Alexander Springs MFL, Lake County
Peer Review Resolution Document for Comments from HSW Engineering, Inc.
04/12/2017

Primary Comments

Comment	Resolution
An argument has been made in the MFL report, after examining various events associated with habitats, that there are not sufficient data for a bottom up approach. A comparative springs analysis was used and seems appropriate, but there may be benefit in using some elements of a top down approach as suggested in our comments. • For example, referring to Figure 38 in the report, under baseline conditions, a low flow of 99.36 cfs for a 120-day duration was used for amphibian habitat protection and has a RI of > 33 years (i.e., it did not occur in the extended period of record data set). Is it protective to change that RI to 2.7 years? The District has concluded that it may not be protective and opted for a more conservative estimate of available water. Perhaps due to the site-specific conditions that result in a flat rating curve (large change in flow with small change in stage), a shorter duration event might be appropriate such as a 90-day or 60-day duration. This might be accomplished by comparing the proposed 6.8% reduction with what would be computed using a different duration for the same flow and RI. • Similarly, consider an event duration of 30 days for the FH for cypress and connectivity. We realize this is reverse engineering but if the District is comfortable with the stage and the return interval values (or the duration and return interval values) associated with an event, then the effect of using a 6.8% flow reduction as an MFL, rather than the larger values presented in the report, is to recognize (or consider) that at least one of the event parameters as presented in the draft report needs adjusting. Also, when evaluating WRVs, we have often set the duration of an event based on what has historically occurred (e.g., the typical duration of the annual maximum flood events for the period of record) and then evaluated the change in RI of incremental flow reductions – i.e., top down approach.	We agree with HSW's observation that it is appropriate to use a comparative approach, given the uncertainty and lack of data. The RI was defined as 2.7 based on what literature and Surface Water Inundation and Dewatering Signatures (SWIDS) data suggest is the minimum frequency necessary for maintenance of pickerel weed, a species that is associated with the temporary ponds used by amphibians in the floodplain. The large change in frequency is likely due to the fact that these habitats (and others within the Alexander Springs floodplain) are maintained by water source(s) other than spring run flooding. As noted, it is because of the lack of data on hydrological requirements (i.e., protective events) of amphibians within this system, and a lack of data regarding the relative importance of flooding versus seepage and ponding, that we feel that the recommended 21% change is too large. Given the uncertainty, we have decided to use the springs comparison instead, which results in the more protective 6.8% reduction. In order to pick a different duration or return interval (as suggested) we would need something on which to base this decision. Simply changing the duration and/or return frequency until the % reduction was lower (or until similar to the 6.8%), would not increase the certainty or defensibility. We would not be able to point to data and/or literature to back up the decision. Recommending 6.8% change is a temporary measure until further data (hydrological and ecological) can be collected, on which to defend a different % reduction, if determined to be appropriate. It is worth pointing out that the amount of reduction projected within the next 20 years is very small (less than 0.5 cfs increase from current). Therefore, we are confident that no harm will occur within the planning horizon,

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			allowing us to revisit this MFL to determine if the analysis of newly collected data, or different metrics (e.g., plant species discussed by reviewers) would result in a different and/or more constraining minimum flow.
A second theme in the comments is that we have offered other possible target species that may be more sensitive to changes in flow (or stage) although it is not clear that event data are any more prevalent.			We are also unaware of data for the species listed (see later comments for details) from which to determine a defensible critical threshold for flow magnitude, duration or frequency. The district will consider other sensitive species, if or when data exist with which to determine protective hydrological events.
Finally, the District may also consider a relative flow-contribution approach and set (or compare) the MFL based on the nearest reach of the St. Johns River where an MFL has been set- near Deland for example. In other words, if the allowable withdrawal at Deland is 7%, then the allowable reduction at Alexander Springs is 7%.			Noted. We agree that it is appropriate to look at MFLs set in receiving water bodies.
page	**paragraph**	**Comment - Hydrology**	
iii	4	The 1st sentence in this paragraph mentions separating withdrawal impacts from climate variations. Suggest adding a summary of rainfall characteristics to the report to provide a perspective for the baseline period. Climate data are described in Appendix B for periods of record but not for the baseline period.	We agree that looking at current climate relative to a baseline, or reference condition is warranted. We will add this to the report if time permits, or at the very least will include an analysis of climate at each reassessment. Future screening level analysis will incorporate change in rainfall trends relative to when the MFLs was set. If the analysis shows that MFLs are not being met, or are trending toward not being met based on the rainfall-adjusted flows and levels, the SJRWMD will conduct a cause and effect analysis to independently evaluate the potential impacts of various stressors (including pumping) on Alexander Springs.

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14	1	The watershed boundary should be added to Figure 1 to be consistent with text.	Alexander Springs watershed was added to Figure 1.
17	Figure 2	Add hydrographic features (i.e., Alexander Springs and traces for Alexander Springs Creek and other major tributaries). Check watershed boundary at mouth at St. Johns River where watershed boundaries would be expected to narrow to a point.	The suggested changes have been made to Figure 2.
21	Figure 3	The addition of hydrographic features (i.e., Alexander Springs and traces for Alexander Springs Creek and other major tributaries) would be helpful and illustrate the distinct difference between surface- and groundwater inputs to the creek.	Since Figure 3 is a graph of calcium trend, we assume the reviewer meant Figure 8. The suggested changes have been made to Figure 8.
23	Figure 9	Add labels to identify locations (e.g. Tracy Canal gaging station)	Labels have been added.
33	Figure 15	Even though transects are discussed in a later section, it would be helpful to add the field transect locations, Tracy Canal gage, and labels to the GIS graphic.	We agree. This change has been made.
34	Figure 16	Even though transects are discussed in a later section, it would be helpful to add the field transect locations, Tracy Canal gage, and labels to the GIS graphic.	We agree. This change has been made.
43	4	Suggest more explicit definition of events – e.g., duration and return interval of events.	The event based approach is explained in detail in the Technical Approach section.
45	Figure 18	Difficult to read	The background has been changed to make reading easier.
46	2	In 2nd sentence, should read …ground elevations are transformed into "inundation" durations and ….	This change has been made.

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46	4	suggest changing hydrologic models are used to "quantify" instead of "understand"	Agreed. This change has been made.
47	3	Add a reference for the value "(0.7)".	This reference has been added.
51	Table 7	It is unclear why the component "Resource Leval Value" is rated "0" for certain WRVs (e.g., Recreation in & on the water") when the Executive Summary (page iii, paragraph 2) identifies the water bodies as legally designated OFW's and OFS's.	We agree. A value of 3 has been added to all WRVs. This doesn't change the overall ranking, but recognizes their importance as OFWs and OFS's.
54	Table 7	Suggest revising the explanation of footnote #1 to "Evaluation of the level to which the resource value is at risk from flow reduction." If authors concur, then also suggest re-visiting the score and rationale associated with "Navigation - Level of resource risk"	This change has been made to footnote #1. The rationale for the score of navigation remains, because withdrawal could increase vegetation encroachment, hampering boat traffic.
81	5	Suggest revising the last sentence to read …and thereby controls "groundwater" discharge through the floodplain system.	We agree. This change has been made.
82	2	suggest elaborating on what an infrequent low might look like (duration and frequency), could protect, and why it is either not present or not important.	An IL was not included because Alexander is a stable system, and an IL would be largely storm-driven, not sensitive to withdrawal.
82	2	revise 2nd sentence to read ….along Alexander Springs "Creek", …	We agree. This change has been made.
83	3	what equation is used to transfer elevation from A-10 to Tracy Canal?	HECRAS rating curves were used to relate the stage of A10 to A8 since there are no observed data at A10. Then the sequential regressions were used to transfer data from A8 to A6, A6 to A5, and A5 to Tracy Canal.
84	table 8	suggest including the baseline return interval to give perspective	This information is given in the text. The % flow reduction suggests that the change from baseline to MFL condition is large, hence the decision to go with the springs comparison.

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84	table 8	what is the relationship between the third column in table 8, third column in table 9 of Appendix B, and column 6 of table 10 of Appendix B?	Table 8 is based on selected criteria while Table 10 in the Appendix B shows stage transfer computations.
85	table 8	none of the MFL frequent low events have occurred in the 33 year estimated record implying that they are not very frequent.	This is part of the reason for not setting the MFL based on the FL. As explained in the text, a lack of hydrological data and the fact that this system is maintained by seepage from the adjacent flatwoods and by ponding, make this FL less reliable than our typical MFLs.
86	table 9	when I plot each cross section stage versus stage at Tracy Canal, A5 is associated with about 1.9 at Tracy (Appendix B Fig 15), which is below measured values. A6 stage of 6.25 is about 4.2 at Tracy and A8 is about 4.6. A5 observation or translation seems off.	This comment needs clarification.
82-88		consider using a 30 day duration. If not explicitly to set MFL perhaps to point out that it better reflects the historical occurrence of the stage and RI than 7 days. Similarly, it is clear that the 7 day event occurs much more frequently than the metrics used in the MFL analysis - almost every year.	We agree that there is a lack of correspondence between our typical metrics and SWIDS data, and the historical or observed period of record at Alexander. It is clear that a water source other than flooding (perhaps seepage or ponding?) is maintaining our typical environmental criteria. Until we have more transect specific hydrological data, we won't be able to partition these sources. This is one of the reasons for not setting the MFL based on this information, but rather using the springs comparison. If we switched to a 30 day duration or different RI for the 7 day flood, we would need a reason, backed by the SWIDS or scientific literature that suggests a specific duration/RI for maintenance of a specific species or community.
89-97		the MFL flow events of 120 days have never occurred - i.e., RI> 32 years. These are not frequent events. If something doesn't occur every 10 years or so (infrequent event), it probably isn't driving anything important.	This is part of the reason for not setting the MFL based on the FL. As explained in the text, a lack of hydrological data and the fact that this system is maintained by seepage from the adjacent flatwoods and by ponding, make this FL less reliable than our typical MFLs.

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Appendix B	Figure 15	why were earlier data excluded from figure and regression equation	Because there are quality issues with the earlier data.
Appendix B		page numbers would help	These have been added.
Appendix B		the text says that regression equations were used sequentially. Does this mean that equations relating stage at each cross section to Tracy Canal were not developed. Wouldn't there be less error to use a relationship between each transect and Tracy Canal directly? (see attached)	The sequential regression relationships are far stronger than each transect relationship with Tracy Canal. The stronger regression relationships minimize any potential accumulated errors.
general		many of the map figures are difficult to read. Gages, springs, other prominent features should be clearly labeled.	We have added the spring, spring run and tributaries to the maps.
		Comments - Ecology	
14	3	The SJRWMD generally uses stage-based and not flow-based metrics for setting MFLs. However, for this spring, stage is quite insensitive to relatively large changes in flows. Perhaps the fact that this spring is an OFS/OFW can trigger a study to maintain flows so that nuisance species such as *Lyngbya* cannot move upstream? (see also comments on pages 99 and 103).	Critical velocity thresholds are evaluated in the independent WRVs report (ATM 2017). ATM found an insignificant change between no-pumping and the MFL condition for the velocity required to scour algae (and for other critical velocities).
15	Fig. 1	Can the spring itself be shown on Figure?	This has been added.
16	2	Walsh (2009) at almost 60% urban does not seem to match Figure 2.	We agree. Walsh et al (2009) doesn't include a springshed description, but (based on the text) seems to be based on a larger springshed than the District's springshed depicted in Figure 2. The latter has less urban and more of the spring flow is coming from a forested springshed.

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16	3	Interesting observation ("older" water increasing in disharge)…..is there a reduction in recent rainfall or a diversion/reduction in water table contribution to perhaps explain this? (not necessarily a big item, but given the lack of development in the basin, somewhat of a "head-scratcher".	The decreasing trend of nitrate and increasing trend of sulfate both suggest less surface runoff (younger) and thus a higher percentage of deeper UFA (older) water. This is likely due to declining rainfall. Pumping in this area is very low.
16	3	*Is that from?: Akaike, Hirotugu (December 1974). "A new look at the statistical model identification". IEEE Transactions on Automatic Control.* ***19*** *(6): 716–723. doi:10.1109/TAC.1974.1100705.*	In the SAS users manual, Akaike's information criteria is used as a tool for optimal model selection. It is based on the following publication: Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In B.N. Petrov and F. Csaki (Eds.), Second international symposium on information theory, 267-281. Budapest: Academiai Kiado.
16	3	Is there a correlation between higher N at lower flows?....if so, could argue the OFS designation would be harmed by lower flows? Am very concerned with the protection of the spring run habitat for several of the "listed" species (plants and animals)…...Lyngbya could pose a significant threat if not prevented from upstream migration with adequate water velocities.	Nitrate levels are very low at Alexander Springs (~ 40 ug/L since 2000). Even if nitrate was high, researchers have found nitrate and flow to be independent, but that nitrate is strongly dependent on time (i.e., loading). Heyl (2012) examined the relationship between nitrate concentrations and flow in the Chassahowitzka River, Homosassa River, Silver Springs, Pumphouse and Trotter springs, Gum Springs, and Rainbow Springs systems. While nitrate had increased in all six systems over time, concentrations were independent of flow.
17	Fig. 2	Can the spring itself be shown on Figure?	This has been added.
18	1	Concur with importance of xeric sand hills	Noted.
21	Fig. 6	Can the spring itself be shown on Figure?	This has been added.

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22	4	Why are the missing data from TS Fay the most important? Are there missing data from drought periods? Do not see any gaps in the hydrograph in Figure 12.	The missing data from Tropical Storm Fay are very important for calibrating the hydrologic model because it was the highest discharge that occurred in the calibration period.
26	Fig. 11	Is there an upward trend in stage elevation over time?	There seems to be an increase of about 0.1 foot. This may be related to SAV growth in the river causing a backwater effect (as we are seeing at Silver Springs), but we do not have information to verify this.
27	Tab. 3+4	From 60cfs up to 202cfs have only a 1.6-1.7' elevation change….stage-based metrics do not prove to be overly sensitive.	For Alexander Springs, our floodplain based metrics are not sensitive, and there is very little change in critical velocity thresholds in the channel (see ATM 2017 for information on WRVs analysis and inchannel velocities). This is part of the reason for not setting the MFL based on the floodplain criteria, but using the springs comparison. This is also the reason this system needs further study in the future, especially inchannel metrics. Pumping over the 20 year planning horizon is very small (less than 0.5 cfs increase from current), so we think we have time to collect additional data and reevaluate this system in the future.
33	Fig. 15	Can the spring itself be shown on Figure?	This has been added.
34	Fig. 16	Can the spring itself be shown on Figure?	This has been added.
36	5	*Lyngbya* will impact rooted SAV…..will in turn impact species such as Dense Hydrobe Snail and Alexander Silt Snail (which utilize SAV)	Given the limited algal scour capacity that currently exists within the Alexander Springs Run, and that velocity reductions under the MFL hydrologic regime is 0.07 ft/sec or less (ATM 2017), algal scour capacity will not change significantly between the no-pumping and MFL conditions.
37	4	Only Limpkin and Wood Stork for birds? Not any other wading birds?	These are the only two listed on the FNAI biodiversity matrix interactive map, for the area surrounding Alexander Springs creek.
39	Tab. 6	After examining all these species….the caddisflies and microcaddisflies and the 2 snail species could be impacted if their substrate were invaded by Lyngbya. The Striped Newt reproductive success could be	Regarding caddisfly habitat and *Lyngbya*, given the limited algal scour capacity that currently exists within the Alexander Springs Run, and that velocity reductions under the MFL hydrologic regime is 0.07 ft/sec or less (ATM 2017), algal scour capacity will not

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		impacted if pools were no longer inundated to the baseline extent. Hydrologic regime preferences for Chapman's Sedge and Ocala Vetch may be important to their continued presence (more in the next comment).	change significantly between the no-pumping and MFL conditions. Regarding striped newt reproduction habitat, we found that our amphibian breeding pond metric was relatively insensitive to flooding (as noted by the reviewer). The pools on the floodplain are likely maintained by the layer of clay which allows rainfall to pond and persist and from seepage from the adjacent upland. Despite this, we took a cursory look at what a striped newt criterion might look like. Using limited life history information, it seems that a reasonable duration for maintaining striped newt breeding habitat would be 6 months (i.e, 6 month continuous wet and 6 months dry), and that a reasonable return frequency for drying of these ponds might be every 5 years. Striped newts live over 12 years, so a 5 year frequency would allow the average reproductive adult to produce multiple strong year classes between periods of pond drying. When we used a 180 day duration and 5 year return interval, the freeboard (~20 cfs) is very similar to the FL, and again we do not consider this constraining enough given data uncertainty and the importance of this system.
42-50	all	The Event-Based Approach description is well-written and helpful. It allows the reader to understand the standard approach taken by SJRWMD. Concur with a fellow reviewer about perhaps more term definition. This approach has served the District well for many MFL examinations to date. After examining the Alexander Springs Report, it may be that, in this specific instance, alternative event parameters might be considered for analysis. Early on in the report (p. 14) the designation of the springs and spring run as OFW and OFS are stressed. On p. 37, the "Listed Species" are introduced. The report identifies 2 snail species that are deemed "Critically Endangered" in	We agree with the reviewer that, given the relative insensitivity of our floodplain metrics, it could be useful to look at other criteria (listed species and others). However, in order for us to recommend a minimum threshold event we need data or literature to suggest the minimum hydroperiod necessary to maintain one or more of these metrics. This would be the case for endemic snails, listed crayfish etc. Regarding whether a flow-based MFL would be useful, we agree that this is important. We contracted ATM to look at numerous critical velocity thresholds to examine whether the recommended 6.8% reduction in flow would significantly impact these. Regarding *Lyngbya*, ATM looked specifically at the velocity needed for algae scour and found that velocity reductions under the MFL hydrologic regime would result in an insignificant reduction to this critical velocity (0.07 ft/sec or less; ATM 2017).

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		Florida. Alexander Springs is either their ONLY known location, or one of just a few springs in Florida. These 2 species require rooted aquatic vegetation. Lyngbya threatens this rooted vegetation. Hence, maintaining hydrologic flows that keep Lyngbya from moving upstream would appear to be a very relevant criteria to assess. The Big-cheeked Cave Crayfish is also an "S1" Listed Species. It appears to have only been found in Alexander Springs. Would not a "flow-based" look at how to protect this species be important? The Striped Newt is a Federal Candidate for "Listing". It requires temporary pools.....the return interval selected for amphibians is 2.7 years.....in order to better assure reproductive success for the striped newt, is it possible to select criteria that require a longer return interval (or perhaps a different set of metrics that result in more total temporary ponds inundated more often at intermediate time periods?) With respect to plants, the Ocala Vetch is considered Endangered in Florida. One of its few known locations is along Alexander Springs/run. Could an elevation study of the occurrence of this species be completed to provide the range of elevations that this species occurs, then focus onthe protection of this set of elevations? Along similar lines, could not the elevation range of the State Threatened Chapman's Sedge be determined within the Hydric Hammocks along Alexander Spring/run and this data be utilized to protect this species?	Species that are maintained by seepage and ponding (e.g., the hydric hammock species mentioned) are likely to also be insensitive to flooding (just as our floodplain metrics were). For response regarding striped newt, please see response to comment above.

Comment			Resolution
42-50	all	Several caddisflies and microcaddisflies are "listed" species. These require sand/hard substrate and high dissolved oxygen. These are "flow-related" factors.	Regarding caddisfly habitat and *Lyngbya*, given the limited algal scour capacity that currently exists within the Alexander Springs Run, and that velocity reductions under the MFL hydrologic regime is 0.07 ft/sec or less (ATM 2017), algal scour capacity will not change significantly between the no-pumping and MFL conditions. ATM (2017) also found a very small change in sediment transport critical velocities.
44	3	Do not forget to add the reference	Reference added.
44	3	Well thought out w/r/t the island eliminating seepage influence	Noted.
49	Bullet #3	How are "ecological assessment info" causative factors in flows or levels? Are we talking about such things as pine plantation transpiration rates versus bahia grass pasture transpiration rates?	This refers to biomonitoring data that helps to partition natural variability versus change due to pumping.
52	2nd BOX	Would not reduced rates of detrital transfer from reduced flows negatively impact OFS/OFW?	Based on the ATM (2017) analysis of relevant WRVs, this ecosystem function will not be harmed significantly.
53	2nd BOX	Would not reduced rates of flow reduce ability of system to filter/flush/assimilate nutrients and increase opportunities for Lyngbya, hence impact OFS?	Based on the ATM (2017) analysis of relevant WRVs, this ecosystem function will not be harmed significantly. Nutrient levels are very low at Alexander Springs and the change between the no-pumping and MFLs conditions will not significantly change the filtration of nutrients.
53	4th BOX	Would not reduced rates of flow negatively impact water quality and OFS/OFW?	Based on the ATM (2017) analysis of relevant WRVs, this ecosystem function will not be harmed significantly.
55-80	all	Transect descriptions and Figures are well done	Noted.
81	2	Concur with importance of seepage	Noted.
83	2	Could this be a place to consider the protection of Chapman's Sedge and possibly Ocala Vetch? Chapman's Sedge is in hydric hammocks. A Minimum Frequent High examination of what it takes to adequately maintain the hydric hammocks where this plant species resides could be valuable.	We agree, and if there is specific hydroperiod requirement information from which an MFL could be developed we can look at this as part of a reevaluation. Also, it is important to note that species that are maintained by seepage and ponding (e.g., the hydric hammock species mentioned) are likely to also be insensitive to flooding (just as our floodplain metrics were).

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86	1	So far I have not located the elevation data on the cypress knees…..cannot find it in the Appendices…..Table 9 shows a large elevation range…..would using the UCL or Maximum Elevation found for a cypress knee along a given transect be worthwhile examining?	Because the difference in elevation between the mean and maximum cypress knee elevations is ~0.5 ft, this would slightly reduce the freeboard, but would still not be the constraint relative to the Frequent Low flow, nor the recommended 7 cfs which results from the springs comparison and allowable 6.8% reduction in mean flow.
87	3	Refers to Figure 35….how is cypress elevation measured at these reference sites? Knee elevation? Base elevation?.....if base elevation, how are these modified to reflect your knee elevations?	See response to question above.
87	4	If the cypress knee UCL or MAX. elevation is used, does this reduce the allowable freeboard?	See response to question above.
90	1	Could this be a place to consider the protection of the Critically Imeriled Ocala Vetch? OBL, in herbaceous wetlands long margins of spring runs and streams…..may want to consider protecting the upper elevation of the marshes to protect this species.	There may be a misunderstanding with the text. The FL magnitude is based on the maximum (upper) elevation of deep marsh.
92	4	Buttonbush is a good choice…..but why use minimum elevations not mean?.....means were used for cypress.	A reanalysis of this would be warranted if this were close to being the sensitive criterion. The FL criterion #3 (amphibian habitat) was much more sensitive (constraining) and changing the buttonbush elevation by a couple of tenths of a foot will not change this to the constraint. It is a good point however.
93	4	Could mention the Striped Newt here as well…..a "listed species"….perhaps consider a substantially longer return interval for the drier intervals to protect this listed species?	We found that our amphibian breeding pond metric (FL criterion #3) was relatively insensitive to flooding (as noted by the reviewer). The pools on the floodplain are likely maintained by the layer of clay which allows rainfall to pond and persist and from seepage from the adjacent upland. Despite this, we took a cursory look at what a striped newt criterion might look like. Using limited life history information, it seems that a reasonable duration for maintaining striped newt breeding habitat would be 6 months (i.e, 6 month continuous wet and 6 months dry), and that a reasonable return frequency for

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			drying of these ponds might be every 5 years. Striped newts live over 12 years, so a 5 year frequency would allow the average reproductive adult to produce multiple strong year classes between periods of pond drying. When we used a 180 day duration and 5 year return interval, the freeboard (~20 cfs) is very similar to the FL, and again we do not consider this constraining enough given data uncertainty and the importance of this system.
96	3	The text switches from pickerelweed max. elevation to min. elevation and back to max. Somewhat confusing as to what was used.	The first sentence notes the metric magnitude (max elevation). The next sentence is noting the range of elevations: *"Line intercept data from A6 shows that pickerelweed has its minimum elevation at stations 936 - 946 in the deep marsh and its maximum elevations in…backswamp depressions."*
97	Fig. 38	Should add a descriptor as to what the top red line is referring to. This figure is not intuitively obvious. It appears that you are proposing a Frequent Low (NOT an Infrequent Low) that has never been measured to date? Based upon the dots in Fig. 38, wouldn't a Frequent Low be expected at around 112cfs or so?	This system's hydrology (or rather the relationship between hydrology and wetland elevations) is not similar to what we typically find. This is one of the reasons why we are recommending the springs comparison (6.8% allowable reduction).
99	1	Could expound upon the unique "protection" of this spring due to its location and its OFS (do not allow decreases in Wqual and flows that would allow Lyngbya to increase its distribution) + a few sentences on those "listed species" most sensitive to flow and stage decreases.	Text regarding the unique nature of this system and its OFS status is found on page 103.
103	4	This may be a site where one or more of the "flow" based WRV criteria are considered for use.	Regarding *Lyngbya*, given the limited algal scour capacity that currently exists within the Alexander Springs Run, and that velocity reductions under the MFL hydrologic regime is 0.07 ft/sec or less (ATM 2017), algal scour capacity will not change significantly between the no-pumping and MFL conditions. If this criterion were used, it would not be more constraining that the floodplain metrics used (nor the recommended 6.8% allowable reduction from the springs comparison).

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General		This system is one of the most pristine in the State. This system supports multiple "listed species" that are flow/stage sensitive. This system is an OFW/OFS, with a "no water quality degradation" requirement. This system has a documented threat from Lyngbya. Perhaps the selection of "event" criteria using a top-down approach to ensure the protection of these "listed species" would be a valuable next step/exercise.	We agree that looking at listed species and criteria that are sensitive to flow is warranted. However, our current analysis shows that many of the listed species mentioned would likely be insensitive to flooding (as are our floodplain metricts). However, in order for us to recommend a minimum threshold event we need data or literature to suggest the minimum hydroperiod necessary to maintain one or more of these listed species. This would be the case for endemic snails, listed crayfish etc. Regarding whether a flow-based MFL would be useful, we agree that this is important. We contracted ATM to look at numerous critical velocity thresholds to examine whether the recommended 6.8% reduction in flow would significantly impact these. Regarding *Lyngbya*, ATM looked specifically at the velocity needed for algae scour and found that velocity reductions under the MFL hydrologic regime would cause an insignificant reduction to this critical velocity (0.07 ft/sec or less; ATM 2017). Regarding water quality, we agree. Based on the ATM (2017) analysis of relevant WRVs, this ecosystem function will not be harmed significantly. Nutrient levels are very low at Alexander Springs and the change between the no-pumping and MFLs conditions will not significantly change the water quality at Alexander Springs. Regarding the striped newt, we found that our amphibian breeding pond metric (FL criterion #3) was relatively insensitive to flooding (as noted by the reviewer). The pools on the floodplain are likely maintained by the layer of clay which allows rainfall to pond and persist and from seepage from the adjacent upland. Despite this, we took a cursory look at what a striped newt criterion might look like. Using limited life history information, it seems that a reasonable duration for maintaining striped newt breeding habitat would be 6 months (i.e, 6 month continuous wet and 6 months dry), and that a reasonable return frequency for drying of these ponds might be every 5 years. Striped newts live over 12 years, so a 5 year frequency would allow the

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			average reproductive adult to produce multiple strong year classes between periods of pond drying. When we used a 180 day duration and 5 year return interval, the freeboard (~20 cfs) is very similar to the FL, and again we do not consider this constraining enough given data uncertainty and the importance of this system.
AppA-p2	1	Do not see anything about cypress knee elevation methods….yet this method was used as part of the report.	Noted. This will be added.
AppB-p7	Table 3	ET is about 60"……	It is a PET and has been updated in Appendix B.
AppB-p8	1	Remember to change the ERROR STATEMENTS	This comment needs clarification.
AppB-p9	Figs. 6+7	Was the >200cfs discharge in 1985? After Elena?...Note the stage at that time was around 10.75'…...Note the discharge never again comes close to 200 cfs,yet the stage frequently goes above 11.0' in stage.	The stages and discharges are observed data and are not always concurrent. A discharge of 202 cfs occurred on 1/18/1984, but there was no stage data. The next stage data available was on 5/3/1984. Backwater influences stage-discharge relationship so the same stage in different periods may correspond different discharges.
AppB-p12	1	Remember to change the ERROR STATEMENTS	This comment needs clarification.
AppB-p21	Fig. 17	Can the spring itself be shown on the figure?	The Alexander Springs location has been added to Figure 17.
AppB-p22	Fig.18	Legend for abbreviations, such as"MD".....what happened to DSS that reduced pumpage from 5mgd down to 1 mgd?	The legend has been corrected.

Draft Review Comments

"Minimum Flow Determination
for Alexander Springs
Lake County, Florida"

HSW is pleased to provide this peer review of the referenced document. The discussion that follows relates to several key items in the report that directly impact the MFL. Specific comments are provided in the table following this discussion.

The fundamental topic discussed throughout our comments, and inferred in the District's discussion at the end of the report, is the difference between a bottom up and a top down approach to setting MFLs. The District has historically used a bottom up approach in setting MFLs, while the top down approach or hybrid has often been used when evaluating Water Resource Values (WRVs). In a bottom up approach, there are sufficient data available to define events that are protective. In the top down approach, there is an assumption that current conditions are protective (in the absence of observation to the contrary – i.e., in recovery) and that some water is available such that the MFL scenario still is protective.

An argument has been made in the MFL report, after examining various events associated with habitats, that there are not sufficient data for a bottom up approach. A comparative springs analysis was used and seems appropriate, but there may be benefit in using some elements of a top down approach as suggested in our comments.

- For example, referring to Figure 38 in the report, under baseline conditions, a low flow of 99.36 cfs for a 120-day duration was used for amphibian habitat protection and has a RI of > 33 years (i.e., it did not occur in the extended period of record data set). Is it protective to change that RI to 2.7 years? The District has concluded that it may not be protective and opted for a more conservative estimate of available water. Perhaps due to the site-specific conditions that result in a flat rating curve (large change in flow with small change in stage), a shorter duration event might be appropriate such as a 90-day or 60-day duration. This might be accomplished by comparing the proposed 6.8% reduction with what would be computed using a different duration for the same flow and RI.
- Similarly, consider an event duration of 30 days for the FH for cypress and connectivity.

We realize this is reverse engineering but if the District is comfortable with the stage and the return interval values (or the duration and return interval values) associated with an event, then the effect of using a 6.8% flow reduction as an MFL, rather than the larger values presented in the report, is to recognize (or consider) that at least one of the event parameters as presented in the draft report needs adjusting. Also, when evaluating WRVs, we have often set the duration of an event based on what has historically occurred (e.g., the typical duration of the annual maximum flood events for the period of record) and then evaluated the change in RI of incremental flow reductions – i.e., top down approach.

A second theme in the comments is that we have offered other possible target species that may be more sensitive to changes in flow (or stage) although it is not clear that event data are any more prevalent.

Finally, the District may also consider a relative flow-contribution approach and set (or compare) the MFL based on the nearest reach of the St. Johns River where an MFL has been set- near Deland for example. In other words, if the allowable withdrawal at Deland is 7%, then the allowable reduction at Alexander Springs is 7%.

page	paragraph	Comment - Hydrology
iii	4	The 1st sentence in this paragraph mentions separating withdrawal impacts from climate variations. Suggest adding a summary of rainfall characteristics to the report to provide a perspective for the baseline period. Climate data are decribed in Appendix B for periods of record not for the baseline period.
14	1	The watershed boundary should be added to Figure 1 to be consistent with text.
17	Figure 2	Add hydrographic features (i.e., Alexander Springs and traces for Alexander Springs Creek and other major tributaries). Check watershed boundary at mouth at St. Johns River where watershed boundaries would be expected to narrow to a point.
21	Figure 3	The addion of hydrographic features (i.e., Alexander Springs and traces for Alexander Springs Creek and other major tributaries) would be helpful and illustrate the distinct difference between surface- and groundwater inputs to the creek.
23	Figure 9	Add labels to identify locations (e.g. Tracy Canal gaging station)
33	Figure 15	Even though transects are discussed in a later section, it would be helpful to add the field transect locations, Tracy Canal gage, and labels to GIS graphic.
34	Figure 16	Even though transects are discussed in a later section, it would be helpful to add the field transect locations, Tracy Canal gage, and labels to GIS graphic.
43	4	Suggest more explicit definition of events – e.g., duration and return interval of events.
45	Figure 18	Difficult to read
46	2	In 2nd sentence, should read …ground elevations are transformed into "inundation" durations and ….
46	4	suggest changing hydrologic models are used to "quantify" instead of "understand"
47	3	Add a reference for the value "(0.7)".
51	Table 7	It is unclear why the component "Resource Leval Value" is rated "0" for certain WRVs (e.g., Recreation in & on the water") when the Execut Summary (page iii, paragraph 2) identifies the water bodies as legally designated OFW's and OFS's.
54	Table 7	Suggest revising the explanation of footnote #1 to "Evaluation of the level to which the resource value is at risk from flow reduction." If aut concur, then also suggest re-visiting the score and rationale associated with "Navigation - Level of resource risk"
81	5	Suggest revising the last sentence to read …and thereby controls "groundwater" discharge through the floodplain system.
82	2	suggest elaborating on what an infrequent low might look like (duration and frequency), could protect, and why it is either not present or n important. Also, in later comment note that the MFL FL is actually quite infrequent such that it has not occurred over the baseline POR.
82	2	revise 2nd sentence to read ….along Alexander Springs "Creek", …
83	3	what equation is used to transfer elevation from A-10 to Tracy Canal?
84	table 8	suggest including the baseline return interval to give perspective
84	table 8	what is the relationship between the third column in table 8, third column in table 9 of Appendix B, and column 6 of table 10 of Appendix B
85	table 8	none of the MFL frequent low events have occurred in the 33 year estimated record implying that they are not very frequent.
86	table 9	when I plot each cross section stage versus stage at Tracy Canal, A5 is associated with about 1.9 at Tracy (Appendix B Fig 15), which is belov measured values. A6 stage of 6.25 is about 4.2 at Tracy and A8 is about 4.6. A5 observation or translation seems off.

82-88		consider using a 30 day duration. If not explicitly to set MFL perhaps to point out that it better reflects the historical occurrence of the stag and RI than 7 days. Similarly, it is clear that the 7 day event occurs much more frequently than the metrics used in the MFL analysis - almos every year.
89-97		the MFL flow events of 120 days have never occurred - i.e., RI> 32 years. These are not frequent events. If something doesn't occur every years or so (infrequent event), it probably isn't driving anything important.
Appendix B	Figure 15	why were earlier data excluded from figure and regression equation
Appendix B		page numbers would help
Appendix B		the text says that regression equations were used sequentially. Does this mean that equations relating stage at each cross section to Tracy Canal were not developed. Wouldn't there be less error to use a relationship between each transect and Tracy Canal directly? (see attache
general		many of the map figures are difficult to read. Gages, springs, other prominent features should be clearly labeled.
		Comments - Ecology
14	3	The SJRWMD generally uses stage-based and not flow-based metrics for setting MFLs. However, for this spring, stage is quite insensitive to relativey large changes in flows. Perhaps the fact that this spring is an OFS/OFW can trigger a study to maintain flows so that nuisance spec such as *Lyngbya* cannot move upstream? (see also comments on pages 99 and 103).
15	Fig. 1	Can the spring itelf be shown on Figure?
16	2	Walsh (2009) at almost 60% urban does not seem to match Figure 2.
16	3	Interesting observation ("older" water increasing in disharge).....is there a reduction in recent rainfall or a diversion/reduction in water tabl contribution to perhaps explain this? (not necessarily a big item, but given the lack of development in the basin, somewhat of a "head-scratcher".
16	3	*Is that from?: Akaike, Hirotugu (December 1974). "A new look at the statistical model identification". IEEE Transactions on Automatic Contr* ***19*** *(6): 716–723. doi:10.1109/TAC.1974.1100705.*
16	3	Is there a correlation between higher N at lower flows?....if so, could argue the OFS designation would be harmed by lower flows? Am very concerned with the protection of the spring run habitat for several of the "listed" species (plants and animals).....Lyngbya could pose a significant threat if not prevented from upstream migration with adequate water velocities.
17	Fig. 2	Can the spring itelf be shown on Figure?
18	1	Concur with importance of xeric sand hills
21	Fig. 6	Can the spring itelf be shown on Figure?
22	4	Why are the missing data from TS Fay the most important? Are there missing data from drought periods? Do not see any gaps in the hydrograph in Figure 12.
26	Fig. 11	Is there an upward trend in stage elevation over time?
27	Tab. 3+4	From 60cfs up to 202cfs have only a 1.6-1.7' elevation change....stage-based metrics do not prove to be overly sensitive.
33	Fig. 15	Can the spring itelf be shown on Figure?
34	Fig. 16	Can the spring itelf be shown on Figure?

36	5	Lyngbya will impact rooted SAV…..will in turn impact species such as Dense Hydrobe Snail and Alexander Silt Snail (which utilize SAV)
37	4	Only Limpkin and Wood Stork for birds? Not any other wading birds?
39	Tab. 6	After examining all these species….the caddisflies and microcaddisflies and the 2 snail species could be impacted if their substrate were inv by Lyngbya. The Striped Newt reproductive success could be impacted if pools were no longer inundated to the baseline extent. Hydrologi regime preferences for Chapman's Sedge and Ocala Vetch may be important to their continued presence (more in the next comment).
42-50	all	The Event-Based Approach description is well-written and helpful. It allows the reader to understand the standard approach taken by SJRV Concur with a fellow reviewer about perhaps more term definition. This approach has served the District well for many MFL examinations date. After examining the Alexander Springs Report, it may be that, in this specific instance, alternative event parameters might be conside for analysis. Early on in the report (p. 14) the designation of the springs and spring run as OFW and OFS are stressed. On p. 37, the "Listed Species" are introduced. The report identifies 2 snail species that are deemed "Critically Endangered" in Florida. Alexander Springs is eithe their ONLY known location, or one of just a few springs in Florida. These 2 species require rooted aquatic vegetation. Lyngbya threatens th rooted vegetation. Hence, maintaining hydrologic flows that keep Lyngbya from moving upstream would appear to be a very relevant crite assess. The Big-cheeked Cave Crayfish is also an "S1" Listed Species. It appears to have only been found in Alexander Springs. Would not "flow-based" look at how to protect this species be important? The Striped Newt is a Federal Candidate for "Listing". It requires temporar pools.....the return interval selected for amphibians is 2.7 years.....in order to better assure reproductive success for the striped newt, is it possible to select criteria that require a longer return interval (or perhaps a different set of metrics that result in more total temporary pon inundated more often at intermediate time periods?) With respect to plants, the Ocala Vetch is considered Endangered in Florida. One of few known locations is along Alexander Springs/run. Could an elevation study of the occurrence of this species be completed to provide th range of elevations that this species occurs, then focus onthe protection of this set of elevations? Along similar lines, could not the elevatic range of the State Threatened Chapman's Sedge be determined within the Hydric Hammocks along Alexander Spring/run and this data be utilized to protect this species?
42-50	all	Several caddisflies and microcaddisflies are "listed" species. These require sand/hard substrate and high dissolved oxygen. These are "flow related" factors.
44	3	Do not forget to add the reference
44	3	Well thought out w/r/t the island eliminating seepage influence
49	Bullet #3	How are "ecological assessment info" causative factors in flows or levels? Are we talking about such things as pine plantation transpiration rates versus bahia grass pasture transpiration rates?
52	2nd BOX	Would not reduced rates of detrital transfer from reduced flows negatively impact OFS/OFW?
53	2nd BOX	Would not reduced rates of flow reduce ability of system to filter/flush/assimilate nutrients and increase opportunities for Lyngbya, hence impact OFS?
53	4th BOX	Would not reduced rates of flow negatively impact water quality and OFS/OFW?
55-80	all	Transect descriptions and Figures are well done
81	2	Concur with importance of seepage

83	2	Could this be a place to consider the protection of Chapman's Sedge and possibly Ocala Vetch? Chapman's Sedge is in hydric hammocks. A Minimum Frequent High examination of what it takes to adequately maintain the hydric hammocks where this plant species resides could b valuable.
86	1	So far I have not located the elevation data on the cypress knees…..cannot find it in the Appendices…..Table 9 shows a large elevation range…..would using the UCL or Maximum Elevation found for a cypress knee along a given transect be worthwhile examining?
87	3	Refers to Figure 35….how is cypress elevation measured at these reference sites? Knee elevation? Base elevation?.....if base elevation, hov these modified to reflect your knee elevations?
87	4	If the cypress knee UCL or MAX. elevation is used, does this reduce the allowable freeboard?
90	1	Could this be a place to consider the protection of the Critically Imeriled Ocala Vetch? OBL, in herbaceous wetlands long margins of spring and streams…..may want to consider protecting the upper elevation of the marshes to protect this species.
92	4	Buttonbush is a good choice…..but why use minimum elevations not mean?.....means were used for cypress.
93	4	Could mention the Striped Newt here as well…..a "listed species"….perhaps consider a substantially longer return interval for the drier inter to protect this listed species?
96	3	The text switches from pickerelweed max. elevation to min. elevation and back to max. Somewhat confusing as to what was used.
97	Fig. 38	Should add a descriptor as to what the top red line is referring to. This figure is not intuitively obvious. It appears that you are proposing a Frequent Low (NOT an Infrequent Low) that has never been measured to date? Based upon the dots in Fig. 38, wouldn't a Frequent Low be expected at around 112cfs or so?
99	1	Could expound upon the unique "protection" of this spring due to its location and its OFS (do not allow decreases in Wqual and flows that v allow Lyngbya to increase its distribution) + a few sentences on those "listed species" most sensitive to flow and stage decreases.
103	4	This may be a site where one or more of the "flow" based WRV criteria are considered for use.
General		This system is one of the most pristine in the State. This system supports multiple "listed species" that are flow/stage sensitive. This syster an OFW/OFS, with a "no water quality degradation" requirement. This system has a documented threat from Lyngbya. Perhaps the select of "event" criteria using a top-down approach to ensure the protection of these "listed species" would be a valuable next step/exercise.
AppA-p2	1	Do not see anything about cypress knee elevation methods….yet this method was used as part of the report.
AppB-p7	Table 3	ET is about 60"……
AppB-p8	1	Remember to change the ERROR STATEMENTS
AppB-p9	Figs. 6+7	Was the >200cfs discharge in 1985? After Elena?...Note the stage at that time was around 10.75'……Note the discharge never again comes close to 200 cfs,yet the stage frequently goes above 11.0' in stage.
AppB-p12	1	Remember to change the ERROR STATEMENTS
AppB-p21	Fig. 17	Can the spring itself be shown on the figure?
AppB-p22	Fig.18	Legend for abbreviations, such as"MD".....what happened to DSS that reduced pumpage from 5mgd down to 1 mgd?