in the baseline.

Munsell McPhillips asked what the split was between human-associated sources of fecal load and animals/wildlife. Trevor noted that this was a good transition to the next topic, a summary of the watershed loading that produced these lake responses. The loading graphs display the portion of loads attributed to point and nonpoint sources.

### **Baseline Modeling Analysis Results – Watershed Loading**

Given the group's interest in the point/nonpoint source assumption issue, Trevor first referred TAC members to Attachment 2 to the memo, which covers the wastewater treatment and disposal assumptions for the baseline analysis. Next he referred the group to the loading graphs and tables in Attachment 3.

Phosphorus was looked at first, and Trevor noted that the vast majority of the increase in load under the future buildout scenarios was due to point sources. Dr. Butcher noted that the team was in the process of QA'ing the modeling assumptions for development loading rates and would be making some changes based on review to date (some results will go up, but the large difference between point and nonpoint source contributions will remain).

Munsell McPhillips asked why fecal coliform loading was predicted to be so much higher in the upper watershed. Tetra Tech responded that this had to do with the higher proportion of drainage area and developable land (~75 percent of total developable land in watershed) in that zone, and the greater number of failed septic tanks. Bruno Kirsh pointed out that the analyses assumed that the discharging package plant wastewater treatment facilities were meeting their disinfection requirements, which meant their contributions were estimated to be far lower than from the failing septic tanks. Tetra Tech confirmed that raw sewage would have an estimated concentration of 1 million organisms per 100 ml, whereas treated effluent was assumed to be around 200 organisms per 100 ml (the latter is considerably lower than runoff from nonpoint sources).

Carl Stapleton noted a problem with the draft Table 1 for sediment loading. Tetra Tech concurred, noting that the existing point sources line should be zeros (it appears that the baseline 1 results were mistakenly repeated in the “existing” row). This will be fixed in the next iteration.

Munsell McPhillips asked what the sources of sediment were assumed to be. Dr. Butcher responded that most were associated with erosion from land activities including developed lots and unpaved roads. Munsell then asked whether the other parameter loads were directly proportional to the sediment load. Jon responded that rates for pollutant buildup and washoff from impervious surfaces are not directly associated with solids (although both are driven by flow), but loads of sediment-associated parameters (such as phosphorus) from pervious land are directly linked to solids loads.

From a big picture perspective, Tetra Tech indicated that management of point sources will particularly help with addressing nutrients, pathogens, and TOC to a lesser degree. Management of nonpoint sources will help reduce sediment, nutrients, pathogens, and TOC.

Munsell asked if there was an easy way to take out wastewater and evaluate the impacts from nonpoint sources only. Tetra Tech indicated that, from the loading perspective, the tables and graphs allow you to see nonpoint source contributions only. However, from the lake response perspective, we would need to model that separately because the proportions of inorganic phosphorus and nitrogen in the runoff are different from that in the wastewater discharges (i.e., the lake response is not linear), and the additional flow from wastewater discharges also influences results.

Ashley asked which loads are most important to focus on. Tetra Tech re-emphasized managing phosphorus. Under the current baseline assumptions, the phosphorus loading increase is so high that it drives the lake to a co-limiting state with nitrogen and maximizes algal growth. Phosphorus is directly correlated to chlorophyll *a*, the indicator for algae response. It is also related to the growth of organic material (so there is some impact on TOC) and Secchi depth response (due to algal turbidity). TOC is important for meeting disinfection byproduct requirements in the water supply operations. Sediment is important for its impacts on turbidity (of greatest concern for impact on water supply operations and subsequently risk to public health). Pathogens are of importance because of the risk to human health.

Bruno emphasized CAW’s concern for TOC because of the issue of disinfection byproducts. Trevor asked how sensitive the water plant operations were to the relatively small changes being predicted (for example, is the change from 3.2 mg/L to 3.6 mg/L significant in meeting the disinfection byproducts requirements). Bruno agreed to follow up with his operational staff to examine this issue further.

Dick Cassatt asked about some of the wastewater assumptions. He thought that TOC should generally be higher than the BOD concentrations in the effluent. Tetra Tech agreed to check the basis for those assumptions further and report back to the group. Tetra Tech also indicated that for the upcoming management scenarios, decisions on how wastewater should be handled and corresponding modeling assumptions would be very important to the outcome. Therefore, Tetra Tech would like to establish a work group of ADEQ and ADH staff to establish the appropriate assumptions for wastewater. Dick agreed to have his staff participate, and Bruno agreed to help bring the appropriate ADH staff together for this purpose.

### **Proposed Inlake Targets**

Trevor turned the TAC’s attention toward discussion of inlake targets. For chlorophyll *a*, Tetra Tech recommended using the research of Welch and Jacoby (2004, *Pollutant Effects in Freshwater*) and Walker (1985, *Lake and Reservoir Management*). They specify a summer median of 3.5 µg/L chlorophyll-*a* as the boundary between oligotrophy and mesotrophy, and 9 µg/L as the boundary between mesotrophy and eutrophy. The USEPA has also established ecoregional criteria: 2.79 µg/L for Ouachita lakes and 4.93 µg/L for Arkansas Valley lakes. Trevor indicated that the challenge for Lake Maumelle is that it falls somewhere in the middle because the drainage area reflects the Ouachita ecoregion, but the lake

itself is in the Arkansas Valley ecoregion. The lake's current conditions are in between the criteria for the two regions.

Trevor reminded the group that targets should also consider spatial location (where within the lake and where within the water column) and temporal basis (annual vs. seasonal). Tetra Tech proposed a midlake target of 3.5 µg/L chlorophyll *a* based on the boundary between oligotrophy and mesotrophy, and a lower lake target of 3.0 to 3.5 µg/L to provide for a bit of a safety factor – both as summer median concentrations.

Munsell McPhillips indicated that this seemed to be a reasonable approach. Bruno Kirsch agreed. The group endorsed moving forward with these proposed values.

For TOC, Tetra Tech recommends a level for the lower lake that allows CAW to meet its requirement of 2 mg/L in the finished water. It is not yet clear what that level is; per his earlier commitment, Bruno will be looking at the plant operations and work with Tetra Tech to establish a recommended threshold for the operations.

For Secchi depth, Trevor indicated that the USEPA ecoregional criteria for the Ouachita and Arkansas Valley lakes cover quite a spread (2.86 m to 1.53 m, respectively). Again, current monitoring data show the lake to be in between these criteria. TAC members felt that the turbidity factor was the biggest issue regarding the goals and objectives, so that target development should focus on what's necessary to protect plant operations and human health. Bruno indicated that they would examine turbidity impacts on plant operations in addition to the TOC review. He agreed to get back to Tetra Tech with whatever information they had available.

For fecal coliform, Tetra Tech indicated that the only direct regulatory target was the Arkansas regulations which have a geometric mean of 200 col/100 ml for primary contact. Since swimming and full body contact is not allowed in Lake Maumelle, the standard isn't that applicable. Also, concentrations predicted at the water supply intake area are only a fraction of this level due to the die-off in the lake because of longer residence time. However, Tetra Tech believes that the fecal coliform concentration can be used as a surrogate for risk for other pathogens with lower die-off rates (e.g., Giardia and Cryptosporidium). Bruno asked whether it could be a direct indicator for other pathogens?

Dr. Butcher indicated that is best used as a relative indicator. Tetra Tech agreed to consider this further and to bring refined ideas back at the next call.

### **Next Steps**

Trevor reminded members that another call was scheduled for March 7 at 10 a.m. EST to continue discussion of the baseline results and targets, and to begin discussing preliminary ideas for management scenarios to test.

Tetra Tech thanked the Council members for their participation, and the call was adjourned.

# Technical Advisory Council Member Attendance

Meeting Date: March 2, 2006

(P indicates present; NP indicates not present)

## MEMBER NAME

## REPRESENTING

<u>NP</u>	Brazil, Ken	ARKANSAS NATURAL RESOURCES COMMISSION
<u>P</u>	Cassart, Dick	ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY
<u>P</u>	Clingenpeel, Alan	U.S. FOREST SERVICE
<u>P</u>	Cranmer, Morris	UNIVERSITY OF ARKANSAS FOR MEDICAL SCIENCES
<u>P</u>	Green, Reed	U.S. GEOLOGICAL SURVEY
<u>P</u>	Hymel, Stephanie	AUDUBON ARKANSAS
<u>P</u>	Kirsch, Bruno	CENTRAL ARKANSAS WATER
<u>NP</u>	Malone, Walter	LITTLE ROCK DEPARTMENT OF PLANNING & DEVELOPMENT
<u>P</u>	Mckenzie, Jim	METROPLAN COUNCIL OF LOCAL GOVERNMENTS
<u>P</u>	McPhillips, Munsell	DEL TIC TIMBER CORPORATION
<u>NP</u>	Miller, Roger	ARKANSAS DEPARTMENT OF HEALTH
<u>P</u>	Pope, Ashley	PULASKI COUNTY DEPARTMENT PLANNING & DEVELOPMENT
<u>NP</u>	Shannon, John	ARKANSAS FORESTRY COMMISSION
<u>P</u>	Stapleton, Carl	UNIVERSITY OF ARKANSAS AT LITTLE ROCK, ENVIRONMENTAL HEALTH SCIENCES

## Others Present

Brewer, Kimberly	TETRA TECH, INC.
Butcher, Jon	TETRA TECH, INC.
Clements, Trevor	TETRA TECH, INC.
Dicker, Herb	POLICY ADVISORY COUNCIL MEMBER
Dicker, Pat	POLICY ADVISORY COUNCIL MEMBER
Nestrud, Chuck	POLICY ADVISORY COUNCIL MEMBER