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To: St. Johns River Water Management District

From: Lee Wilson, Ph.D.

Date: March 20, 2009

Re: Minimum Levels Reevaluation, Indian Lake, Volusia County, Florida

SJRWMD tasked me to review scientific and technical data, methodologies and assumptions related to MFLs development for lakes that include Indian Lake. The Indian Lake report was authored by Jane Mace who used the SJRWMD standard methodology, which emphasizes relationships between plant communities, topography, soils and hydrology. My review considers overall methodology, the data, methods and assumptions used by the author, the resulting recommended MFLs, and the overall organization and presentation of the report. I begin with comments that apply to all the reports reviewed, and conclude with comments specific to the Indian Lake report.

Primary comments

1. As I have stated before, it is my opinion that the SJRWMD MFL program is scientifically sound and at the forefront of the application of ecological principles to protection of instream flows. The six lake reports are professionally done and in conformance to the District's MFL guidance.

2. The fact that my comments are critical of certain aspects of the reports is a reflection of my assignment, which is to identify issues and find possible problems, and should be read in that spirit. Many of the comments are at the nit-picking level and others are aimed more at suggesting improvements to future reports rather than changes that need to be made in these drafts. Many comments reflect the fact that different authors addressed a given issue in different ways, which may not matter. Put another way, I don't expect all comments to be responded to.
3. There are two areas of substantive comments that I do need think to be addressed. One is that these reports all deal with sandhill lakes where hydrology is not as straightforward as SJR floodplains and lakes, but extremely important to how the MFLs were approached. Each report would benefit from an extended discussion of hydrology and its relation to soils and vegetation (see detailed comments below). Moreover, based on our field visits I expected similarities in MFL approach and results. However, the reports differ in this regard as much or more as they are similar. Each author needs to stand back and feel comfortable that his/her results are consistent with the sandhill lake literature.
4. The second substantive area is that the MFLs, and especially the FH, recommend a fairly large increase in "permanent drought" hydrology. I didn't find the justifications for this to be sufficiently rigorous or entirely satisfactory. Again, there is more detail below.

#### Organization and level of detail in MFL reports

5. From this and other reports reviewed in the same timeframe, it appears that SJRWMD has gone a long way toward settling on a consistent outline for its MFL reports, but is not yet quite to the point of complete consistency. I encourage the District's continued efforts toward settling on a "best" organization.
6. One specific example where organization is not consistent is that in the section called "General Information" or "Background Information" (neither one a great title), wetlands are sometimes presented before soils, sometimes after. As the soils are the foundation, but dependent on hydrology, I suggest soils go before wetlands.
7. Some reports provide a lot of detail on published soils maps and descriptions; others ignore this almost entirely. Since MFLs are based on field soils data, cutting out the details in this background section would help shorten some reports. A citation to the published soils survey, a map and perhaps a table would provide good routine content; or just the citation.
8. Land use maps are in some reports and probably should be in all.
9. Sylvan has a section on morphometry which was helpful, and I suggest something similar be in all future reports.
10. There is quite a variation in Executive Summary content, detail and organization. It might be useful to develop a standard template that ensures that the essential information, and

nothing more, appears at the beginning of the report. If there is already guidance to this effect, then please consider how best to ensure the guidance is followed in future reports.

11. The Executive Summaries differ most dramatically in that some have extended discussions of each MFL, others simply contain the summary table. I think one paragraph on each MFL, plus the table, is about right.
12. Another difference in the Executive Summaries is that some discuss methodologies (including SWIDs) and/or the hydrologic model; others don't really do much with that; and those that do have such discussions say different things. I think at least one somewhat consistent paragraph on the method and on the hydrologic compliance analysis is worth having, though it isn't essential in the current drafts.
13. Two statements appear in some reports and probably should be in all. One is the "intended to support" (e.g. Avalon) paragraph and the other is the "not effective until" and "reassessment" text (e.g. Johns).
14. Of all the Executive Summaries, I thought Sylvan came closest to having the necessary material without too much else. I suggest it be reworked per specific comments and shared as an example for others to at least consider in future reports.
15. There are report sections that are effectively boilerplate, such as the description of the MFL program, but the language still varies a bit from report to report. Making this true boilerplate, where each author copies from a master, is probably advisable for future reports.
16. All the reports have a location map early on (except Indian Lake). But they are too large in scale to allow most folks to know exactly where the lake is. I recommend a more regional location map. This is something for consideration in future reports, though it wouldn't hurt if it could be addressed now.
17. Note that many of the color graphics are hard to read when printed or copied in black and white. Something to keep in mind as future graphics are prepared.

#### Ways to synthesize the methods and results

18. The next comments all relate to the fact that the reports use a large amount of verbiage to describe various aspects of MFLs in general and the MFLs of each particular lake. For future reports, the more this information could be captured in text tables, and the text shortened, the better. By text table I mean something that is used where the same kinds of things are said repeatedly about different subjects -- in this case, for example, the text on each different MFL has the same pattern and is well suited for a table.
19. Three examples of text tables could be: what each MFL level is intended to protect and what they typically represent as to frequency and duration; the field transect results (all

transects on one table); how the MFLs relate to observed vegetation, observed soils and modeled hydrology.

#### The ten factors

20. It is not clear how the District intends to address the 10 factors. In these reports they are typically noted as part of the introduction and there is an expanded listing a bit later. But there is no standalone section that then discusses the role of the factors in setting MFLs, or the effect of the MFLs on the factors. At most there are mentions of individual factors somewhere in the body of the report. In other words, the factors are highlighted, but their application is buried. I suggest there be a section on the factors “as applied” near the end of each MFL report. This would state whatever is to be stated on this subject, even if it was judged that none of the factors required any in-depth study. This would be useful in the existing reports as well as future ones.

### Hydrology

21. The essence of MFLs is the relationship between hydrology and soils/vegetation. Indeed MFLs are as much about hydrology as anything else. The reports present some information on hydrology (mostly stage data) without any analysis. I suggest there is a need to do more, and in particular to demonstrate an understanding of essential hydrologic relationships for each lake as a predicate for defending each MFL determination.
22. Specifically, each report should explain what it is that controls the hydrology (that then controls the ecology), and how the controls may have changed (or not changed) over time. For these lakes that discussion will consider runoff, surface precipitation/evaporation, outlets, and seepage. Since there are model reports for each lake, it might be possible to cut and paste at least some of this in-depth hydrology into the existing reports.
23. I understand most if not all the lakes are sandhill lakes. The characteristics of sandhill lakes receive extensive attention in some reports (e.g. Avalon, see pp. 19-21) and are barely mentioned in others (Indian Lake). The fact of sandhill lakes is justified as a reason for no MA in some lakes, making it unclear why MA is defined in others.
24. An issue that reflects sandhill lake hydrology is that one might expect the exceedence graphs to be similar and to not show the mean as representing a particularly common condition, i.e. (per CH2M-Hill 2005) “because they appear to lack a mean around which the system is organized”, and this is used to justify no MA. In fact, several of the hydrographs suggest that conditions near the mean are common enough that they would impact vegetation but there is no MA (example Johns Lake) while others show the mean to be just another number in a highly variable system, but there is an MA (example Indian Lake).
25. Suggest putting the MFLs on the curves showing stage history (as done for Hiawassee).

### Compliance

26. One particularly important aspect of hydrology is the compliance analysis. The use of MFLs to impose pumping limits creates impacts on the regulated community and offers opportunity for controversy and legal challenge. Therefore I think it is particularly important that the compliance analysis be as transparent as it can be. Rather than rewrite the compliance appendices, I suggest an expanded discussion in the text.
27. One specific element in this discussion would to summarize the causality relationships determined in the hydrologic model and in particular to present something that shows that aquifer levels predict lake levels.
28. Only Indian Lake contains a statement as to the result of the compliance analysis. I recommend the aquifer drawdown limit be stated explicitly, with whatever caveats are needed. It should be clear that the value is a limit on the long-term average, i.e. it doesn't mean that the hydrograph can't decline more than the indicated level during droughts.

29. The compliance analysis appears to assume constancy in other controls of lake levels, when the available information does not make that a certainty. Is this covered by the “reassessment” language?
30. The bottom line results of the compliance analysis should be given a higher profile in the report, show up in the Table of Contents, and be stated in the Executive Summary. It might properly be the last item in the main body of the report.

### SWIDS

31. I’m not sure I understand how the District uses SWIDs. In some reports (Johns) it looks like a SWIDs graph was used to determine an appropriate duration-frequency and the MFL selected accordingly. In others the MFL was determined by vegetation and “supported” by the SWIDs.
32. Whichever way, there seems to be a pattern in which it is considered appropriate for the MFL to allow future conditions to be in the “dry” part of a SWIDs. This is necessary for there to be allowable drawdowns, and I recall it reflects some prior peer review suggestions. Somewhere the approach needs to have rigorous justification and in particular the existing “dry” SWIDs need to be for healthy communities where the hydrology is comparable to the lake being assessed..
33. The shrub swamp SWIDs in Johns Lake and Prevatt are different.
34. The Sylvan Lake report shows the effects of the proposed MFL compared to existing conditions on each SWIDs graph. I thought this was excellent and recommend it be used universally.

### Soils and vegetation sampling

35. For some lakes, sandhill lake stage indicators were evaluated, but this was not done at all lakes. Will the District be able to defend the absence of this approach in some reports?
36. The discussions of sandhill lake indicators make it sound like these were used as the basis of the MFLs, but when the MFLs are actually presented, they are based on vegetation, with soils observations “supporting” the MFL determination. Perhaps there could be a clarifying sentence or two when the soil indicators are introduced that makes their role in the process more clear.
37. The soils sampling sections should probably all either have a “we looked for these indicators” description (Avalon is an example where this is done).
38. Some reports discuss calculations of TWSV, others don’t. For those that do, it may help to indicate why this was done and how the results were used. For the others, perhaps the file needs to have a note as to why.

39. For the vegetation sampling in particular, it seems as though there should be a standard methods reference that could be cited, so that the report could focus on the transect results.

MFLs

40. I will repeat here my general concern that the MFLs seem to reflect a basic assumption that each and every ecosystem can sustained even if it receives substantially less inundation. Is this supportable?
41. Each report contains (usually as Figure 1) a “Hypothetical percentage exceedence curve”. I strongly recommend that a “real” curve be developed which compares the existing versus MFL defined condition for each lake. This should be done for the current drafts.
42. The FH indicators vary considerably between the lakes - two shrub swamps, two wet prairies, one hardwood swamp, one transitional swamp. For future reports it might be of value to cite local edaphic or other factors that explain why a particular community is found at the dry end of transects on a particular lake.
43. The return interval for the 30-day duration MFH ranges from 2 to 5 years. This seems like a large variation and the 5 year return (Sylvan) seems especially long.
44. The changes in terms of percentage of years when the 30-day level will be reached also seem large - for Sylvan the frequency is cut in half, and for most others the change is one-third.
45. I would judge the wet prairie analysis (Avalon, Hiawasee) is about as far as the District should go in using SWIDs to justify increased withdrawals.
46. See comment on astatic nature of sandhill lakes with respect to the MA MFL.
47. The return interval for the 120-day duration MFL ranges from 3 to 5 years. This seems like a large variation.

Comments specific to Indian Lake report

48. This is the only title page where the report is assigned a complete number. The dates may need to be changed.
49. The Indian Lake Executive Summary is longer than most and contains much material not found in other MFL reports. Specifically, other reports typically don't have the 2<sup>nd</sup> and 3<sup>rd</sup> paragraphs; don't provide such an extended discussion of the individual MFLs; and don't have a conclusions and recommendations section. I do think the MFL discussions belong, but the others could be omitted.
50. This Executive Summary doesn't have the standard final paragraph on “not effective until” and “reassessment”. It also would benefit from the “intended to support” paragraph.
51. Appendices should have names and these should be included in the Table of Contents.

52. Page 1. To be consistent other reports, standard language on the intent of MFLs should be included either in the first paragraph (where other reports have it) or in the program overview (which may make more sense).
53. Recommend a location map be included.
54. P. 4. Type glitch in figure title: “exceedence”.
55. P. 5. If other reports are a guide, the section on methodology is out of place and should come after the background information on the lake. Also, other reports use the headings “Methods” and the sub-heading “Field Transect Site Selection”.
56. P. 9. Possibly connect the dots on the stage graph.
57. P. 10. This is the only report that didn’t have a section on SWIDs.
58. P. 13. This graph doesn’t look “astatic”.
59. P. 15. Other reports have more info. on the lake itself at the beginning of the General Info. section.
60. P. 17. Bayhead vegetation is discussed at length in the report and is interpreted as depending more on ground water seepage than lake inundation for its wetland characteristics, hence it was not considered in setting the MFLs. The literature cited seemed somewhat generic and the discussion of hydrology somewhat speculative. It would be useful to state any hard evidence that the exclusion of bayhead vegetation from the MFL assessment is appropriate at this specific lake, especially since the transect shows this community to occur at something pretty close to the FH (see Figure 9) and the plant community is fairly similar to hardwood swamp.
61. P. 18. Figure 18 shows a stage curve that is very different than the other lakes. In particular, the classic seepage decline relationship is not seen. From the hydro. report this appears to reflect aquifer conditions, and probably deserves a comment in the text.
62. P. 19. In the text (p. 17), Figure 5 is described as if it is based on data, but the Figure itself refers to simulations. This curve is quite different from most of the sand hill lakes, with almost no flattening in the middle. See general comments regarding MA.
63. The wetlands graphic (Figure 6) needs to be supported by at least some brief descriptions of the mapped communities, rather than deferring all discussion to the results section. This would be consistent with other reports.
64. This is the only one of the MFL reports in this cycle that did not discuss SWIDS.
65. P. 31-32. These figures would benefit from some additional annotation or text discussion. shows shallow marsh extent.
66. P. 52. The other reports are more generic in discussing ML determination -- in particular discussions of specific FH, MA and FL criteria and determinations are in the discussion of the recommended MFLs.

67. The text that begins on p. 52 is an example where much of the narrative could be captured in one or two tables. One table would set out the essential generic hydrology and soils for each level. The second table (or the right side of a single table) would be the site-specific findings for each level.
68. P. 54-55. The FH goes from once per 2 to once per 3 years, which seems a sufficiently big change that some discussion is needed.
69. P. 55. While rainfall expected once per 2 years is commonly considered “normal”, I’m not sure once in 3 years is.
70. P. 59. Where soil surveys are simply being quoted, some type of special formatting is suggested.
71. P. 64. The CDM reference makes it sound like there is a competing MFL report.
72. Appendix B does not add value. It belongs in a methods manual.
73. Is it correct that Figure C11 indicates that the selection of the minimum average has no margin of safety? Is the analysis accurate enough for this to be a comfortable determination?