Silver Springs MFL, Marion County
Peer Review Resolution Document for Comments from Lee Wilson and Associates, Inc. (LWA)
03/08/17

See attached for Peer Review document. Below are comments from the peer review document and District responses.

Primary Comments

Comment	Resolution
1. I strongly recommend that early on in the report there be an explanation of why a conventional MFLs analysis is appropriate for a system that is not behaving conventionally. This explanation can be set out as follows. • Under current conditions (elevated nitrate concentrations, extensive vegetative growth, and suppression of spring flows), there is no possibility of the proposed MFL flows occurring at the historic duration and frequency. Rather, if and when a particular MFL flow now occurs, the consequent stage will be significantly higher than the stage used to evaluate the effects of the MFL. • The current condition is not representative of future conditions. Once the nutrient problem is resolved, future conditions can reasonably be expected to be similar to those observed before year 2000. [Note, I don't actually believe this given climate change and the like, but it is in fact the proper assumption as the MFL program is now implemented.] • SJRWMD must manage its consumptive use permits in anticipation of the future return to the historic MFLs regime. Consequently, the MFLs analysis must be	We agree, in part. We agree that the report should explicitly explain the context of the MFL. This explanation will include clarifying that the MFL is based on an assumption that the hydrological regime for the spring and river since 2000 is not a new permanent state, but rather part of a cycle, and that the system will return to conditions seen in pre-2000 if it experiences climatic factors present before 2000. Evidence suggests that the primary factors driving the post-2000 low flows are related directly and indirectly to climate, and also exacerbated by high nutrient concentrations. The primary causes of declining flow since 2000 are as follows: ▪ 112" deficit rainfall since 1970; ▪ SAV growth in the lower section of Silver and Ocklawaha Rivers, caused by ▪ Prolonged deficit rainfall, leading to a lack of

Comment	Resolution
based on ecological conditions established under that regime.	backwater/dark water from the Ocklawaha; ▪ A lack of high-scour events from Silver; ▪ High nutrients ▪ Flow suppression/ gw mounding due to SAV growth in Silver and Ocklawaha Rivers. The supposition that groundwater suppression/mounding is causing declining flows at Silver Springs is supported by: ▪ Increasing spring boil water levels since 2000 ▪ Increasing or stable gw well levels near Silver Springs since 2000 ▪ HEC-RAS and EFDC studies demonstrating the effects of increased channel roughness on flow velocities The cause and effect relationship between ▪ **low rainfall** → ▪ low flow → ▪ increased SAV → ▪ rising river stage and → ▪ and **spring flow suppression** was seen in 2011 and 2012 in the Ocklawaha River, just downstream of the confluence with the Silver River. *Hydrilla* proliferated during low rainfall, low stage causing increasing stage and declining Q. When high rain events scoured out the

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	SAV, this resulted in quickly falling stage and concomitant increasing discharge. Setting the POR to post-2000 would also be premature because we don't know the relative contribution of eutrophication vs climate for the post-2000 regime. This would make more water available, and would cause harm if/when SAV are removed by floods and dark water, causing river stages to drop. Also, setting MFL as if post-2000 regime is a new permanent state (due to nutrients) also implicitly assumes that FDEP's TMDL program, and other nutrient load reduction efforts will not work. These points have been added to and/or clarified in the text.

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2. The current hydrologic regime is presumably impacting the stream and especially the floodplain through prolonged high stages. The report hints that this is causing ecological stress, but doesn't tackle it head on. If no problems are evident from nearly decades of stages above the MFLs, it may be difficult to defend the ecological benefits of the MFLs now proposed. Demonstrating at least some degree of harm from non-MFL conditions (or explaining why it is too early to see such problems) seems important.	We agree. While flows have been reduced since 2000, likely due primarily to flow suppression and drought, stages have increased to the point that we believe the floodplain swamps may be too wet (flooded for too long). We believe this is primarily due to an increase in the abundance and areal extent of the native SAV beds (*Sagittaria* and *Vallisneria*) below the USGS 02239501 gaging station and the increase in the invasive exotic, *Hydrilla*, in the river channel downstream of MFLs transect number 3. The result may be a negative impact on the recruitment of native floodplain tree species. This has been added to the text.
3. This report reinforces my advice that the District begin to address non-stationarity in its MFLs program, including how future climates and other conditions may impact this watershed. It may be this should be done outside any particular MFLs report.	We agree that non-stationary is something we should address. However, it is not easy to address non-stationary in a world of uncertainty. There are a lot of uncertainties in predicting future climates. MFLs have their own uncertainties. We believe introducing future climate uncertainties into MFL development process would make things more complicated. Because of this, we believe that a better approach is to implement an adaptive management strategy which is discussed in the technical approach section of the report in detail. In summary, we will perform a screening level analysis incorporating change in rainfall trend and uncertainty to monitor the status of the adopted MFL. We believe that adaptive management strategy would help us better monitor the status of the adopted MFL and detect any potential issues at an early

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	stage due to uncertainties in setting the MFLs. In addition, we are also planning to fully reevaluate the MFL in ten years. Furthermore, we should also keep in mind that the purpose of MFLs is to prevent any further withdrawals from being significantly harmful to the water resources. Therefore, addressing any potential impact on the system due to the possible change in climate is not part of MFL program.

Specific Comments

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4. I have previously commented on a prior draft of this report. Many of those comments have led to changes in the report; others were addressed in responses to comments. As a result, while my review of the new report has been thorough, and I reviewed how my previous comments were responded to, the resulting comments here are considerably abbreviated.	Noted.
5. I appreciate that this report has aspects of a rough draft. I've not made comments on matters that I expect will get addressed during SJRWMD's editorial review (e.g. pagination glitch in the early pages).	Noted. Copy editing was not complete at time of review; pagination etc will be addressed in final version.
6. I assume the prior report was never made available for public review. If so (and even if not) you may want to explain how it came to be that the prior report found the need for a recovery plan, whereas the current one identifies the need for a prevention strategy.	An earlier version of the report was made available through public records requests. The earlier draft did not show Silver Springs in Recovery, but in Prevention. The current version also shows Silver Springs in Prevention.

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7. I suggest that references to the recommended MFLs should use words like "at least" or "no more than".	We agree and these have been added.
8. In Table ES-1, the column "level" seems to actually set out "flow", with values in cfs, not ft NAVD/NGVD.	We have corrected this mistake.
9. Table of Contents should list the individual appendices.	We have added these to the TOC.
10. I need to understand how nitrogen loading has increased 11 fold but nitrogen concentration have less than tripled, even with a decrease in flow. I assume the difference is vegetative uptake, but it would be good to say that and to otherwise account for the fate of the N inputs.	The N loading in Munch et al. (2006) is the estimated total annual loading to the land surface within the Two-year capture zone (Table 7-1 in Munch et. al 2006). It is not the loading at the spring boil. The majority of N is likely assimilated/transformed during transport processes within the capture zone. The relationship between watershed loading and concentration in the spring is not 1 to 1 and likely is not linear either. The key point is that the loading is to the surface of the springshed, and isn't the N loading at the spring boil. We will clarify in the MFL report that the N loading rate is within the two-year capture zone of the spring.
11. The phrase "surface water basin" on p. 5 needs to be explained. You clearly are excluding Half Mile Creek, even though it is within the drainage basin; and appear to limit the 'basin' to the floodplain and adjoining uplands. I have no objection to such a limit, but only ask that it be clearly explained.	We have changed the basin boundary (and maps) to include Half Mile Creek and other contributing areas.

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12. Similarly in Figure 5, what is a "Detailed" Surface Water Basin?	The word "detailed" has been removed.
13. Consider explaining how 75% of the water discharging from Silver Springs originates within a 2-year travel -time capture zone (p 13) but has an age of 10 to 50 years (p. 15).	The 75% was estimated using a regional groundwater model which is based on certain hydrologic condition. The age of 10-50 years is based on a limited number of chemical tracer concentration measurements. Because both methods have their own uncertainties and limitations, we do not believe comparing them would be appropriate. However, we agree that an explanation or rewording would be warranted to prevent any confusion. We will update the relevant sections in the report.
14. The map on p. 17 reminds me that I previously recommended providing a water budget for this spring system, i.e. one that accounts for the fate of the recharge. Staff did not accept this recommendation. I continue to recommend this be addressed in the report given that the discharge component at Silver Springs has undergone a major volumetric change and thus must be having a significant water budget effect somewhere. Is it possible to fully understand this system without knowing anything about where has the suppressed flow has ended up?	The springshed of Silver spring encompasses a very large area that could be influenced by many factors even beyond its boundaries. Particularly, its interaction with the nearby Rainbow springs makes it more complicated to reasonably develop a water budget that can be used to tease out the effect of suppression on groundwater system. The evidence of groundwater mounding in the vicinity of spring pool might be an indication that the suppressed flow may have increased the groundwater storage. Although we agree that understanding the fate of suppressed flow could be beneficial to better understand the system, we should keep in mind that the purpose of MFLs is to prevent any further withdrawals from being significantly harmful to the water resources. Therefore,

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	we believe that understanding the impact of groundwater withdrawals on the spring flows is more crucial. We use groundwater models for that purpose.
15. It is ok for the discussion here to ignore the effect of water quality on spring discharge if, as suggested above, this subject is addressed more generally early on. Otherwise, some discussion is needed.	The relative effects of nutrients and climate are now addressed in the introduction and conclusions, in a discussion of MFL context.
16. Not major, but doesn't USGS use "gage" rather than "gauge"? See p. 24 among other places.	All have been changed to "gage".
17. P. 30. Some discussion of how this change parallels what is seen at Rainbow Springs would be of value.	We have not included the change in stage-discharge relationship post-2000, because of uncertainty due to SWFWMD's lack of stage data.
18. Figure 19. The use of colors to associate a particular equation with a particular plot doesn't work for folks who print out the report on a conventional printer in black and white.	Noted. This plot has been changed to grey-scale.
19. P. 38. Is there a reason for the scarcity of flood events? Should this fact be considered in discussions of the FH?	The scarcity of floods is due to the prolonged drought (112" deficit rainfall since 1970). The FH is based on long-term probabilities and the assumption that the entire POR (with wet and dry periods) can be used to determine the frequency distribution of the baseline condition and recommended MFLs.
20. P 39, suggest you present the actual values for the gpcd demand.	We will add the value of gross gallons per capita per day used to estimate the groundwater use from 1930 to 1977

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21. P. 46-47, the on-going status does not clearly indicate that the 5-year review will consider the role of aquatic vegetation as impacting the MFLs.	Text has been added from the last section (Future Monitoring and Adaptive Managment) which addresses monitoring the stage-flow relationship.
22. P. 47 addresses "Consideration" of environmental values. Shouldn't Appendix E be referenced here? If not here, where? Also might cross-reference the WRV report, even if that report is not yet public.	Since the environmental values screening table and the WRVs are results, they are referenced in the Results section, not the Technical approach section.
23. P. 67. I strongly suggest that the discussion of each MFL include information on how the system is responding to water levels that are much higher (for a given duration and interval) than observed historically. As is, the discussion of the levels seems to have no relation to what is actually being observed on the ground. See for example your response 70 to my comments of February, 2013.	Duly noted. This information has been added to the text.
24. P. 69-71, the change in return interval for the FH (flooding reduced from 35 to 20 events per century) seems large for a system where the hydrology is so uncertain. The SWIDs graph shows this change but a distinct shift from "normal". Also, if we look at 1998-2010 conditions, wouldn't the existing data point be already shifted more than what the graph shows would occur?	The period from 1998 to 2010 does represent a long-term drought. As such the recommended flood frequency of the FH is not being met. However, this MFL (as with all) is a long-term probability that encompasses wet and dry periods. If, in future the current vegetative damming conditions have not changed, even with normal rainfall and periods of above-normal rainfall to counteract the effects of drought, the MFL will need to be reevaluated. This assumption regarding POR and the MFL being based on long-term frequencies has been added to the text.

Comment	Resolution
25. The cfs value for FH has not been observed for nearly two decades, and for practical purposes has essentially no chance of recurring so long as the vegetation situation is not rectified. This reinforces the need early in the report to discuss the vegetation issue and somehow justify the context in which a traditional MFLs methodology is applied.	Agreed. The relative effects of nutrients and climate on the stage/discharge relationship are now addressed in the introduction and conclusions, in a discussion of MFL context.
26. P. 73. The discussion of biogeochemical and water quality functions is another instance where the information provided relates to conditions not now being observed.	The floodplain functions mentioned still relate to the long-term conditions. Current conditions (post-2000) would not allow for some of the functions mentioned, but when we are no longer in a deficit rainfall situation, and SAV are reduced, stages will drop and the functions mentioned will be applicable.
27. At p. 76, I suggest that it be made clear that the 1.7 year return interval represents 3 years in any five, not an event that recurs with a 20-month spacing.	Agreed. This has been added to the text (under the return interval section).
28. P. 80. I continue to be concerned about setting MFLs that are at the extreme of the SWIDs diagrams without a supporting analysis that shows the referenced SWIDs is for a comparable ecological setting and is associated with a healthy condition.	The lakes that are towards the dry end of the organic soils SWIDS analysis are all fairly stable (fluctuation of less than 10' over the POR; many fluctuating ~ 5') making them useful analogs for a stable spring-fed river. Also, many of the lakes that have signatures similar to what is proposed for this MFL, are minimally altered (e.g., Hopkins Prairie and Halfmoon Lakes in the Ocala National Forest).
29. The first paragraph on p. 83 is an example of why I think the report needs some type of upfront discussion of why it is reasonable to	We agree with the first sentence and have added text to put the MFL in context, as suggested.

Comment	Resolution
set MFLs based on traditional analyses, even though such MFLs are arguably meaningless given current conditions. In this case it makes sense to recommend an FL that will allow periodic drawdowns but prevent excessive drawdowns and to explain how this benefits the system. However, there is no prospect of actually achieving much drawdown until the nutrient problem is largely addressed, so it also makes sense to discuss the extent to which the system is currently impaired.	We do not agree that there is no prospect for achieving lower stages in the near-term. We have clarified in the text that evidence suggests that the post-2000 change in stage-discharge relationship is due largely to the multi-decadal drought which has caused a lack of dark water (backwater) from the Ocklawaha, lack of scouring floods from the Silver River.
30. The discussion on p 85 made me think that it would be of value for this (and other "importance" discussions) to include photos or other illustrations.	We agree and will make an effort to include photos that illustrate the ecological functions discussed. Given time constraints that may not be possible for this report, but is a good suggestion for future reports.
31. P. 87. Same comment as before: I consider it essential that using an extreme SWIDS be supported by a demonstration that the SWIDs in question is in a comparable ecological setting and is associated with a healthy condition.	The lakes in question are fairly stable (low fluctuation) making them somewhat analogous to stable spring-fed rivers. In addition, by using species-based SWIDS we remove some of the uncertainty about whether we are comparing similar systems with similar communities. We are comparing beds of the same species that have the same physiological tolerances. Further, much of the data for SWIDS was collected pre-2000, prior to some of the unusually severe droughts/ hydrologic perturbations of the last 16 years. These details have been added to the text

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32. If SJRWMD provides an early discussion of the flow-stage issue, that discussion can be cross-referenced in the last paragraph in the "Importance" section on p. 90. The paragraph just above provides a good rationale for setting the MFLs, i.e. the District needs an ecological basis for evaluating consumptive use permits and that basis can reasonably assume that basis will reflect future conditions after the nutrient problems are addressed.	Agreed. We have added text explaining the MFL context and assumptions made. Namely that we are using the entire POR based on evidence that the multi-decadal drought (and nutrients) are likely driving the vegetative damming that has caused the post-2000 change in stage/discharge relationship. We have cross-referenced this text with the section on (previous) page 90.
33. At the bottom of p. 90, suggest stating the velocity regime of Silver pre- and post-2000 so that the subsequent discussion of the literature has more context.	Agreed. This text has been added.
34. P 97 establishes that a prevention strategy is required. Suggest you indicate if this results from a build-out of existing permits and if so the potential magnitude of the problem (i.e. how much over pumping could occur absent the prevention strategy).	The prevention status is based on 2035 projected demand and development and implementation of a prevention strategy will ensure MFL achievement at 2035. This will be clarified.
35. The info. on p. 98 is the type I think could be presented early on.	Will consider whether to also mention future monitoring and adaptive management as part of the Technical Approach section.
36. At p. 178, Appendix B, Table B1 shows flows higher for German than USGS, but the text in the paragraph above the Table says the USGS flows are higher than German.	This was a typographical error in Table B1 (USGS and German were transposed). This has been corrected.
37. For Figure B8, p. 185, suggest the caption make clear that the higher of the curves is the pre-2000 relationship.	Agreed. This has been added to clarify.

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38. On Figure B9, p 186, it was not clear to me why the plot has lowest flows around 500 cfs, when Figure B8 had flows as low as 300 cfs.	The graph in figure B9 was produced by calculating a weighted average flow at each stage for the entire POR. Flows could be different at a specific stage in different time periods. Especially due to suppression, during post 2000 condition, flows are significantly less than the flows during pre-2000 condition at the same stage. Because we are calculating weighted average, the lowest flow at the lowest stage in figure B9 is the weighted average of the lowest flows in pre-2000 and post 2000 conditions in figure B8.
39. Figure B13 is a rather compelling argument against stationarity. This reinforces my recommendation that the main report needs to explain that the system is now out of balance, but that MFLs need to be established assuming a future return to balance so that the District can make appropriate permitting decisions.	Our opinion is that the post-2000 is due primarily to drought and flow suppression from SAV (not "out of balance"). We will add an explanation of this, clarifying that the MFL is based on an assumption that the hydrological regime for the spring and river since 2000 is not a new permanent state, but rather part of a cycle, and that the system will return to conditions seen in pre-2000 if it experiences climatic factors present before 2000.
40. In reviewing Appendix E, I wondered how the various WRVs are affected by the current stage-flow relationship. I suggest the District think this through and consider whether the results shed any light on the main report (e.g. possibly add discussions of the specific MFLs that relate directly to a WRV).	Because the WRVs (and MFLs) are treating the post-2000 condition as part of a natural cycle (driven primarily by drought and flow suppression from vegetation), both are assessing the long-term frequencies of critical events and thresholds.

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To: Andrew Sutherland, Ph.D.

From: Lee Wilson, Ph.D.

Date: 3 January 2017

Re: Minimum Flows Determination for Silver Springs, Marion County, Florida

This memorandum reflects my ongoing assignment from SJRWMD to review reports related to MFLs development for water bodies within the District. The subject report, for Silver Springs and Silver River, was authored by Andrew B. Sutherland, Robert Freese, Jodi Slater, and Greenville B. Hall. This is the third version of the report I have reviewed.

I continue to hold the 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 fact that certain of my comments are critical of certain aspects of this report is a reflection of my assignment to identify issues and find possible problems, and should be read in that spirit.

Primary comments

41. I strongly recommend that early on in the report there be an explanation of why a conventional MFLs analysis is appropriate for a system that is not behaving conventionally. This explanation can be set out as follows.

- Under current conditions (elevated nitrate concentrations, extensive vegetative growth, and suppression of spring flows), there is no possibility of the proposed MFL flows occurring at the historic duration and frequency. Rather, if and when a particular MFL flow now occurs, the

consequent stage will be significantly higher than the stage used to evaluate the effects of the MFL.

- The current condition is not representative of future conditions. Once the nutrient problem is resolved, future conditions can reasonably be expected to be similar to those observed before year 2000. [Note, I don't actually believe this given climate change and the like, but it is in fact the proper assumption as the MFL program is now implemented.]
- SJRWMD must manage its consumptive use permits in anticipation of the future return to the historic MFLs regime. Consequently the MFLs analysis must be based on ecological conditions established under that regime.

42. The current hydrologic regime is presumably impacting the stream and especially the floodplain through prolonged high stages. The report hints that this is causing ecological stress, but doesn't tackle it head on. If no problems are evident from nearly decades of stages above the MFLs, it may be difficult to defend the ecological benefits of the MFLs now proposed. Demonstrating at least some degree of harm from non-MFL conditions (or explaining why it is too early to see such problems) seems important.

43. This report reinforces my advice that the District begin to address non-stationarity in its MFLs program, including how future climates and other conditions may impact this watershed. It may be this should be done outside any particular MFLs report.

<u>Specific comments</u>

44. I have previously commented on a prior draft of this report. Many of those comments have led to changes in the report; others were addressed in responses to comments. As a result, while my review of the new report has been thorough, and I reviewed how my previous comments were responded to, the resulting comments here are considerably abbreviated.

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46. I assume the prior report was never made available for public review. If so (and even if not) you may want to explain how it came to be that the prior report found the need for a recovery plan, whereas the current one identifies the need for a prevention strategy.

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48. In Table ES-1, the column "level" seems to actually set out "flow", with values in cfs, not ft NAVD/NGVD.

49. Table of Contents should list the individual appendices.

50. I need to understand how nitrogen loading has increased 11 fold but nitrogen concentration have less than tripled, even with a decrease in flow. I assume the difference is vegetative uptake, but it would be good to say that and to otherwise account for the fate of the N inputs.

51. The phrase “surface water basin” on p. 5 needs to be explained. You clearly are excluding Half Mile Creek, even though it is within the drainage basin; and appear to limit the ‘basin’ to the floodplain and adjoining uplands. I have no objection to such a limit, but only ask that it be clearly explained.

52. Similarly in Figure 5, what is a “Detailed” Surface Water Basin?

53. Consider explaining how 75% of the water discharging from Silver Springs originates within a 2-year travel -time capture zone (p 13) but has an age of 10 to 50 years (p. 15).

54. The map on p. 17 reminds me that I previously recommended providing a water budget for this spring system, i.e. one that accounts for the fate of the recharge. Staff did not accept this recommendation. I continue to recommend this be addressed in the report given that the discharge component at Silver Springs has undergone a major volumetric change and thus must be having a significant water budget effect somewhere. Is it possible to fully understand this system without knowing anything about where has the suppressed flow has ended up?

55. It is ok for the discussion here to ignore the effect of water quality on spring discharge if, as suggested above, this subject is addressed more generally early on. Otherwise, some discussion is needed.

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57. P. 30. Some discussion of how this change parallels what is seen at Rainbow Springs would be of value.

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60. P 39, suggest you present the actual values for the gpcd demand.

61. P. 46-47, the on-going status does not clearly indicate that the 5-year review will consider the role of aquatic vegetation as impacting the MFLs.

62. P. 47 addresses “Consideration” of environmental values. Shouldn’t Appendix E be referenced here? If not here, where? Also might cross-reference the WRV report, even if that report is not yet public.

63. P. 67. I strongly suggest that the discussion of each MFL include information on how the system is responding to water levels that are much higher (for a given duration and interval) than observed historically. As is, the discussion of the levels seems to have no relation to what is actually being observed on the ground. See for example your response 70 to my comments of February, 2013.

64. P. 69-71, the change in return interval for the FH (flooding reduced from 35 to 20 events per century) seems large for a system where the hydrology is so uncertain. The SWIDs graph shows this change but a distinct shift from “normal”. Also, if we look at 1998-2010 conditions, wouldn’t the existing data point be already shifted more than what the graph shows would occur?

65. The cfs value for FH has not been observed for nearly two decades, and for practical purposes has essentially no chance of recurring so long as the vegetation situation is not rectified. This

reinforces the need early in the report to discuss the vegetation issue and somehow justify the context in which a traditional MFLs methodology is applied.

66. P. 73. The discussion of biogeochemical and water quality functions is another instance where the information provided relates to conditions not now being observed.

67. At p. 76, I suggest that it be made clear that the 1.7 year return interval represents 3 years in any five, not an event that recurs with a 20-month spacing.

68. P. 80. I continue to be concerned about setting MFLs that are at the extreme of the SWIDs diagrams without a supporting analysis that shows the referenced SWIDs is for a comparable ecological setting and is associated with a healthy condition.

69. The first paragraph on p. 83 is an example of why I think the report needs some type of upfront discussion of why it is reasonable to set MFLs based on traditional analyses, even though such MFLs are arguably meaningless given current conditions. In this case it makes sense to recommend an FL that will allow periodic drawdowns but prevent excessive drawdowns and to explain how this benefits the system. However there is no prospect of actually achieving much drawdown until the nutrient problem is largely addressed, so it also makes sense to discuss the extent to which the system is currently impaired.

70. The discussion on p 85 made me think that it would be of value for this (and other "importance" discussions) to include photos or other illustrations.

71. P. 87. Same comment as before: I consider it essential that using an extreme SWIDS be supported by a demonstration that the SWIDs in question is in a comparable ecological setting and is associated with a healthy condition.

72. If SJRWMD provides an early discussion of the flow-stage issue, that discussion can be cross-referenced in the last paragraph in the "Importance" section on p. 90. The paragraph just above provides a good rationale for setting the MFLs, i.e. the District needs an ecological basis for evaluating consumptive use permits and that basis can reasonably assume that basis will reflect future conditions after the nutrient problems are addressed.

73. At the bottom of p. 90, suggest stating the velocity regime of Silver pre- and post-2000 so that the subsequent discussion of the literature has more context.

74. P 97 establishes that a prevention strategy is required. Suggest you indicate if this results from a build-out of existing permits and if so the potential magnitude of the problem (i.e. how much over pumping could occur absent the prevention strategy).

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79. Figure B13 is a rather compelling argument against stationarity. This reinforces my recommendation that the main report needs to explain that the system is now out of balance, but that MFLs need to be established assuming a future return to balance so that the District can make appropriate permitting decisions.

80. In reviewing Appendix E, I wondered how the various WRVs are affected by the current stage-flow relationship. I suggest the District think this through and consider whether the results shed any light on how the main report (e.g. possibly add discussions of the specific MFLs that relate directly to a WRV).

Items in scope of work

I have reviewed the MFLs report with consideration given to four specific review items specified in the Scope of Work.

1. Assess adequacy of environmental data in terms of appropriateness, quality and length of record.

a. Are there any deficiencies and/or errors regarding data availability? *None of significance.*

b. Were appropriate analytical methods and field procedures used for data collection? *Yes.*

c. Were reasonable quality assurance assessments performed on the data? *Yes.*

d. Was relevant data available but discarded without appropriate justification? Would use of discarded information significantly affect the development of the MFLs? *I identified no problems regarding use or discarding of data.*

e. Was "best information available" utilized in developing the MFLs? *Yes.*

2. Assess methods and procedures for data analysis, including, where appropriate, performing appropriate statistical analyses of data to ensure that each is statistically valid and is used appropriately.

a. Are there any deficiencies and/or errors in analytical methods and procedures? *No.*

b. Were appropriate analytical methods and procedures used for data analysis? Yes.

c. Were the analytical methods and procedures appropriate given the "best information available"? *Yes, but need to be clear that they are assessing a historic condition which will be restored.*

d. Do the analyses include all necessary factors? *Yes, but I would like to see a nitrogen budget.*

e. Were the analyses correctly applied? *Yes, but the stage-flow conundrum should be presented early so that the context of the MFLs analysis is more transparent.*

f. Were any limitations and imprecisions in the information handled appropriately? *Yes.*

g. Are the analyses repeatable? *Yes.*

3. Evaluate the validity and appropriateness of all assumptions used and conclusions made in the development of the MFLs analysis.

a. Are the assumptions reasonable and consistent given the "best information available"? *Yes.*

b. Is there information available that could have been used to eliminate any of the assumptions? Would the use of this additional information substantially change the development of the MFLs? *No to both questions.*

c. Are the assumptions stated clearly? *Really need to have the context discussion up front so that it is clear that the bulk of the report is predicated on the eventual return of the system to "normal" conditions*.

d. What, if any, assumptions are implied or inherent in the methodologies? *That the current stage-flow relationship will be modified and eventually flows and stages will be comparable to pre-2000 conditions*.

e. Are other analytical methods or procedures available that would require fewer assumptions but could provide comparable or better results? Are adequate data available to support using these alternative methods or procedures? *No.*

f. Are there deficiencies and/or errors in the MFLs or application of findings and conclusions? *Only that the context needs to be clear – these MFLs assume that the normal stage-flow relationship is restored.*

g. Identify all sources of uncertainty and assess their impact on developing MFLs that will prevent significant harm to the ecological structure and/or function of the water resource. *The sources of uncertainty are a) those intrinsic to ecological variability, which are adequately addressed; and b) those relating to channel vegetation and nutrient loading which are not entirely MFLs issues, but which do need to be clearly articulated*.

4. Determine if the data, analyses, and interpretation of results support the recommended MFLs. *Yes, subject to specific comments presented above.*