UORB Lakes HSPF Model and Report: Remaining Questions and Issues

per Workshop I (2/3/16 – 2/4/16) and Sensitivity Analysis Teleconference (5/12/16)

General Comments/Issues:

1. Need better documentation
    a. When describing methods (more citations)
    b. When making assumptions
2. Need more detail
    a. Water balance/budget
    b. More summary tables throughout (e.g., with variables and explanations)
3. Need to address uncertainty (SJRWMD requests more specific guidance from panel)
    a. Effect of uncertainty on model results
    b. Effect of model uncertainty on MFLs results
    c. Include discussion of adaptive management

Specific Comments/Issues from Workshop I:

1. Include table of DCIA used in this model, versus other efforts by the District.
2. How sensitive are model results to DCIA?
3. Has other land use been considered? It is ideal to change land use in the model, but it is very difficult to achieve.
4. Specify hydrologic data source.
5. How were non-contributing areas delineated and identified?
6. For non-contributing area: how much does it contribute to baseflow?
7. Document data source for basin delineations.
8. Explain use of rain gages. Were others looked at and if so explain why not used.
9. Compare NEXRAD to rain gage data. How representative are the data used?
10. Show residuals of composite rainfall data. Justify why there is a seamless transition.
11. What assumptions are made using pre-1991 mean spring flow data?
12. Bathymeteric data: is Δ L constant over time? Need to document assumptions.

13. How has bathymetry changed over time?
14. To what extent does groundwater model result variability affect sw model results?
15. To which variables is the model most sensitive? (to be addressed with sensitivity analysis)
16. Beef up documentation regarding rainfall/ET disagregation from daily to hourly data
17. Need water budget for each land use type; Evaluate ET for each land use relative to each other, as a check if reasonable.
18. Daily data should be evaluated with Nash-Sutcliff efficiency test instead of monthly data
19. Need explanation of how the model is being used. (to be addressed with Application Report)
20. How does model uncertainty influence MFLs assessment?
21. Need better explanation of data manipulation (reasons, methods, citations).
22. Explain why one method was chosen over another.
23. Listing all input data in tables will help
24. How to relate model result to transects?
25. Plot residuals for various tests used.
26. Figure 56: change X-axis; begin at year 0
27. Better explanation needed for “existing condition” (aka baseline)
28. Compare 48 year simulated POR with long-term rainfall data. Does the model capture the range of variability in the long-term rainfall?
29. Color-code regression graphs showing observed vs simulated levels, to better explain reason for data spread.
30. Explain any potential bias in results (e.g., why are 80% of Lake Eustis data an overestimate?)
31. Perform sensitivity analysis
32. Water budget needs more documentation: stand alone water budget; can we defend as based on most appropriate data?
33. What is the effect of water level on total phosphorus in Lake Apopka?
34. Should City of Apopka permit be used in the baseline model?

Specific Comments/Issues from Sensitivity Analysis Teleconference:

1. What is the significance (to the MFL, compliance, water use) of the differential sensitivity of the model to drought versus high-water conditions?

2. Is there an issue with the fact that the model is relatively much more sensitive to rainfall?

    a. Do we need to use more/different rainfall stations?

3. Need to incorporate the assumptions and conclusions of the Sensitivity Analysis into the Calibration Report.

4. Does the fact that the model is sensitive to rainfall mean anything significant for other parameters in the model? E.g., does pot surface respond to changes in rainfall?

5. Sensitivity analysis does not address model performance (accuracy?), but may indicate areas/parameters for which we need further calibration (is this true??). If so, is further calibration necessary?

6. Model response is very conditional with respect to initial condition. +/- 10% may not be a large change for some parameters. If that is the case, we could incorrectly conclude that the model is not sensitive to some parameters; this may not be true.

7. Regarding the response to rainfall (Figure 16 of Sensitivity Analysis), why is there a slow recovery of the Rain -10% graph in 2004?

8. Explain more fully the cumulative effect of year after year of lower rainfall.

9. Does the result for rainfall indicate that there is too much uncertainty in the rainfall data? Do we need different (or better) rainfall data?

10. Is the model calibration as good in wet years as in drought?

11. We need to incorporate in the calibration report a discussion of uncertainty in model performance during drought.

12. In the discussion mentioned above, include graphs of Predicted vs Observed residuals versus rainfall, and versus time.

13. OUC comment/question #1: We would like to see a more detailed schematic of the NSRA and Marsh Flow way, and how they are managed relative to inflows from and outflows to Lake Apopka.

14. OUC comment/question #2: Why was only a -1 ft scenario modeled for the NSRA pump schedule parameter (i.e., why not a +1 ft scenario too)?

15. Need big-picture discussion about the effect of uncertainty in the model on MFLs.

    a. How to address?

b. Acknowledgement of uncertainties and range of confidence in output data?

c. Adaptive management for MFLs?

16. Questions from Friends of Lake Apopka (comments by Jim Hawley):

Lake Apopka MFL - Questions on Sensitivity Analysis.
Sensitivity analysis, general questions

1. Using the 12 year calibration time to judge the impact of sensitivity changes over the 48 years might miss important affects on Lake water levels. Why were the sensitivity tests not run over 48 years?
2. The sensitivity analysis used the baseline data. Would using the observed data give a clearer picture of how changing the parameters can affect Lake water levels?
Sensitivity analysis, for Lake Apopka

3. Did the UFA POT surface analysis adjusts for expected Apopka spring flow or was it maintain at LAUORB calibration levels? If not, should it then adjusted to account for the UFA changes?

4. Did the rainfall changes of 10% include adjustment for expected surface runoff?

5. I do not understand how the like Apopka rating curves compared to the actual discharges which occurred at the dam/NURF. Lake Apopka has been experiencing outflows when it is below its regulation schedule and even when it is below its "minimum desirable elevation". This occurs because the downstream lakes demand a minimum flow, which is roughly equal to the flow from the Apopka spring. FOLA beliefs this practice should be stopped in order to help restore Lake Apopka to 55 ppb of TP concentration. Does the model or sensitivity test include a "minimum outflow" for Lake Apopka in their analysis?

6. The NSRA pump schedule sensitivity study varied the pump output on the 6700 acre Zellwood property. It did not include pump schedules for the 3000 acre Duda property, or for the 5300 acres on the west side of the A/B canal. The baseline curve shown in figure 26 has a lower Lake Apopka stage that the calibration baseline. The observed data shows even a larger difference, particularly during 2003 and 2004. During those years the observed results show water levels in Lake Apopka which are significantly higher, about 2 feet 2003 and 0.5 feet in 2004.
In the sensitivity tests for the NSRA area a baseline value of 5.7 CFS was used. This low rate does not seem to be consistent with the pump rates which were used during the calibration of 1995-2006. My data from the District shows that during this time the discharges on the east side of the A/B canal averaged over 18 CFS. How was the 5.7 CFS obtained? What are the water budget assumptions which support this discharge rate? What are the discharge rates expected from the Duda property and the property on the west side of the A/B canal?

Comments on the Report
1. The report states that discharges made from the Duda property and NSRA areas will occur "when need" (page 90). These types of discharges do nothing to establish an MFL for Lake Apopka that is consistent with restoring the Lake TP to 55 ppb. These "when needed discharges" will likely happen when the areas are overfilled and experience a large storm during the summer hurricane season. At that time it is likely that Lake Apopka also will need to discharge. The 15,000 acres of North Shore all used pumps to control their water levels. These areas also can tolerate a wide range of water levels. We know that Lake Apopka has lower TP when the Lake is maintained at higher water levels. Hence, when large amounts of water are discharged they

cannot be reclaimed to increase the Lake Apopka stage. FOLA believes that the North Shore areas should be used in a manner which is consistent with restoring the goal of 55 ppb.

2. In figure 55 of the report the pump which is labeled "Drains to Lake Apopka" actually discharges to the A/B canal and if the NURF is operating or the dam is open the water will flow to Lake Beauclair. Since this water has been alum treated we believe it should be returned to Lake Apopka

3. The nutrient removal facility (NURF) should be shown on figure 2 of the report and described as having its inflow from the A/B canal and its outflow on the downstream side of the dam.

17. Comments and questions from Edward McDonald:

Thank you very much for keeping me updated with regards to what the SJRWMD is doing in regards to minimum flow and levels. I see that, based on your attached schedule, the next activity involves the "calibration" of the new model. In general, I think that models are an important tool to help us understand the physical world, but that being said, I don't necessarily believe that they are all that good. Is it fair to say that calibration of a model is a way to correct the input data when there is insufficient or questionable real world data? In other words, the more the model must be "calibrated" the less accurate the original input data and therefore the results of the model become more uncertain. I also have concerns about the time frame used to "calibrate" a model. Would it be accurate to say that unless a model can accurately predict all reliable, real world data then the model is not a true representation of real world conditions? A model that is "manipulated" (calibrated) (forced) to "accurately" model a limited data set must not be used for conditions that are not represented within the data set. In other words, to use a model to predict responses (output) based on input data that falls outside of the data used for calibration would be highly suspect. A model that required "calibration" could not be reliably used to perform "what-if" scenarios.

Modeling work is important, but it is just as important to understand the limitations and uncertainties of the models. Models are only one tool out of many that are available to water managers.

18. Comments and questions from Linda Bystrak:

Thank you for the teleconference information. Unfortunately I will not be available for that time period. Therefore I ask that my comment here be added to the official record on this subject. On p. 78 there is an explanation of the "calibration period" which is 1995- 2006. That period of time was over a decade ago, and too much has happened to the lake levels and the surrounding watershed in that 10 year time period to be a valid time span for this study.

In your explanation you mention the necessity of having a high and low period, and you cite the 1998 El Nino as a the high, peak event, but no mention is made of the 3 hurricanes in 2004, which would have also been a high during that "calibration period". It would have even been higher if you had not opened all the dams days before the 3 storms arrived in anticipation of the excess water. (Was the volume released added into the computer model?) Then you cite the 1999-2002 period as the low, drought period, but no mention is made about the more recent 2010-2012 drought which is not within the "calibration period". Therefore you have 2 highs and only one low. Why don't you at least shift the "calibration period" from 1998 to 2012 to accommodate two highs and two lows? This shift would also include more of the changes that have occurred in the watershed since 2009.

Also of concern, is the large volume of reclaim water added to the watershed from Conserve II, originating from Reedy Creek-Disney, included in the calculations for this MFL? I have been told that some of that water is entering Lake Apopka thru Gourd Neck (Apopka) springs. Also, is the amount of the CUP for Spring of Life water company, which is pumping/selling water for Niagara bottled water, from that same spring, being considered?