# APPENDIX 1D

Dunn, Salsano & Vergara, Consulting, LLC, Barnes, Ferland and Associates, Inc., SDII Global, and West Consultants, Inc. 2016. Pithlachascotee River MFLs peer review. Prepared for the Southwest Florida Water Management District. Brooksville, Florida.

# Pithlachascotee River MFLs Peer Review

**PREPARED FOR**

Southwest Florida
Water Management District
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## Southwest Florida Water Management District

**PREPARED BY**

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**NOVEMBER 30, 2016**

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# INTRODUCTION

## OVERVIEW

The Southwest Florida Water Management District (District) has contracted with a panel of three experts to provide a technical peer review of its proposed minimum flows and levels (MFLs) for the Pithlachascotee River in Pasco County, Florida.

These proposed MFLs for the Pithlachascotee River are described by the District in a document titled *Proposed Minimum Flows for the Pithlachascotee River-Revised Draft Report for Peer Review*, August 29 2016, with a separate volume of appendices, also dated August 29, 2016. These MFLs include only minimum flows for the river.

The report is an updated version of an earlier draft produced by the District in 2014. The current draft addresses review comments provided by the Florida Department of Environmental Protection (FDEP), the Florida Fish and Wildlife Conservation Commission (FFWCC), and Tampa Bay Water (TBW). Those agency comments and the District staff's responses to those comments are included as appendices.

The District proposes two sets of minimum flows one for the upper freshwater section of the system and another for the lower, tidally influenced, estuarine section. The proposed minimum flows were developed using a percent-of-flow (POF) approach for three seasonal blocks, and with specific low and high flow thresholds.

A baseline flow record for the river was developed for the U. S. Geological Survey (USGS) gage site - Pithlachascotee River Near New Port Richey. The existing flow record was corrected for existing withdrawal impacts. The corrected baseline was then used to develop minimum flow recommendations using a POF approach. Using this POF approach, potential changes to critical environmental values, such as habitat, associated with baseline flow reductions were assessed to identify minimum flow recommendations. Other thresholds were developed in similar fashion including minimum low flow (MLF) and minimum high flow (MHF) designed specifically to address environmental features of the river's flow regime. Critical resources identified for the upper freshwater section of the river included fish passage, instream habitats for fish and invertebrates, and floodplain inundation. For the estuarine section resource evaluations were focused on potential changes to salinity distributions for surface/shoreline, bottom and water column habitats.

The District's proposed minimum flows for the upper freshwater segment of the river allow for withdrawal reductions of up to 18% of daily flow for the spring dry season (Block 1), 17% of daily flow in the fall and winter moderate flow season (Block 2), and up to 16% for the summer wet season (Block 3). In addition, to maintain sufficient inundation of the floodplain system in the upper river when daily flows in Block 3 are greater than a MHF threshold of 50 cfs, the allowable flow reduction is limited to 9% of the daily flow. A MLFs threshold of 25 cfs is applicable to potential surface water withdrawals in all seasonal blocks.

Minimum flows for the lower estuarine section of the river include withdrawal related reductions of up to 25% of daily flow in all seasonal blocks up to the MHF threshold of 60 cfs. Flow reductions of up to 35% would be allowed when the four-day average of the daily flow exceeds the MHF threshold of 60 cfs.

The District concludes that this minimum flow regime for the upper and lower sections are protective of all relevant environmental values required to be considered when establishing MFLs.

The District is committed to the independent scientific peer review of all data, methodologies, and models used in the establishment of MFLs. Accordingly, the District voluntarily engaged the services of three independent experts with collective expertise in the fields of hydrology, hydrogeology, limnology, and biology. These experts served as a peer review panel (panel) to evaluate and review information used for development of recommended MFLs for the Pithlachascotee River.

The panel includes

- Raymond Walton, Ph.D., P.E. D.WRE, WEST Consultants
- Sam Upchurch, Ph.D., P.G., Sdii Global Corporation
- Bill Dunn, Ph.D., DSV Consulting

Dr. Bill Dunn served as the panel's chair.

## PEER REVIEW PANEL'S SCOPE OF WORK

This document provides a summary of the panel's completion of its contracted scope of work, covering the following five major tasks.

Task 1—Complete conflict of interest forms.

Task 2—Review draft District MFL documents on proposed minimum flows for the Pithlachascotee River, and review relevant supporting documents.

Task 3-1—Participate in publicly noticed project kick-off meeting at District Headquarters (DHQ) in Brooksville, and a publicly noticed field trip to sites on the Pithlachascotee River.

Task 3-2—Participate in a publicly noticed panel meeting at DHQ in Brooksville.

Task 3-3—Participate in three publicly noticed teleconferences facilitated by the District to support peer review panel discussions and work efforts

Task 4—Post written review comments on District's Web Board, and collaboratively develop a single final peer review panel report for submission to District.

Task 5—Post meeting agenda, summaries and other relevant comments to the Web Board.

With the submittal of this document, the panel's final report, Tasks 1 through 5 of the panel's work effort is complete. Tasks 2, 3-1, and 3-2 were accomplished on Friday October 21, 2016. Three publicly noticed teleconferences hosted by District staff took place on October 28, November 14 and November 28. For each meeting an agenda and meeting summary are posted on the Web Board.

## PEER REVIEW PANEL'S APPROACH

Section 373.042, Florida Statutes (F.S.), provides that minimum flows for a given watercourse represent the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area and the minimum water level is the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

Section 373.042, F.S. also provides that MFLs shall be calculated using the best information available, that the Governing Board shall consider and may provide for non-consumptive uses in the establishment of MFLs, and when appropriate, MFLs may be calculated to reflect seasonal variation. The law also requires that when establishing MFLs, changes and structural alterations to watersheds, surface waters, and aquifers shall also be considered (Section 373.0421, F.S.). The State Water Resource Implementation Rule (Chapter 62-40, Florida Administrative Code) includes additional guidance for the establishment of MFLs, providing that:

> "…consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows or levels, and environmental values associated with coastal, estuarine, aquatic, and wetlands ecology, including:
>
> a. Recreation, in and on the water;
> b. Fish and wildlife habitats and the passage of fish;
> c. Estuarine resources;
> d. Transfer of detrital material;
> e. Maintenance of freshwater storage and supply;
> f. Aesthetic and scenic attributes;
> g. Filtration and absorption of nutrients and other pollutants;
> h. Sediment loads;
> i. Water quality; and
> j. Navigation."

Section 373.042, F.S., also addresses independent scientific peer review of MFLs, specifying the review of all scientific or technical data, methodologies, and models including all scientific and technical assumptions employed in each model, used to establish a minimum flow or minimum water level. In addition, the law requires that FDEP or the governing board shall give significant weight to the final peer review panel report when establishing the minimum flow or minimum water level.

This report utilizes a tabular template for each of the three peer reviewers to meet the District's peer review requirements. Included as Appendices are two sets of summary tables to capture the key elements of each technical review. The first set of tables, the review comments tables, summarizes each panel member's individual general and specific review comments along with any recommended actions (Appendix Tables 1-1, 1-2, and 1-3). Each comment is treated as a separate row in these tables. The second set of tables, the peer review assessment criteria tables, include each panel member's comments concerning the District's peer review assessment criteria, which are described in the following outline (Appendix Tables 2-1, 2-2, and 2-3).

The District's peer review assessment criteria, addressed by each panel member in the second set of appended tables are as follows:

(A) Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented.

1. Supporting Data and Information: Review the relevant data and information that support the conclusions made in the report to determine:

   (a) the data and information used was properly collected;

   (b) reasonable quality assurance assessments were performed on the data and information;

   (c) exclusion of available data from analyses was justified; and

   (d) the data used was the best information available.

   **Note:** The peer review panelists are not expected to provide independent review of standard procedures used as part of institutional programs that have been established for collecting data, such as the USGS and District hydrologic monitoring networks.

2. Technical Assumptions: Review the technical assumptions inherent to the analysis used in the Pithlachascotee River MFLs report to determine whether:

   a. the assumptions are clearly stated, reasonable and consistent with the best information available;

   b. the assumptions were eliminated to the extent possible, based on available information; and

   c. other analyses that would require fewer assumptions but provide comparable or better results are available.

3. Procedures and Analyses: Review the procedures and analyses used in the Pithlachascotee River MFLs report to determine whether:

   a. the procedures and analyses were appropriate and reasonable, based on the best information available.

   b. the procedures and analyses incorporate all necessary factors;

   c. the procedures and analyses were correctly applied;

   d. limitations and imprecisions in the information were reasonably handled;

   e. the procedures and analyses are repeatable; and

   f. conclusions based on the procedures and analyses are supported by the data.

(B) If a proposed method used in the Pithlachascotee River MFLs report is not scientifically reasonable, the Peer Reviewers shall:

1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies;

2. Determine if the identified deficiencies can be remedied.

3. If the identified deficiencies can be remedied, then describe the necessary remedies and an estimate of time and effort required to develop and implement each remedy.

4. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable. If an alternative method is identified, provide a qualitative assessment of the relative strengths and weaknesses of the alternative method(s) and the effort required to collect data necessary for implementation of the alternative methods.

(C) If a given method or analyses used in the Pithlachascotee River MFLs report is scientifically reasonable, but an alternative method is preferable, the Peer Reviewers shall:

1. List and describe the alternative scientifically reasonable method(s), and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s).

# SUMMARY OF REVIEW PANEL COMMENTS/ QUESTIONS

As described, each panelist's detailed review comments are Included in Appendices as a set of two summary tables that capture the two key elements of each technical review. The first set of tables, the review comments tables, summarize each panel member's individual general and specific review comments on the MFL document along with any recommended actions (Appendix Tables 1-1, 1-2, and 1-3). Each comment is treated as a separate row in these tables. The second set of tables provide each panel member's conclusions for each of the District's peer review assessment criteria (Appendix Tables 2-1, 2-2, and 2-3).

As the three panelists conducted their individual reviews of the subject MFLs report and appendices, sets of questions/comments from each panelist were posted to the Web Board. District staff posted responses to these questions/comments as soon as they could be developed. The panelists' questions/comments as well as District staff responses are included on the appropriate tables included in the Appendix.

The three panelists are in general agreement that District staff has developed MFLs recommendations based on best available data. The three panelists also agree with the report's basic assumptions, methods of data collection, analysis and presentation, development and selection of minimum flows, and conclusions as presented in the MFLs report. The three, however, also collectively expressed concerns for the effect of uncertainty of these data (and subsequent analyses) on conclusions regarding the proposed minimum flows. Characterizing the sources of uncertainty, the magnitude of each, and their individual and collective effect on conclusions should be part of every MFLs setting process. Such analysis of uncertainty is not addressed in an explicit and integrated approach in the District's report. Panelists agree that a critical part of the MFLs process should be the development and implementation of a comprehensive adaptive management plan that, among other things, would reduce data uncertainty in the future. The panelists are particularly concerned with the uncertainty in method for estimating the fish passage criterion for the upper section of the river. For this Dr. Walton has made some very specific recommendations for reducing the uncertainty in this estimate. Finally, the panelists are also in agreement that some sections of the District's MFLs report do not flow as well as it should to be easily understandable by all readers. On this point the detailed comments in Appendix Tables 1-1, 1-2, and 1-3 highlight specific sections of the report in need of clarification.

Following is a summary of the most significant concerns expressed by each panelist. Of the three panelists, only Dr. Walton has reviewed and addressed the District staff comments.

# SUMMARY OF COMMENTS/QUESTIONS SUBMITTED BY DR. SAM UPCHURCH

Dr. Upchurch recognizes that setting minimum flows and levels (MFLs) for a low-flow stream such as the Pithlachascotee River is difficult because of several confounding factors. These include:

1. The river is a low-flow stream for most of its reach;
2. Regional wellfields are known to have impacted flows, beginning prior to systematic hydrologic data collection; therefore, pre-development hydrologic data are unavailable;
3. The available hydrologic data are poor to good with data gaps and possible uncertainties resulting in concerns for creating an adequate time series;
4. Non-tidal reaches of the river experience periods of zero to minimal flow while the tidal reaches of the river are subject to tidal stresses, storm surges and other maritime events;
5. Modeling techniques commonly utilized to synthesize and/or characterize hydrologic data are likely not robust when representing hydrologic extremes, such as extreme low and high flows; and
6. Implementation of the Pithlachascotee River MFLs involves characterizing hydrologic regimes for processes that operate on different time scales: (1) rainfall-runoff events that function on the time scale of hours to weeks and (2) groundwater discharge to the river that varies on a time scale of moths to years.

Dr. Upchurch's review of the MFLs report focuses on the quality of the hydrologic data, methods used to characterize the data, and MFLs development. The review included study of the primary MFLs document entitled "Proposed Minimum Flows for the Pithlachascotee River – Revised Draft Report for Peer Review" dated August 29, 2016, and developed by the Southwest Florida Water Management District (District). In addition, relevant appendices included in "Appendices for Proposed Minimum Flows for the Pithlachascotee River – Revised Draft Report for Peer Review" were reviewed.

Dr. Upchurch asserts that any document that sets the MFLs for a water body should be easily understood by lay stake holders as well as scientists, engineers, and other water managers affected by the MFLs. To this end, the report should either present or reference all relevant data, techniques utilized to develop the MFLs, and supporting investigations and reports. The actual data can be presented in appendices, as was done in this MFLs report, or in easily accessed publications. The report, however, should (1) lay out the sources, quality, and uncertainties concerning all data, (2) explain the reasoning and assumptions used in MFL development, and (3) present all conclusions in a simple fashion. Transitions between topics should flow seamlessly, and there should be no unexplained leaps in logic. Finally, the process of MFLs implementation should be explained so that lay persons and entities subject to the MFLs clearly understand the intent of the MFLs and management considerations that will be utilized.

Dr. Upchurch's comments indicate that the District's MFLs report is well written and use of appendices is appropriate. However, he has identified the following concerns that apply to the entire document.

1. There are logic gaps and transitions, which are noted in the tables, that need to be closed. These gaps are most pronounced in the early portions of the report where the measurement data and use of the Integrated Flow Model (IFM) are presented.
2. The District needs to build a case early in the report as to what constitutes “best available data” as defined in Chapter 373 F.S. There should be a thorough discussion of the quality of the measurement data and the uncertainties that result from use of these data. Building the case for use of the IFM as a data source constitutes a logic jump because the quality of the measured, as opposed to synthesized, data remains unclear.
3. The report begins with a discussion of the entire Pithlachascotee River basin, including Crews Lake and the drainage upstream from the lake. It then rightly limits the MFLs to the river downstream from Crews Lake and the Fivay Junction gage. There needs to be an explanation as to why the Crews Lake reach of the river is excluded, including noting (and referencing) the separate MFLs being developed for Crews Lake. It should also be noted that the Crews Lake reach of the river is within an internally drained area from which groundwater typically goes to coast rather than the river. Therefore, there is a basis for managing the lake and its tributaries separately from the river reach.

   This comment is a segue to a broader discussion that should be included in the report. With implementation of the MFLs for Crews Lake and the Pithlachascotee River and the permit conditions for the wellfields that are likely to affect flows in the river, few water bodies in Florida are as so highly managed and constrained. While all of these water-management instruments are written to stand alone, they overlap in their effects on the river. A section describing the effects of these water-management tools on water availability in the river should go a long way towards (1) mitigating concerns about river flows and the environment and (2) data uncertainties.
4. Finally, the report should set up a final chapter explaining how the District will implement MFLs that deal with natural low and high flows, surface-water withdrawals that operate on short time scales, and groundwater withdrawals that operate on the time scale of months to years. This discussion is a great place to present the constraints on groundwater extraction and cooperation with Tampa Bay Water.

## SUMMARY OF COMMENTS/QUESTIONS SUBMITTED BY DR. BILL DUNN

Dr. Dunn's review indicates that the District has done a commendable job in developing the proposed minimum flows. He agrees with basic assumptions, methods of data collection, data analysis and presentation, development and selection of minimum flows, and conclusions as presented in the MFLs report. However, managing uncertainty, which should be part of every MFLs setting process, is not addressed in an explicit and integrated approach in the District's report. Dr. Dunn believes the management of uncertainty is best accomplished as an adaptive management (AM) process and suggests that a comprehensive assessment of major sources of uncertainty and the magnitude of each source should be addressed in an explicit plan to manage the effects of uncertainty and reduce its impacts in the future using an AM approach.

On the topic of AM, Dr. Dunn points out that by their very nature MFLs are adaptive strategies for management of the District's critically important water bodies. Each adopted MFL, as well as the District's entire MFLs program define an adaptive, learn as you go management strategy. The District would benefit from an explicit adaptive management approach that is based on identifying and addressing elements of uncertainty.

The field of AM has been developed over the last several decades specifically to deal with the effects of uncertainty in making and implementing resource management decisions, such as the management of water resources through MFLs. The basic tenets of AM are:

- All resource management decisions and resource management plans have elements of uncertainty; yet, management decisions must be made.
- Decisions should be made based on the best science, knowledge, and information available, but clearly identifying sources of uncertainty and accounting for their range of impact on predicted outcomes
- Uncertainty can be characterized, its effects can be described, and it can be managed, thus allowing prudent water resource decisions using the best available information.
- Monitoring of the condition of the resource of concern and its response to change is necessary in order to make better-informed future management decisions.

AM framework has become embedded in large ecosystem management and restoration programs for the Florida Everglades, Colorado River, California Bay-Delta program, Delaware River estuarine fisheries, and many other water resource management programs across North America. The framework for AM is a goal-seeking, six-step adaptive feedback process as follows.

1. Assess the problem
2. Design a solution
3. Implement the solution's management plan (e.g. the minimum flows)
4. Monitor the resources of concern
5. Evaluate resource health/condition, and develop resource management adjustments as needed
6. Implement adjustments to the minimum flow regime

As an example, an AM approach integrated into the minimum flow regime for the Pithlachascotee Rivers would include:

- Use the proposed minimum flows as the initial condition, representing distillation of the best available information and analysis.

- Understand, describe, and quantify the sources of uncertainty affecting development of the minimum flows.
- Implement specific monitoring and compliance requirements that will reduce the effect of uncertainty and improve management decisions in the future.
- Collect and analyze monitoring data.
- Use data, analytical tools, and models to evaluate responses of resource values being tracked.
- Assess whether minimum levels are being met. If not, then revise relevant portions of the minimum flows.
- Implement changes to minimum flows as needed.

This AM approach can also encompass SWFWMD's MFLs compliance assessments done as part of both water use permitting decisions and the District's five-year water supply planning process. For MFLs, the congruence between the development of protective flows and levels for water bodies and the classic AM approach provides a framework for prudent use and protection of water resources while also providing goal seeking, adaptive strategies for dealing with uncertainty.

Dr. Dunn also strongly recommends that the District strengthen the technical basis for MFLs beyond its reliance on a 15 percent allowable change in each habitat condition. Dr. Dunn acknowledges that the 15 percent change metric has much merit, has been strongly and justifiably supported in many peer reviews, and has been successfully applied to many riverine MFLs in the District. The method is, however, based on a general presumption that a 15 percent change in the given habitat condition will not result in harm to the water resource, ecological, and human use values of the riverine system. Dr. Dunn notes that specific data-based protective criteria have been developed by other Florida water management districts. He also highlights that the District has also applied this approach in developing some minimum flows for riverine systems, such as the MLF for fish passage for the Pithlachascotee River. Dr. Dunn strongly recommends that whenever possible MFLs should be based on statistically defined protective hydrological events composed of 1) a magnitude (flow and/or level), 2) continuous duration for the specific inundation or drying period, and 3) with a return interval. He points out that the St. Johns River Water Management District has defined such hydrologic event criteria for most of the water resource values of concern that the District focused on for the upper and lower sections of the Pithlachascotee River. Thus, Dr. Dunn points out that there exists a great deal of peer reviewed research, and application of event based MFLs that the District can build upon.

## SUMMARY OF COMMENTS/QUESTIONS SUBMITTED BY DR. RAYMOND WALTON

Overall, Dr. Walton felt that best available data were used for the hydrologic and hydraulic analyses, and that generally appropriate evaluation analyses were performed. His concerns are summarized in the next paragraphs and in the Tables 1-3 and 2-3 in the appendices.

Dr. Walton's comments 2 through 7 in Appendix Table 1-3 address questions regarding the isohaline regression analysis that is used by the District to develop minimum flows for the lower, estuarine section of the river. Overall, the District used best available data and appropriate methods, except as presented in Appendix Table 1-3 below. As such, the resolution of the questions/comments raised by Dr. Walton can affect the conclusions of the District report, specifically the minimum flows proposed for the lower Pithlachascotee River. We note, however, that resolving this uncertainty is far less important than resolving the uncertainty in the hydraulic modeling of the upper river as the lower river minimum flows are much larger than the minimum flows in the upper river.

Dr. Walton's comments 8 through 12 in Appendix Table 1-3 raise important questions regarding the HEC-RAS modeling analysis, which is critical to the development of the minimum flow regime for the upper, freshwater section of the river. Again, best available data and appropriate methods were used. However, he is concerned about the level of uncertainty in the minimum flow resulting from the hydraulic model analyses, including the systematic bias seen in the calibration of the HEC-RAS hydraulic model. Dr. Walton particularly notes potential effects on the fish passage criterion, which defines the recommended MLF. Resolving the HEC-RAS issues raised by Dr. Walton is most critical because the minimum flows proposed for the upper river appear to be more sensitive, and thus critical for river system management, than the minimum flows for the lower river.

The concern is whether the HEC-RAS hydraulic model is sufficiently accurate to determine that a minimum flow of 25 cfs achieves the minimum depth of 0.6 feet throughout the upper river. We recommend that the hydraulic model be revisited to reduce the level of uncertainty in the fish passage analysis by:

- Measuring 4-6 water surface profiles along the upper reach for a range of flows between 10-50 cfs.
- Consider whether additional cross sections are needed to improve the accuracy and adequacy of the model's geometry
- Re-calibrate and validate the hydraulic model using the new information, specifically to remove the systematic bias seen in the current model calibration.
- Re-do the minimum flow analyses for the upper river, and incorporate into the MFL report and appendices.

# REFERENCES

Geurink, J. S. and R. Basso. 2013. Development, calibration, and evaluation of the Integrated Northern Tampa Bay Hydrologic Model. Report prepared for Tampa Bay Water, Clearwater, Florida, and the Southwest Florida Water Management District, Brooksville, Florida.

Munson, A. B. and Delfino, J.J. 2007. Minimum wet-season flows and levels in southwest Florida. Journal of the American Water Resources Association 43: 522-532.

SWFWMD 2016 a. Proposed Minimum Flows for the Pithlachascotee River—Revise Draft Report for Peer Review. Southwest Florida Water Management District, Brooksville, Florida

SWFWMD 2016b. Appendices for Proposed Minimum Flows for the Pithlachascotee River—Revise Draft Report for Peer Review. Southwest Florida Water Management District, Brooksville, Florida

# APPENDICES

# Appendix A
# Table 1-1. Upchurch Review Comments on MFL Documents

# TABLE 1-1. UPCHURCH REVIEW COMMENTS ON MFL DOCUMENTS

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-1, Upchurch | | To be completed by Report Author(s) |
|---|---|---|---|---|---|
| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| 1 | General comment | No | The District and its consultants have created a succinct and useful MFL basis report. I like the use of appendices to present the results details. This style makes review much easier.<br>There are editorial issues that need to be corrected, and the maps that utilize the aerial photograph as a background are very hard to read. There are also graphs where the se lection of background and line colors makes them unreadable. | I suggest that the photograph be omitted and a few important landmarks (i.e., Rowan Road) be provided on a blank background for the maps. | Response: Doug Leeper, MFLs Program Lead, SWFWMD. Editorial comments and formatting suggestions provided by the panel will be considered by staff during the report revision process. |
| 2 | General comment | No | Recognizing that Chapter 373 F.S. allows for use of "best available data" for MFLs development, the case for use of the integrated model as a source of data has not been completely addressed as "best available data." The raw discharge data are not adequately addressed in the report or appendices.<br><br>It is understood that use of the integrated model to simulate pre-development flow in the river is the best source of pre-development information. However, if the simulation of flow within the 10-year interval (a short time frame for MFLs development) that was modeled is problematic, then the flow simulated by eliminating the groundwater pumpage component in the model will also be problematic. | The raw discharge data should be presented with an analysis of outliers, data gaps, and indications of cyclicity (season al, AMO related, etc.). It should be made clear where these data have been utilized, including 1) relationship of the modeled, predevelopment discharge and current discharge to these data, 2) use of the physical data to verify the integrated model, including analyses of residuals and goodness of fit, and 3) comparison of the modeled data to the physical data showing relationship of the modeled data to hydrologic cycles, etc.<br><br>The modeled data should be compared to the actual data, outliers and residuals should be analyzed, and the context of the modeled data | Response: Ron Basso, Chief Hydrogeologist, SWFWMD. Tampa Bay Water and SWFWMD have collaborated on the calibration and use of the INTB model which was successfully peer reviewed in 2013 by a three-member panel of model experts with one member of the model peer review panel (Ray Walton) currently serving as a panelist for the Pithlachascotee MFLs peer review. We began this collaboration in the late-1990s as a result of litigation between the agencies over wellfield impacts and the partnership plan between the two agencies that reduced the 11 central system facility withdrawals from 150 mgd to a maximum of 90 mgd. Both SWFWMD and TBW agreed to work together to develop one model to assess the hydrologic conditions in the Tampa Bay wellfield area. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-1, Upchurch | | To be completed by Report Author(s) |
|---|---|---|---|---|---|
| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| | | | | relative to seasonal and long-term hydrologic cycles should be explicitly provided.<br><br>Finally, explain to the reader what portions of the physical data and modeled flows constitute "best available data" and why. Explain why a 10-year time series is suitable for MFLs development.<br><br>Response Ron Basso Comment: I realize that this is the case. My issue is that none of the data is presented or evaluated in this report. I'm not suggesting that the fine work done by the District and TBW be repeated or even critiqued. I am suggesting that the report should stand alone and not require the reader to review the work previously completed. | A complete assessment of the calibration and verification of the model from 1989-2006 is contained with Geurink and Basso (2013). We can make this report available for the Panel's review if requested. We can also provide the peer review report on the INTB application that was completed by Ray Walton, EJ Wexler, and Norm Crawford in 2013. Based on this information, we (TBW and SWFWMD) believe that the INTB model is a part of the "best available information" discussed in the statute.<br><br>We recognize the difficulties in numerical model prediction results for a predevelopment (pumps off) condition. In fact, TBW has a proposed study with the University of South Florida to examine the INTB "pumps off" simulation to note any deficiencies with that approach. No predevelopment calibration was performed with the INTB model as this would be difficult due to lack of observed data prior to the 1930s in the area. Withdrawals were initiated at the Cosme-Odessa wellfield in the 1930s. The flows recorded by the USGS at the NPR gage only go back to the 1960sand Eldridge-Wilde and the Section 21 wellfields were already pumping by that time.<br>One of the limitations discussed in the response to questions posed by Ray Walton is the rainfall that actually fell during the simulation period from 1996-2006 –which was drier than average. Hundreds of rainfall realizations conducted by |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-1, Upchurch | | To be completed by Report Author(s) |
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| | | | | | TBW using the INTB model for the same period based on the historical range of rainfall in the area suggest that predicted impact to flow can vary by 0.6 cfs depending upon the climatic conditions of the period.<br><br>The climatic variability, uncertainty in the "pumps off" simulation, model error, and varying pumping distributions all play a role in predicted impacts to the system. These factors are why staff did not exclusively rely on model results but determined that the minimum flows were being met with supplemental data as measured in the field over the last 5-6 years. Flow observations and aquifer water levels in the area both show that they are similar to background conditions during the last 5 to 6 years.<br>We think the 10-year time period used for MFLs development is suitable because it to incorporated extremes in the climatic record, including the 2000 drought and the 2004 rainfall associated with multiple hurricanes that serve as surrogate for variation expected over a much longer time-frame. Due to the complexities previously discussed, it represented a suitable period to conduct the MFLs analysis, given the long history of wellfield withdrawals in the area and limitations of predevelopment data. |
| 3 | General comment | No | The multiple linear regression analyses used to simulate flow need to be better explained and analyzed. For example, one of the two regression equations presented in the report | Explain what data were used in the regressions, model-derived or actual? I may have missed it, but please be sure explanation is provided and that residuals analyses are provided. | Response:<br>Doug Leeper, MFLs Program Lead, SWFWMD<br>Staff is in the process of discussing the panelist's questions with the consulting firm, Janicki |

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| | | | and appendix utilizes 150-day lagged pumpage from regional wellfields as a variable. How was this term identified? Did you use stepwise multiple regression? What were the variables that were eliminated? Use of a 150-day lagged term suggests that the signal from a pumping event arrives at the river in 150 days. While this lag may well be reasonable, it suggests a management problem.<br><br>The MFL is written is such a way as to allow for management of surface water withdrawals over short time intervals. The groundwater component with a 150-day delay suggests a different management process. The report should, but does not, address each of these management issues and how they will be implemented. | If it takes 150 days for actions at the nearby wellfields to be manifested in river flow, describe how this delay will be anticipated? Finally, how will these management issues be considered vis a vis low flow during droughts?<br><br>Response to Doug Leeper: Provide a short paragraph explaining to the reader, how you got there. | Environmental, Inc., that developed a regression for predicting baseline flows. Interim responses to the questions are provided below; development of additional responses is ongoing. The 150-day lagged term for withdrawals from the Starkey-North Pasco wellfield was used for developing Equation 1 in the draft minimum flows report was based on consideration of various lag term, including 7-day, 14-day, 30-day, 60-day, 90-day, 120-day, 150-day and 180-day moving average pumping values for individual wellfields in the area. Wellfield pumping values for the various lag-times and wellfield combinations (Cross Bar-Cypress Creek, Eldridge-Wilde, South Pasco, Section 21 and Cosme-Odessa) that did not exhibit statistical significance were excluded from model development. Staff notes that as explained in the draft report, elimination of the lagged-term for combined withdrawals from the Starkey and North Pasco wellfields (see Equation 2 in the draft report) yielded predicted baseline flows that were similar to those predicted using Equation 1. For development of both regression equations, modeled values derived from INTB model simulations were used for baseline and impacted flows. For the lagged-pumpage term in Equation 1, measured pumpage data were used. For predicting of baseline flows, measured (i.e., reported or observed) flows at the NPR gage were substituted for INTB-modeled impacted flows in Equation 1 and were used along with |

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| | | | | | reported lagged-pumpage values to predict baseline flows. Very low baseline flows, specifically those less than 1.6 cfs were, however, predicted using values derived from the INTB model simulation.<br>Minimum flow rules are developed to specify daily withdrawal rates that can be used for short-term surface water withdrawal management and associated water use permit conditions. In contrast, based on the more diffuse and temporally variable effects of groundwater withdrawals on streamflow, evaluations for requested groundwater withdrawals and for assessment regarding whether minimum flows are being met are conducted on a long-term basis. That is, they are typically conducted using long-term mean and/or median flows predicted with numerical or other models with supporting evidence provided by monitoring data. Drought conditions are expected to be incorporated into analyses supporting minimum flow development, and as noted in response to item 1 above, this was the case for the analyses supporting development of proposed minimum flows for the Pithlachascotee River. In addition, District rules include provisions for management actions that can be implemented during water shortages that may occur as a result of drought or other factors. |
| 4 | General comment | No | The MFL is being developed for the Pithlachascotee downstream from Crews Lake. Crews Lake, the Mazaryktown Canal, Jumping Gully and portions of the Cross Bar Ranch | Add a discussion of the reason for exclusion of the basin upstream of the Crews Lake outfall from this MFL. The Crews Lake MFL should be cited, and I think it would be helpful to the reader | Response: Ron Basso, Chief Hydrogeologist and Doug Leeper, MFLs Program Lead, SWFWMD. There is some ambiguity in reference to the actual drainage basin delineation, as some |

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| | | | Wellfield are within the river basin (Figure 2-2). There should be a discussion of the reason for exclusion of the basin upstream of the Crews Lake outfall from this MFL. The Crews Lake MFL should be cited, and I think it would be helpful to the reader to explain that the basin upstream from the Crews Lake outfall is part of a second groundwater basin with internal drainage that flows to the coast, not the river. | to explain that the basin upstream from the Crews Lake outfall is part of a second groundwater basin with internal drainage that flows to the coast, not the river.<br>This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | reference sources terminate the drainage basin Prior to Crews Lake (see figure below).<br>Much of the system becomes internally drained under deep water table conditions near Crews Lake and areas surrounding the lake. This transition area becomes a mostly unconfined Floridan aquifer, deep water table, highly karst-dominated, and high recharge environment near the boundary of the Central and Northern Groundwater Basins which is represented well in the INTB model. Regardless of the drainage basin delineation, the INTB model covers a 4,000 square mile area. Groundwater impact scenarios were simulated by zeroing out all withdrawals in the Central Groundwater Basin (included all of Cross Bar wellfield withdrawals even though northern portion of the wellfield is outside the basin). We can add the discussion to the report regarding groundwater basin boundaries and the change in the system going from a shallow water table, leaky Upper Floridan aquifer (UFA) to a deep water table largely unconfined UFA. The District is in the process of establishing minimum levels for Crews Lake and reference to these MFLs or their ongoing development will be incorporated into revisions of the draft report addressing minimum flows development for the Pithlachascotee River. Other established MFLs located in the basin upstream of Crews Lake, including those adopted for several lakes and a few isolated wetlands in the southern portion of the Cross Bar |

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| | | | | | Ranch wellfield will also be identified in the revised document. |
| 5 | 10, P 2 | No | There should be a comma after river in first sentence. | Insert comma | |
| 6 | 10, P 4 | No | Bay is misspelled | Change Bat to Bay | |
| 7 | 15, P 4 | No | The 15 percent change criterion should be referenced. | Reference Section 1.4.6. Consider moving this section up to immediately deal with the 15 percent criterion when first mentioned. | |
| 8 | 16, P 1 | No | I like this discussion of conditions. However, subsequent sections do not adequately discuss the AMO, etc. in the context of the measured or modeled data. This lack of discussion cuts to my concerns about extreme flows and cycles in the data sets. | Need to discuss the measured and modeled time-series data in terms of adequacy and representation as best available data. There is a need for a discussion of extreme conditions and patterns in the measured and modeled data. | |
| 9 | 17, S 1.4.6 | No | This is the discussion of the 15 percent criterion that should have been presented on page 15. The last paragraph is good in that it allows for groundwater withdrawals. | See above. | |
| 10 | 18, P 3 | No | "…continuing to us the 15…. Use is misspelled. | Change us to use. | |
| 11 | 20, S 2.2 | No | This section is a good discussion of the entire Pithlachascotee basin. The section tends to mislead the reader later on, however. There should be a discussion of the hydrologic reasons why the Crews Lake reach is not considered in the MFL here. See general comments. | Add discussion. | |
| 12 | 21ff, S 2.3 | Yes | The only rainfall data presented is a graph showing the average monthly rainfall. The reader | Add discussion. | |

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| | | | is not told what gage data are included and how close the gage(s) is to the Pithlachascotee. Also, there is no discussion of long-term rainfall, trends in rainfall over time, the AMO, data quality, etc. | | |
| 13 | 22, P. 2 | No | The physiographic province discussion is fine. However, there should be a discussion of karst in the basin, especially as relates to the exclusion of the Crews Lake reach from the MFL. | Add discussion | |
| 14 | 22, P 2 | No | Stratigraphic nomenclature has long since been changed. The Bone Valley is now a member of the Peace River Formation and the Alachua is no longer recognized. Neither is recognized as a formation. | Read Arthur, et al., 2008. Hydrogeologic Framework of the Southwest Florida Water Management District. Florida Geological Survey Bulletin 68 and revise report accordingly. | |
| 15 | 22, P 2 | No | The Bone Valley and Alachua are mentioned here, but neither is of any importance in the basin. What about the strata that form the surficial aquifer (SAS), where present, and the Floridan strata (Ocala, Suwannee, Avon Park)? | Add discussion. | |
| 16 | 23, P 1 | No | The SAS, intermediate aquifer and confining unit (IAS) and UFA are mentioned here. There is controversy as to whether the SAS exists in much of the basin because the clay residuum from the IAS is often missing (as suggested in this paragraph). There is essentially no discussion of the UFA, which is important when dealing with the groundwater component of the MFLs. | Add discussions. | |

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| 17 | 24, F 2-4 | No | These maps should be in chronological order. Also, they are too small to study. Strongly suggest that a boundary between the Crews Lake reach and MFL reach be shown. | Modify maps. Consider omitting the Crews Lake reach from the maps to allow for magnification of the view. | |
| 18 | 27, P 1 | No | The recovery strategy is important to the MFL. This is a good place to discuss the effects of implementation of the recovery plan on groundwater levels and surface water flows. | Add discussion. | |
| 19 | 30, S 2.8.1 | No | Prior to discussion of flow rates and river hydrology and while groundwater is still the topic of concern, suggest that recharge be discussed, including a map. With the changes in land use just discussed, recharge patterns have changes and will have impacts of river hydrology. This assist in discussions of river hydrology in this section. | Add discussions. | |
| 20 | 30, S 2.8.1 | Yes | This report does a poor job of discussing the measured flows in the MFL basin. | Add discussions of measured flow data, data gaps, data uncertainties, periods of record, records of extreme events (low and high flow, droughts, etc.), absence of baseline data and why, District's ability to utilize data for MFL development, etc. | |
| 21 | 30, S 2.8.1 | Possibly | I am a fan of use of unit discharge (Q/drainage basin area). However, with the karst in the area, unit discharge measurements can be deceiving. Are the basin areas all tributary to the river or are some internally drained? How are the Crews Lake reach and basin treated, are they include in the areas, or they ignored? | Add discussion. | |
| 22 | 30, F 2-8 | Yes | The flow duration curve (FDC) needs to be backed up by presentation of the data. The | Add discussion. | |

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| | | | reader needs to see the times of no flow and extreme flow in order to understand the FDC. | | |
| 23 | 30, P 3 | No | This discussion of the unusually low runoff rates is important. However, the recharge map mentioned in Comment 15 is important here. Also, some of Cobie's conclusions deal with the deep sands and low water table in the Crews Lake reach, not in the MFL basin. In much of the MFL basin, the depths to the water table are very similar to those in the Anclote, especially as one approaches the Gulf. | Rewrite and expand paragraph. | |
| 24 | 31, S 2.8.2 | Possibly | The discussion of seasonality is important in order to define the blocks used for MFL development. However, it is not supported by a good discussion of the raw rainfall data. | Add discussion. | |
| 25 | 32, P 1 | No | Use of has is incorrect in 3rd line. | Change has to have. Wellfields is plural. | |
| 26 | 32, F 2-10 | No | This is an important graph. The reader needs to be informed about the data, particularly the semi-diurnal nature of the tide cycle, location of the head of tides in the river, extreme events, etc. This will help explain the changes in the tidal river when the gage location was changed (Figures 2-10 and 2-11). | Add discussion. | |
| 27 | 36, S 2.9.2 | No | After reviewing the model-development reports, most of my concerns about the model were answered. Please be sure to reference these reports often to steer the reader to these discussions. | Add references. | |
| 28 | 36, P 3-5 | Yes | The model-development reports present some of the data required for presentation in this MFL report, the MFL report is in serious need of | Assuming that the measured flow data have been previously discussed, add graphs comparing the model-derived data and | |

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| | | | improvement in order to establish that model-derived data constitute best available data. | measured flow data, discuss ability to fit the raw data, patterns in residuals, and completeness of the record. | |
| 29 | 36, P 3-5 | Yes | The defense for use of the "pumps off" scenario results as background data needs strengthening. | I agree that these data are the best available, but there should be a separate section here presenting the case in clear terms, including the facts that development in the basin and of local wellfields pre-date streamflow data collection. | |
| 30 | 36, P 4 | Yes | The statements about predicted flows might be clearer if graphs can be used here. | Consider adding a graph showing predicted reductions in flow with different wellfield extraction scenarios. | |
| 31 | 36, P 5 | No | 2014 is repeated in line 3. | Delete repeat. | |
| 32 | 39, F 2-14 | Probably not | The bottom graph suggests that a regression equation was fit to the top graph. Please discuss; why is this important? | Add the regression, equation, and coefficient of determination to top graph or text. Move bottom graph to middle position and discuss residuals. | |
| 33 | 39, P 1 | No | The assumption that dissolved phosphate and o-PO4 are the same is functionally correct. | No action needed. | |
| 34 | 40, P 1 | No | The assumption that NO3 and NO3+NO2 are the same is probably safe, but they are not the same. NO2 is relatively unstable in an oxygenated environment, so it is probably de minimus. | No action required. | |
| 35 | 40, P 3 | No | Define NOx for the reader. Chemically NOx is functionally NO3+NO2. | Define. | |
| 36 | 41, F 2-15 | No | See comment 28 and apply to phosphorus graphs here. The graphs suggest that there were varying detection limits in the data and that they were treated as measurements. If this is true, it should be discussed. | See comment 28. Discuss role of detection limits in these graphs. | |
| 37 | 42, F 2-16 | No | See comment 32. | See comment 32. | |

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| 38 | 43, P 4 | No | The statement that DO is negatively correlated with flow appears to disagree with the middle graph in Figure 2-14. Also, use of correlations required that the line (I assume it is linear), equation, and coefficient of determination be presented in either the graph or a separate table. | Address as indicated. | |
| 39 | 45, F 3-1 and forward | No | The maps that utilize an aerial photograph for background are all very hard to read and the background is distracting. | Suggest use of a plain background with a few landmarks (gage locations; roads, esp. Rowan Rd. & US 19; or other landmarks for reference. | |
| 40 | 46, S 3.2 | No | Glad to see a discussion of tides here. To complete the discussion, suggest addition of spring and neap tides and storm surges. | Address as necessary. | |
| 41 | 46, P 3 | No | Suggest a map comparing the head of tides versus extent of saline water. | Consider adding this. Not critical. | |
| 42 | 47, F 3-3 | No | Horizontal lines representing the medians are not visible. | Change background color in boxes. | |
| 43 | 48, F 3-4 | No | As mentioned above, the dark aerial photograph background makes this figure unreadable, especially in the stream segment upgradient from the bay. | Remove the background and add a few landmarks. Bathymetry in the riverine segment will still be unreadable. The figure could be broken in a series of panels that would make the riverine part more easily read. Also, consider including a long profile of the river so that one can get a sense of the bathymetry of the river reaches. | |
| 44 | 49, F 3-5 | No | Label for horizontal axis misrepresents data. | Change to Area, Volume. As written the title suggests a fraction rather than two different metrics. | |
| 45 | 52, F 3-7 | No | See comments on maps with aerial photo backgrounds. | See above. | |
| 46 | 60, P 3<br>61, F 4-1 | No | This paragraph says that Crews Lake and Five Mile Creek were also evaluated. They are not included in descriptions in Section 3. | Reconcile Sections 3 and 4 relative to what data are included and what are excluded. | |

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| | | | Figure 4-1 does not show or suggest evaluation of Crews Lake, etc. | | |
| 47 | 61, P 3 | Yes | Last sentence in bottom paragraph states that the measured and modeled data fit "fairly well" and that there were "short-term differences." | These terms suggest problematic uncertainty. It is critical that these differences be documented as suggested in Comment 16 and elsewhere, it is important (1) to present and discuss the measured data, including data gaps, extreme events, etc., and (2) to compare the modeled and measured data, especially with respect to residuals and how extreme events are modeled. Finally, (3) the uncertainties represented in the measured data and in the modeled data must be discussed.<br>Much of this can be in Appendix 4B, and if the data are presented in other documents in such a way as to deal directly with the Pithlachascotee MFL, references can be used. Referenced data should deal specifically with the river downstream from the Fivay Junction gage. | |
| 48 | 62, P 1 | Yes | As noted above, a graph comparing the measured and modeled time series and showing the residuals should be included and discussed here. | Add graphs and discussion. | |
| 49 | 61, S 4.2 | Yes | This is the last location in the report where, in my opinion, the justification for use of modeled data as opposed to measured can be made. | Please insure that this argument is included prior to this section. | |
| 50 | 62, Eq. 1 | Yes | The 1.15 constant in the equation suggests a systematic difference in modeled baseline and modeled impacted flow. Is this the long-term impact of groundwater extraction or a short-term difference related to climatic cycles? | Discuss meaning of the constant and implications to the MFL. | |

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| 51 | 62, Eq. 1 | No | Units for use in the equation (I assume they are daily estimated cfs) should be added. | Add units. | |
| 52 | 62, Eq. 1 | Yes | The use of the 150-day average term causes confusion for several reasons.<br>1. Are $Q_{base}$ and $Q_{imp}$ daily calculated values?<br>2. Is $Q_{pump150}$ a moving average with 1 one-day time step?<br>3. How was the 150 average term withdrawal identified? Stepwise multiple regression? If so, what variables were dropped and what did they contribute to the coefficients of determination? | Address questions posted in Column A. | |
| 53 | 62, P 4 | Yes | There is a need for a graph showing the $Q_{base}$ data, regression line, and coefficient of determination. | Add graph and discuss as necessary. | |
| 54 | 62, Eq. 2 | Yes | 1. Units for use in the equation (I assume they are daily estimated cfs) should be added.<br>2. Are $Q_{base}$ and $Q_{imp}$ daily calculated values? | Add graph and discussion. | |
| 55 | 63, P 2 | Possibly | Last sentence says that staff considered use of gaged flows to incorporate short-term flow variation into the baseline record. This is a problematic statement. What does it mean? Explain? Does the modeled $Q_{base}$ not include short-term variability? Define short-term variability. This is very important to understanding what the MFL is representing. If short-term variability is not included in $Q_{base}$ and $Q_{imp}$, how do you deal with it? Why is it not significant? | Answer questions in a thorough discussion of the meaning of this sentence. | |

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| 56 | 63, P 3 | Yes | In this paragraph, good agreement between gaged and modeled flows is asserted. This statement needs to be backed up with data. | Insert graph showing time series for gage data, $Q_{imp}$ and residuals. Discuss correspondence and residuals. | |
| 57 | 63, P 3 | Possibly | Use of the flow duration curves to compare data is fine once the data are validated. FDCs should not be used to assert that two data populations in time series agree because individual values may not correspond. | See Comment 52 and couch this discussion on comparison of the FDCs on the populations of data, not correspondence of day-to-day variability, which is implied herein. | |
| 58 | 64, last P | Yes | In this paragraph the period of record (POR) for $Q_{base}$ and $Q_{imp}$ is said to have been moderately dry with high groundwater withdrawals.<br><br>Is it appropriate to develop a MFL on a POR that does not include extreme climatic events, such as severe droughts and high rainfall events? Why? | As noted in several comments above, the context of the modeled PORs, esp. $Q_{imp}$, must be established. Questions should be addressed. | |
| 59 | 65, S 4.3 | No | Use of the flow blocks concept is useful and well explained herein. | No action required. | |
| 60 | 66, F 4-4 | Yes | In block 2, the modeled flow is systematically less than measured flow, why? During block 3 the measured flow is often less than modeled. In one period near the end of the block 3 period, the measured is significantly higher than modeled. Please explain. This figure suggests that the modeled data (Qimp) do not always adequately capture high-flow events. | Explain the differences in $Q_{imp}$ and measured flow and how these differences affect the MFL. | |
| 61 | 69, F 4-5 | No | See previous comments about readability of maps using aerial photographs as background. | See previous comments. | |
| 62 | 73, F 4-6 | No | Comment about the background of figure and low visibility of the transect locations apply. Labels of Veg transects should be related to the floodplain "study sites" in caption. | Change background, etc. State in caption what Veg 1, etc. represent. This is evident, but not good style. | |

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| 63 | 83, Eq. 3 | Possibly | As with equations 1 and 2, the regression is presented without a discussion of how it was derived and the uncertainties associated with it. | See comments on Equations 1 and 2 for recommended issues to be addressed. It is important to explain how the t+3 time lag was identified and why measured stage data and modeled stage are mixed in the equation. Goodness of fit should be discussed. Some of this information is in Appendix 4E, but it also should be included in the main report. | |
| 64 | 115, F 6-2 | No | The pumps off hydrograph is illegible. | Revise graph background or line color and weight. | |
| 65 | 116, F 6-3 | No | See above. | See above. | |
| 66 | 123, F 6-7 & 6-8 | No | See above. | See above. | |
| 67 | 124, F 6-9 & 6-10 | No | See above. | See above | |
| 68 | 128. P 1 & F 6-14 | Possibly | Fitting polynomials to time series is tricky and usually ends up with artifacts of the data behavior at the beginning and end of the time series. Such is the case here. There is an upward trend in the data from mid-2009 forward, but the polynomial appears to be "over fitting" it. | The graph and discussion would be better if a simple moving median is calculated. This should fit only the data and be insensitive to the tails of the time series. The patter looks like a climatic cycle with a change in the late 1980s. | |
| 69 | Section 6 | Possibly | The presentation in Section 6 is excellent for the most part. I especially appreciate the discussion on sea-level rise.<br><br>As mentioned in our teleconferences, I believe there should be a subsection at the end of this section discussing how the MFLs will be managed. This section clearly sets the stage for dual criteria; one for groundwater withdrawals which operate on a time scale of moths to years | Add a subsection to function as a conclusion on how this complex MFL will be managed. | |

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| | | | **A. Reviewer's Specific Comments** | **B. Reviewer's Specific Recommended Corrective Action** (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **C. Action to be Taken in Response to Comment** |
| | | | and the other for surface water which operates on a time scale of days to months. The stakeholders should have this dichotomy in MFL implementation carefully explained. The data are in this section; just pull it together in a summary. | | |
| Comments on Appendix 4A | | | | | |
| 1 | General | Yes | Appendix 4A is well written and provides important background information concerning quality and use of measured and modeled data. However, it does not provide the comprehensive evaluation and analysis of the measured flows in the Pithlachascotee basin. For example, there are at least seven historical stream flow gages in the basin. Data from many are of little use for MFL development because of short periods of record. Others are mentioned in the main report but not dealt with in this appendix. For example, the main report uses the Fivay Junction gage as the upper end of the MFL reach of the river. I had hoped that presentations and evaluations of the gage data would be in the appendix since they were not in the main report. Unfortunately, this appendix also falls short for measured data evaluation and building a case for use of the modeled data as being "best available." | Somewhere, main report of here, the discussion about measured data quality and utility must be included in order to bolster use of the modeled data as being best available. | |
| 2 | General | No | Inclusion of the Brooker Creek analysis is distracting since this appendix is being proffered to support the Pithlachascotee MFL. | It is probably too late to change this. | |
| 3 | 2-1, P 1 | Unknown | The first sentence mentions that the data have been "altered." How? Why? | Insert explanation. | |

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| 4 | 2-1, P 2 | Possibly | The report is limited to analysis of the data from the Pithlachascotee River near New Port Richey FL (02310300) gage. What about the other gages on the river? | Insert explanation as to why this analysis is limited to one gage. | |
| 5 | 2-1, P 3 | No | Third sentence gives the drainage basin area as 182 $mi.^2$. Does this area include or exclude the Crews Lake reach of the river? | Annotate sentence. | |
| 6 | 2-1, P 4 ff | No | I like the analysis of flows using FDCs. However, the raw data must also be presented so the reader can see how the flow patterns changed. Are changes systematic or random, for example. | Add analysis of raw data. | |
| 7 | 2-1, P 4 | Possibly | "…changes are more pronounced at the lower end of the curves…." This statement indicates that low-flow conditions have changed. How? Why? | Add clarification. Table 2-1 can be used to explain. | |
| 8 | 2-5, S 2.2.2 | Possibly | Last paragraph on page suggests that the cloud of data around the 1:1 line in cross plots shows that the modeled data area a "reasonable fit." Figure 2-5 indicates that at flows below 100 cfs, the uncertainty of modeled flow can be almost 100%. This much uncertainty is hardly a reasonable fit. This statement must be defended. | Add defense of the reasonable fit argument. Use plots of the measured and modeled time series and explain the behaviors of the residuals. FDCs do not provide this information. | |
| 9 | 2-6, F 2-4 & 2-5 | No | The conventional way of plotting measured versus derived data even when regression is not invoked is to plot the measured data on the horizontal axis to indicate that these data are assumed to be more-or-less error free and that the modeled data (vertical axis) contain any uncertainty. In these graphs, the implication is that the modeled data are correct and the measured data contain the error. | Reverse axes and replot. | |

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| 10 | 3-2, S 3.1 | Yes | See comments about these regressions in the main report. | See above. | |
| 11 | 3.3, F 3-1 & 3-2 | Possibly | The fact that the INTB modeled data and the regressed data fit better than the INTB data versus the measured data suggests that the regression is removing some of the natural variability in the measured data. In other words, the regression is not reproducing the raw data. This is problematic, at least. | Include time series graphs to compare measured data, INTB modeled data, and regressed data. Also, plot the residuals and discuss any patterns, uncertainties, or outliers. | |
| 12 | 4-1, F | Yes | 1. Again, use of FDCs hides uncertainties in time-series data because the FDCs mask relationships of synchronous data.<br>2. This graph shows a substantial difference between the measured data and both forms of modeled data. Taken at face value, I would assume that neither set of modeled data fit the actual measured data. The time series analysis or another approach is needed to validate the modeled data. Unlike the statements concerning the coefficients of determination ($R^2$s), this graph does not support statements about the good quality of the data! | Add time-series data analyses and uncertainties analyses as suggested above. Then, if the uncertainties are minimal and one can assume that data points on each FCD are synchronous, the FDCs can be used to compare the raw and modeled data.<br><br>These analyses are a must. Then, include a thorough discussion as to why the District used the modeled data and why it is the best available data. | |
| 13 | Graphs following conclusions | Possibly | There are graphs of residuals and FDCs attached to the report. They are unlabeled as to which creek they apply and there is no analysis of content. These are useless. | Label and discuss graphs in their appropriate locations in text. | |

# Appendix B
# Table 1-2. Dunn Review Comments on MFL Documents

# TABLE 1-2. DUNN REVIEW COMMENTS ON MFL DOCUMENTS

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| 1 | General comment | Yes, possibly | Report should have an explicit, integrated treatment of sources of uncertainty with evaluation of magnitude of each source, effect on the proposed minimum flows, and recommendations for how to reduce effect of each source in the future. | Consider developing an overarching adaptive management approach and narrative for this MFL, and the District's MFL program itself. A detailed recommendation as to how this can be accomplished is provided in Dr. Dunn's summary comments in Discussion section of this report. | |
| 2 | General comment | Yes, possibly | The percent of flow method has many inherent assumptions. Whenever possible the District should develop specific event based criteria with defined magnitude (flow or level), continuous duration (inundation or drying), and return interval. | Consider using an event based statistical approach for some criteria. Also, consider a comparative analysis. A detailed recommendation as to how this can be accomplished is provided in Dr. Dunn's summary comments in Discussion section of this report. | |
| 3 | General comment | No | In several parts of the document the authors state that all the relevant water resource, ecological, and human use values are protected by a given minimum flow. It is hard for a reader to reach this conclusion on their own | Include a summary table that gives a short explanation as to how each water resource criteria is explicitly, or implicitly covered. | |
| 4 | Section 1.4 Overview of Methods and Assumptions, pages 14-18 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | |
| 5 | 1.4.1 Fundamental Assumptions, page 15 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | |
| 6 | 1.4.3 Baseline flows and | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | |

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| | conditions, page 16 | | | | |
| 7 | 1.4.4 Building Block Approach, pages 16-18 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | |
| 8 | 1.4.6 Percent-of-Flow Method and 15% Change Criteria, pages 17-18 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | |
| 9 | Section 2.10 Water Quality, pages36-44. | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | |
| 10 | Section 4.4 Resources of Concern for Upper River, pages 66-68 | No | Material is clearly stated, and I concur with choice of critical resources. | No further action required. | |
| 11 | Section 4.4.2 Methods for the Upper River, pages 68-79 | No | Material is clearly stated, and I concur with choice of critical resources. | No further action required. | |
| 12 | Section 4.5 Resources of Concern for the lower River, pages 79-81 | No | Material is clearly stated, and I concur with choice of critical resources. | No further action required. | |
| 13 | Section 4.5.2 Methods for the Lower River, pages 81-87 | No | Material is clearly stated, and I concur with choice of methods. | No further action required. | |

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| 14 | Section 5.2.1 Minimum Low Flow Threshold, pages 88-90 | No | I concur with the selection of the fish passage as the defining criterion. The plot in Figure 5-1 (page 89) very clearly demonstrates this. | No further action required. | |
| 15 | Section 5.2.2 Instream PHABSIM Results, pages 90- | No | District's MFL team have used PHABSIM for other MFLs. The use of PHABSIM as a best available aquatic habitat assessment tool has also been accepted by previous peer reviews. Was the PHABSIM application for the Pithlachascotee River done in standardized approach, comparable to how it has been applied to other river systems in the District? Were there any significant variations from the District's standard PHABSIM data collection, or analysis? | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>The approach used for application of PHABSIM analyses for the Pithlachascotee River was comparable to previous use of the model suite for determining minimum flows for flowing freshwater systems within the District. There were no significant variations from previous PHABSIM data collection or analysis activities. Staff notes, however, that the District has used differing approaches for summarization and use of PHABSIM results supporting minimum flow development. |
| 16 | Section 4.4.2.3 covering PHABSIM methods, pages 71-75. | No | Have previous MFL peer reviews assessed the suite of embedded PHASIM tools (i.e., hydraulic model, TSLIB, etc.)? If so, have the models been deemed appropriate for use with rivers in the District? Were any cautions or limitations highlighted by other peer reviewers? | Response provided by This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. Doug Leeper adequately addresses the question. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>All peer reviews conducted for the District to date have supported the use of PHABSIM analyses as a component of the District's development of minimum flows. Some review panel reports have identified Draft, Page 9 weakness associated with the PHABSIM tools and recommended that enhanced hydraulic modeling tools (e.g., 2-D models or hydrodynamic models) could be considered to improve habitat-based assessments. |
| 17 | Table 5-1, page 92 | No | Overall results of the PHABSIM analyses are summarized in Table 5-1 (page 92) of the report. It is not clear how the summary in Table 5-1 are | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. |

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| | | | derived from the plots in Appendix 5B. Please provide a step wise description. | few modifications, inserted in the report, would suffice to address my comment. | Plots of WUA (weighted usable area per 1,000 linear feet) as a function of flow are presented for each taxon/life history stage/guild in Appendix 5-B. This information was used in the PHABSIM analyses to calculate site-specific habitat availability gains/losses relative to baseline condition by month for various flow reduction scenarios (10%, 20%, 30% and 40%), using WUA values for each taxon/life history stage/guild. These “gain/loss” results are presented as the bar charts included in the appendix.<br>stage/guild. These “gain/loss” results are presented as the bar charts included in the appendix.<br>The summary results presented in Table 5-1 are based on changes in WUA for the study reach that were developed using composited WUA values for the three assessed PHABSIM sites. The process used for the analysis and reporting included:<br>a. Identifying the WUA by month for each taxon/life history stage/guild for each PHABSIM site for the baseline and four flow reduction simulations.<br>b. Compositing (adding together) the WUA values for the three PHABSIM sites to develop taxon/life history stage/guild WUA values for the study reach for the baseline and flow reduction scenarios. |

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| | | | | | c. Determining percent changes from the composited, baseline WUA values for each flow reduction scenario by month.<br>d. Identifying flow reductions associated with a 15% decrease in the WUA values, typically through linear interpolation of results for the 10%, 20%, 30% and 40% flow reduction scenarios.<br>e. Identifying monthly flow reductions associated with the 15% decrease in WUA values by Block (May and June results for Block 1 and October through April results for Block 2) and identifying the most restrictive, blocks-specific monthly value for each taxon/life history stage/guild.<br>f. Summarizing (in Table 5-1) block-specific responses associated with 15% habitat availability changes that were less than the maximum 40% flow reduction scenario. |
| 18 | Table 5-1, page 92 | No | Table 5-1 indicated and the supporting text in report say that the PHABSIM analyses were done separately for flow regime Blocks 1 & 2. I did not see comparative plots for Blocks I and 2 by taxon in Appendix 5. How can I verify the summary values for Blocks 1 & 2 in Table 5-1? | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>Draft, Page 10 The habitat gain/loss plots included in Appendix 5-B illustrate how monthly PHABSIM results can be represented graphically. As noted in the response to question 4 above, determination of block-specific allowable percent-of-flow reductions simply involves identification of the most sensitive monthly response for each block. However, as also noted in the previous response, the plots shown in Appendix 5-B depict site-specific results and the summary information presented |

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| | | | | | in Table 5-1 is based on composited, study-reach results. It may be useful to prepare habitat gain/loss plots similar to those included in the appendix to show gains/losses associated with the composted WUA values. Alternatively, this information could be presented in tabular format. |
| 19 | Table 5-1, page 92 | No | For the critical values in Table 5-1---can the threshold be exceeded by a single month's excursion. Please explain. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>As noted in the response to questions 4 and 5 above, the allowable, block-specific percent-of-flow reductions identified in Table 5-1 were developed based on the most sensitive monthly response within each block, i.e., within Block 1 and within Block 2. |
| 20 | Table 5-1, page 92 | No | I understand that maximum allowable percent flow reductions presented in Table 5-1 were calculated using mean monthly value for river flows for baseline versus incremental percent flow reductions. Mean monthly flow values were in turn used to estimate mean monthly habitat values, and percent change from baseline. The explanation for this analysis in Appendix 4C was unclear. Please provide a step-wise description as to how the final maximum allowable flow reductions values in Table 5-1 were calculated. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>Please see the process description provided above in response to question 4. |
| 21 | | No | District's MFL team have used a criterion for floodplain inundation for other MFLs. The use of floodplain has also been accepted by previous peer reviews. Was the floodplain inundation for | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>The approach used for the floodplain inundation criterion is a standard approach that has been used for nearly all of the minimum flow |

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| | | | the Pithlachascotee River done in standardized approach, comparable to how it has been applied to other river systems in the District? Were there any significant variations from the District's standard or typical floodplain inundation analysis, or data collection? | | recommendations developed for freshwater river segments within the District. The minimum flows developed for the Gum Slough Spring Run provide the exception to our use of the approach. Data limitations precluded use of floodplain inundation criteria in the Gum Slough Spring Run analyses. The approach used for the Pithlachascotee River did not include any significant variations from previous applications of the approach that have been used to set other minimum flows. |
| 22 | Section 5.2.4.3 Floodplain Inundation Results and Proposed Minimum High Flow Threshold for the Upper River, pages 99-102 | No | Analyses use mean elevation of the various floodplain features. Did staff consider using a more conservative, more protective elevation value like the 80th percentile, or higher? Has the use of mean elevations of flood indicators been evaluated in other peer reviews for riverine system MFLs? | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>Consideration of mean vs. other elevations associated with floodplain features has not been previously addressed by panel's reviewing proposed minimum flows for District rivers/streams, although the panel that reviewed minimum levels proposed for the middle segment of the Peace River suggested it may be reasonable to consider flow-related inundation patterns associated with target elevations that include specified water depths for particular floodplain features. Staff believes that by assessing potential changes in the inundation of a variety of floodplain features which occur across the range of floodplain elevations (e.g. refer to features listed in Table 5-4 in the minimum flows report), the allowable, Block-3 percent-of-flow reductions included in the proposed minimum flows are protective of all |

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| | | | | | environmental values associated with the "higher-end" of the flow regime. |
| 23 | Page 99 | No | In paragraph 2 of page 99 the report states that analysis sought to identify the percent of flow reduction that could occur without reducing the number of days of inundation of the respective features and habitats at each cross-section by 15 percent or more. Please provide an explanation as to how the change in days of inundation were determined. For instance, was this done by summing the number of daily exceedances over the complete time series (period of record)? | Response provided by Doug Leeper adequately addresses the question. Please add this description to the document. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>The total number of days of inundation of the specified floodplain elevations was calculated by summing the number of daily exceedances of flows associated with inundation of the feature elevations for the entire period of record used for the minimum flow analyses. |
| 24 | | No | Regarding the floodplain inundation analysis, the report focuses on a simple duration of inundation, defined as number of days, presumably over the time series. In contrast the SJRWMD MFLs team's methods use magnitude of inundation, plus continuous inundation periods of critical duration (days) and return intervals (years) to define minimum events that they have determined are required to maintain the floodplain feature. The method used in this report is simply limits allowable change in number of days of inundation over the time series. As such it does not address two important components of hydrologic events—critical periods of continuous inundation with defined return intervals. Please answer whether | Response provided by Doug Leeper raises other approaches that could be used to set minimum flows or levels for floodplain systems. So, it appears that the methodologies may evolve in future applications. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>Staff believes the exceedance-dependent criterion is protective of floodplain habitats and associated processes as have peer-review panels that have previously considered the District's use of the criterion for minimum flows development. Recently staff have begun exploring inundation of floodplain habitat on a spatial-temporal basis by coupling water level (i.e., stage) predictions from hydraulic models with topographic GIS data layers to create daily time-series of inundated floodplain habitat area. Changes in area associated with flow reductions can then be evaluated to identify changes in inundated habitat on spatial basis. As an example, this approach has been used to |

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| | | | the floodplain protection criterion used provides reasonable protection of floodplain resources, despite not also quantifying periods of continuous inundation and return intervals. Is it possible in the future for staff define critical maintenance hydrologic events in terms of magnitude (flow and/ or stage), duration of continuous inundation, and with a return interval? | | support development of currently proposed minimum flows for the Rainbow River System. Interestingly Munson and Delfino (2007) have shown that that temporal-based criterion may yield more conservative results than those based on flow-related spatial habitat reductions. |
| 25 | Section 5.2.4.3 pages 99-101 | No | A key part of the method is setting a minimum high flow threshold. Setting this threshold is covered in Section 5.2.4.3 on pages 99-101. The explanation of the values used to set the high flow threshold is given in the third paragraph on page 99. This paragraph is difficult to follow. Two points need to be explained more clearly. First, staff state that values "tended to stabilize around 9 percent for moderate to high flows (Figure 5-10)." Does this mean that a regression was line was fit? How was the 9 percent value arrived at? Next, the report states in sentence 2 of that paragraph "an additional allowable percent of flow reduction that may be applicable…. for Block 3, was developed. Based on the 25th percentile exceedance." It is not at all clear to me how and why the 25th percentile value is deemed appropriate. Please provide a more complete explanation. | Response provided by Doug Leeper still makes it sound like the selection of the 25th percentile is a professional judgement call. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD. Draft, Page 14<br><br>The 9% allowable flow reduction for higher flows in Block 3 is the mean of the allowable flow reduction percentages calculated for target floodplain elevations that are inundated with flows greater than the Minimum High Flow Threshold of 50 cfs, which is defined for the Pithlachascotee River near New Port Richey gage. The 50 cfs Minimum High Flow Threshold was established based on identification of this flow as the out-of-bank flow associated with the gage site. As noted in the minimum flows report, staff identified a second allowable flow reduction for periods when flows during Block 3 are less than the Minimum High Flow Threshold. This second allowable percent-of-flow reduction was established at the 25th percentile of the allowable flow reduction identified for targeting floodplain features in association with flows of |

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| | | | | | less than 50 cfs at the near New Port Richey gage. The 25th percentile was selected as a reasonable, allowable flow reduction that is comparable to the allowable flow reductions associated with the lower flow Blocks 1 and 2. It is considered protective of relevant environmental values during periods of lower flows that may occur during Block 3. |
| 26 | | No | Table 5-4 (p. 100) lists 16 floodplain features that were measured in the field across the 15 cross-sectional transects. Are all 16 features considered equally important? Or are there one of more that the District finds more useful for this type of analysis. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>We have found all of these floodplain features to be useful for characterization of target elevations associated with floodplain habitat. We believe that assessing how inundation of a range of floodplain target elevations may change as a function of flow reductions and limiting the magnitude of this change is a reasonable means to promote persistence of floodplain structure and function and prevent significant harm. |
| 27 | Figure 5-10, page 101 | No | In Figure 5-10 (p. 101) the data points plotted appear to represent multiple types of floodplain features. Since Table 5-4 on the previous page lists 16 different features, I ask is it correct to assume that all features have equal value, and therefore there is no need to differential them in this plot? Intuitively I suspect that all 16 features should not get equal weight. Please respond. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>Please see the response to the several questions above, which describe our focus on protecting habitats and representative features across the range of floodplain elevations. We further note that for some previous minimum flow determinations we have also examined potential allowable percent-of-flow reductions for the range of flows that may be expected, selecting a suite of percentiles or some other array of flows for the assessment. That approach is equivalent to assessing changes in inundation of the full |

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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| | | | | | range of elevations that can be associated with floodplain features, including specific features such as wetland plant assemblage distributions and ecotones, and more generally, ground elevations across the floodplain from the top of bank to the upper edge of the floodplain. We believe this perspective furthers our support for assessing potential change in inundation of the all relevant floodplain habitats. |
| 28 | Figure 5-10, page 101 | No | On Figure 5-10, two red lines are added one at 16% for flows less than 50cfs, and the other at 9% for flows greater than 50 cfs. Please describe how these lines were determined. Also, would it be useful to also include confidence intervals, such as 90% or 95%, for each line? Some measure of statistical significance would be helpful. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD. Draft, Page 15<br><br>Derivation of the allowable 9% and 16% flow reductions for periods when flows during Block 3 are, respectively, above or below the Minimum High Flow Threshold of 50 cfs is described above in response to question 5. The 9% allowable reduction for periods of higher flows was based on a mean value. The standard deviation for the 91 percentage values used to determine the mean allowable 9% flow reduction is 3.5%. The 16% allowable flow reduction for periods of low flows during Block 3 was set at a 25th percentile value for the 81 allowable flow reductions calculate for the lower Block 3 flows that, as illustrated in Figure 5-10 within the minimum flows report, ranged from 13% to 40%. For regulatory application of minimum flows, staff believes it is appropriate to identify block and/or flow-specific allowable percent-of-flow reductions rather than a range of flow reductions bounded |

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| | | | | | by a confidence or prediction interval or some other variance/range descriptor. |
| 29 | Section 5.3 Summary of Proposed Minimum Flows for the Upper River, page 101 | No | I agree with the summary, add detail | No further action required. | |
| 30 | Section 5.4 page 103 | No | Text states that all relevant water resource and human use values for the upper river are protected. It may be more persuasive to the reader if a tabular summary was provided. | Provide a summary table listing each of the criteria, and a statement as to how that criterion is protected, or is not relevant to the upper of lower segments of the Pithlachascotee River. | |
| 31 | Section 5.5 Results for the Lower River, pages 104-110 | No | Ray Walton has reviewed the salinity regressions and posed questions for staff. | Staff will respond to questions posed by Dr. Ray Walton. | |
| 32 | Section 5.5.2 page 109 | No | It is not clear from the text how the 60 cfs flow threshold was determined. How can the reader review and verify? | Please provide clarification. | |
| 33 | Table 5-5, page 102 | No | This is a very helpful tabular summary. I agree with the three identified criteria for the upper river: fish passage for all seasonal blocks, PHABSIM for Blocks 1 and 2, and floodplain inundation for Block 3. | No further action required. | |
| 34 | Section 5.6 paragraph 2, page 110 | No | I concur with the conclusion that the approach used is a conservative one. | No further action required. | |
| 35 | Table 5-10 page 110 | No | I concur with the summary of evaluated and selected criteria for the lower, estuarine segment of the river. | No further action required. | |
| 36 | Section 5.6 Summary of | No | I concur. | No further action required. | |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| | Proposed Minimum Flows for the Lower River, pages 110-112 | | | | |
| 37 | Section 5.7 page 112 | No | Text states that all relevant water resource and human use values for the upper river are protected. It may be more persuasive to the reader if a tabular summary was provided. | Provide a summary table listing each of the criteria, and a statement as to how that criterion is protected, or is not relevant to the upper of lower segments of the Pithlachascotee River. | |
| 38 | Table 6-1, Page 115 | No | Good point, summarizing the relative effect of individual wellfields | No further action required. | |
| 39 | Table 6-2, Page 116 | No | Good point, summarizing the relative effect of individual wellfields for the current pumping @ 74.3 mgd versus 90 mgd | No further action required. | |
| 40 | Figure 6-3, page 116 | No | Figure clearly shows that there is little difference in monthly streamflow impact to the river at 74.3 mgd compared to 90 mgd. | No further action required. | |
| 41 | Table 6-3, page 177 | No | Comparison of mean and median flows in PR shows relatively small differences between the current and MFL flows for the upper river. Indicates that either the MFL is just being met, or that it may only be slightly above or slightly below the proposed minimum flows. | Enhance the point that the upper river's flow regime appears to be close to its minima. | |
| 42 | Table 6-4, page 118 | No | Same comment as immediately above. | Same action as immediately above. | |
| 43 | Figure 6-4 and 6-5 (page 119) and supporting text, pages 118-119. | No | This is a very helpful coverage of statistical confidence. | As above, enhance the point that the upper river's flow regime appears to be close to its minima. | |
| 44 | Section 6.2.3 INTB model | No | Uncertainty is a major issue in this report, and in general for the process of setting MFLs. | Consider developing a comprehensive management plan for uncertainty. | |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | uncertainty, page 120 | | | | |
| 45 | 6.3 Other supporting information | No | Additional information was very helpful in covering related water management activities in the watershed, especially those addressing the response of surface and groundwater resources to reduced pumping from adjacent and nearby wellfields. | No further action required. | |
| 46 | 6.3 Other supporting information, pages 120-130 | No | Range of topics covered added solid supporting evidence: changes to PR flow (6.3.1), aquifer levels (6.3.2), INTB model drawdown (6.3.3), PR flow changes and rainfall (6.3.4), and Area MFLs status and wetland recovery near Starkey Wellfield (6.3.5). | No further action required. | |
| 47 | 6.3.6 consideration of sea level rise, pages 130-135. | No | Sea level rise must be considered in water use and water resource management decisions for coastal systems, such as the PR. Section 6.3.6 does a good job of covering recent trends u=in sea level rise along the northern Gulf Coast of the District. | No further action required. | |
| 48 | Section 6.3.6.5 Sea Level Rise Analysis Discussion, pages 134-135 | No | Based on the analysis presented in Section 6.3, I concur with the conclusion in Section 6.3.6.5 that sea level rise will have a negligible effect on amplifying the consequences of flow reduction on salinity based habitats. | No further action is required. | |
| 49 | | No | | | |
| 50 | 6.4 Summary of MFLs Status, page 135 | No | Report concludes that the MFLs proposed for the upper and lower segments of the PR are currently being met and are 0065pected to be met during the coming 20-year planning period. While I generally agree with this, I think it | Consider stating that there while the MFLs are being met, there are also clear signs that there is little freeboard in the river's flow regime. | |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | prudent to note that the compliance assessments show that the MFLs are close to being exceeded. | | |

# Appendix C
# Table 1-3. Walton Review Comments on MFL Documents

# TABLE 1-3. WALTON REVIEW COMMENTS ON MFL DOCUMENTS

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-3, Walton | | To be completed by Report Author(s) |
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| | | | **A. Reviewer's Specific Comments** | **B. Reviewer's Specific Recommended Corrective Action** (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **C. Action to be Taken in Response to Comment** |
| 1 | App. 4E | No | It would be useful to include data used for statistical analyses in this appendix. | Add data as a table<br>Response acceptable if table added | Response: Doug Leeper, MFLs Program Lead, SWFWMD. Staff will consider including the tabular data in the appendix. |
| 2 | App. 4F | Yes | How was 4-day average of flow arrived at? Why not look at travel times to determine averaging period? | Response did not answer question. Higher flows will have shorter travel times. There is no information in the report how 4 days was arrived at. | Response: Doug Leeper, MFLs Program Lead, SWFWMD. The four-day mean flows were developed and used for model construction to account for recent flow history of the river. |
| 3 | App. 4F | Yes | Why not use predicted tides and add residually (observed-predicted) from a nearby gauge? Approach used misses storm surge effects which might be important. | There is no way to know unless this is tested. As noted, the approach could miss tidal surges, which could influence the analysis. | Response: Doug Leeper, MFLs Program Lead, SWFWMD. Staff acknowledges this could be done, but believes the regression models are sufficient for assessing long-term salinity trends. |
| 4 | App. 4F | Yes | Why is sqrt(flow) used as "flow" variable? Why not flow, or log(flow), etc.? Suggest that you plot flow versus isohaline position and fit functions to determine "best" function. I know that this ignores tidal effects, but they are added back to the statistical analyses. | Need to show analysis that shows sqrt(flow) is better than other flow variable.<br>Response does not answer the question. | Response: Doug Leeper, MFLs Program Lead, SWFWMD. The regression models were developed to produce the best available information for the District's minimum flow analyses. |
| 5 | App. 4F | Yes | Why did you develop synthetic tide at Main Street rather than use observations from New Port Richey directly? Why is Main Street the focus of the tide and not another location? | Response accepted. | Response: Doug Leeper, MFLs Program Lead, SWFWMD. Synthetic tide stage data at the Pithlachascotee River at Main Street were developed and used in conjunction with measured tide stage at the gage site so that tide stage from a single, consistent location could be used to develop regression models for predicting isohaline location. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-3, Walton | | To be completed by Report Author(s) |
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| | | | **A. Reviewer's Specific Comments** | **B. Reviewer's Specific Recommended Corrective Action** (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **C. Action to be Taken in Response to Comment** |
| | | | | | The isohaline regressions were constructed using salinity profile data collected from March 1985 to April 1987 and from May 2008 to September 2009. Although tide stage records for the earlier data collection period were available for the Pithlachascotee River at New Port Richey gage, 15-minute data did not become available for the site until October 1987. Similarly, tide stage data were not available for the Pithlachascotee River at Main Street site for the early data collection period, although they were available for the more recent salinity-data collection period.<br><br>To promote a consistent tide stage record for regression model development, staff worked with HDR Engineering, Inc. to first, create synthetic tide stage records for the Pithlachascotee River at New Port Richey gage for the period from January 1, 1985 through August 31, 2010. The regression model presented as Equation 3 in the minimum flows report was developed to predict tide stage at the Pithlachascotee River at Main Street site using the data synthesized for the at New Port Richey site. As discussed during a recent Panel teleconference, Equation 3 in the draft minimum flows report erroneously refers to the Pithlachascotee River near New Port Richey gage, rather than the Pithlachascotee River at New Port Richey gage – this error will be corrected when the report is revised. For isohaline regression model development, |

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| | | | | | measured tide stage values at the Main Street site for the 2008-2009 salinity-sampling period were combined with predicted missing values for the site derived using Equation 3. For the 1985-1987 salinity-sampling period, Equation 3 was used to predict all tide stage values at the Main Street gage.<br>The Main Street Site was selected based on its historical and recent implementation and general utility for developing isohaline regressions. |
| 6 | App. 4F | Yes | Explain the 45-minute lag used for tides. Based on water depths, I think that the wave speed between these two locations would be faster (therefore shorter lag time). | Response does not answer the question. | Response: Doug Leeper, MFLs Program Lead, SWFWMD.<br>Draft, Page 12<br>Again, staff notes the regression models were developed to produce the best available information for the District's minimum flow analyses. |
| 7 | Eq. 3, main report | Yes | The equation feels wrong. Generally, one would expect the offset at high tide to be smaller (flatter water surface) than the offset nearer low tide. If the tidal prism extends farther upstream than both stations, then the water surface would be generally quite flat when the tidal range is small (e.g., 3 feet) and wave travel times much faster than the tidal half period (about 6 hours). | Response does not answer the question. | Response: Doug Leeper, MFLs Program Lead, SWFWMD. Please see response to question 4 above for discussion of the error in Equation 3. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-3, Walton | | To be completed by Report Author(s) |
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| | | | **A. Reviewer's Specific Comments** | **B. Reviewer's Specific Recommended Corrective Action** (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **C. Action to be Taken in Response to Comment** |
| 8 | App. 4B | Yes | What were the final calibration values of Manning's n (channel and overbank) at each cross section? | The channel values seem high at larger flows. The model should be re-calibrated to remove the systematic bias. As it stands, there is little way to know if Q=25 cfs is a "good" flow to give 0.6 feet of depth for fish passage.<br>Also, it is not clear why there is variation in Mannings *n* with lower values upstream and lager values downstream. Generally, it is the other way around. | Response: Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. and Yonas Ghile, Senior Environmental Scientist, SWFWMD. The final Manning's n values vary at each cross section as summarized in Table (not included here) |
| 9 | App. 4B | Yes | What sensitivity analyses were performed to demonstrate that this was the "best" calibration? | A sensitivity analysis should be done. Specifically, the District needs to know (1) what is the acceptable accuracy of the model (accurate to xx feet), (2) what parameters will change the results? | Response: Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. Per the original project scope of work, no sensitivity analyses were included in the model calibration task. |
| 10 | App. 4B | Yes | Table 3.1 (in Appendix 4B) shows a 1-ft range for the "calibration targets" but a 1.5-ft range for the model results. This "error" is systematic (low at low flows, and high at high flows). Could this model "bias" influence the conclusions drawn from the various uses of the HEC-RAS model results, especially estimating the minimum flows needed for fish passage? | The model should be re-calibrated to remove the systematic bias. As it stands, there is little way to know if Q=25 cfs is a "good" flow to give 0.6 feet of depth for fish passage.<br>There is only one location for model calibration, and the results here are used for fish passage depths <u>throughout</u> the reach. Recommend that additional data be collected to measurement water surface elevations along the reach for a range of flows, and then re-calibrate the RAS model to these observations to ensure that the model is working everywhere and can give more confidence that fish passage depths can be | Response: Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. The model calibration targets were derived from a polynomial regression curve, which was developed on the basis of the USGS flow measurement data (since USGS stage-flow rating curve is unavailable at this location). The model calibration targets and calibration results may vary depending on the regression curve selected and future flow measurement data available for the analysis, particularly for the low flow conditions. Since the differences between the simulated stages and calibration targets fall within the calibration criteria of +/- 0.5 foot and the simulated model |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | **To be completed by Reviewer(s) Table 1-3, Walton**<br>A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **To be completed by Report Author(s)**<br>C. Action to be Taken in Response to Comment |
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| | | | | achieved throughout the reach based on the hydraulic model. | results fall in the historic USGS gage data, the HEC-RAS model was considered to be well calibrated and could be used as a useful tool for the subsequent ecological study. |
| 11 | App. 4B | Yes | Is the model sensitive to the number and placement of cross sections (part of sensitivity analyses)? | A sensitivity analysis should be done, and focus on whether the RAS model can achieve sufficient accuracy to model fish passage depths along this reach. At a minimum, we should understand how certain we are that Q=25 cfs is a good value. | Response: Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. Per the original project scope of work, no sensitivity analyses were included in the model calibration task. Please note that the cross section data were provided by the District, including a stormwater model created for the Baker Creek and Pithlachascotee River Watershed Management Plan project and the vegetation transects survey by the District. No new cross section survey data was collected during the HEC-RAS modeling project. |
| 12 | App. 4B | Yes | Did the modeling group consider using a downstream "normal depth" boundary condition to allow comparison of the observed and modeled downstream rating curve through model calibration (rather than model specification)? | I suggest that this be tried as it could provide a second calibration location. It might help identify the vertical range of Mannings *n* values needed to remove the system bias in the results. | Response: Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. No. Per the original project scope of work and discussions with the District, the boundary conditions should use a flow-stage rating curve. This approach has been previously used in other HEC-RAS modeling projects by the District. |
| 13 | Fig 4-3 | No | Did District consider the number of days of flow deficits, rather than just comparison to mean and median flows? The gauge record shows that more than 70% of "natural" flows are less than | Given that the lag time is generally long, it is probable that using the "long-term average and median flow changes" is OK. However, it would be useful to provide consistency with this assumption. However, if "compliance" is assessed based on the previous day or the | Response: Ron Basso, Chief Hydrogeologist, SWFWMD<br>As briefly discussed during the initial peer review panel meeting, impacts to streamflow are primarily determined based on long-term average and median flow changes using |

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| | | | 25 cfs (see Figure 4-3 in main report, for example)? | previous 4-days, then the results should run through this filter. While I agree that this filter is probably not physically realistic for groundwater response, one should be consistent with the other. | numerical models – this is essentially done for all assessments of groundwater impacts to streamflow in the District since the time scale of impact is often several years due to a long-term lowering of the water table. For the Pithlachascotee River, the mean and median flow change over an 11-year period from 1996-2006 between non-pumping and pumping conditions was simulated using the INTB (results reported at the U.S. Geological Survey Pithlachascotee River near New Port Richey gage, i.e., at the NPR gage). Roughly 46 percent of the simulated stream flow record is less than 5 cfs for this period. As I noted during our initial peer review panel meeting, we did not attempt to calibrate to flow values less than 5 cfs for the Pithlachascotee River or other low-flow rivers in the INTB application. Staff at Tampa Bay Water (TBW) and the District recognize the limitations of using the sub-regional INTB model at these very low river flow rates and therefore did not want to exceed the limitations of the model. |
| 14 | p. 61 | No | Does the District have plots of IHM model results versus observations at the Cotee River gauges? Useful plots would include time histories and scatter plots. | A plot of the results (such as a scatter plot) would reinforce this. | Response: Ron Basso, Chief Hydrogeologist, SWFWMD<br><br>The calibration and verification statistics from 1989-2006 between simulated flows and observed values are included in Geurink and Basso (2013). A plot of the average monthly streamflow at the NPR gage between non-pumping and pumping conditions is shown in the draft minimum flows report with mean and |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-3, Walton | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| | | | | | median flow change for the 11-year simulation period. A plot of the P5-P95 range of daily flow impact is also shown in the report. Staff can provide the daily time series of simulated values and observations from the NPR gage for the period of interest. As a reminder, the INTB model is being run in scenario mode based on a well-calibrated model. TBW wellfield quantities are adjusted for a particular scenario with all other users pumping from 1996-2006 – therefore there is no direct apples-to-apples comparison of measured streamflow as simulated for the scenario runs. |
| 15 | Section 6.2.2 | No | Can the District shed light on why groundwater abstractions of 74.3 mgd cause a deficit of 0.7 feet and abstractions of 90 mgd cause a deficit of 0.8 feet? What groundwater abstraction would cause zero deficit? | I did mean "cfs" and not "feet". Response is accepted. | Response: Ron Basso, Chief Hydrogeologist, SWFWMD<br><br>I believe you meant 0.7 cfs and 0.8 cfs median flow change from the INTB model as simulated at the NPR gage for those two specific pumping scenarios – those are the projected deficits between the median flow rate under non-pumping conditions with adjustments for allowable decline due to the proposed minimum flows and the current pumping scenario. The largest flow change is associated with the Starkey wellfield that is withdrawing approximately 4 mgd. Previous simulations with the INTB model that isolated individual wellfield impact has shown the greatest impact to Pithlachascotee River flows are from wellfields closest to or within the river basin with much less to essentially zero flow impacts from more |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-3, Walton | | To be completed by Report Author(s) |
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| | | | | | distant wellfields. The reason that the impact only changes by 0.1 cfs between TBW pumping at 90 mgd versus 74 mgd is that Starkey and the North Pasco wellfields are pumping about the same for both scenarios.<br>We're not sure what groundwater withdrawals would be predicted to cause zero deficit. The location and magnitude of withdrawals would play a large factor in that determination. Staff did run one scenario where one mgd was redistributed from the northwest corner of Starkey wellfield to the eastern side. The results reduced the predicted deficit by 0.5 cfs. The rainfall that actually fell during the 1996-2006 period was also a factor in the predictions. Tampa Bay Water has conducted hundreds of rainfall realizations during the 1996-2006 period using the INTB model. That analysis indicated predicted withdrawal impact can vary up 0.6 cfs based on the range of historical climate conditions in the area. |
| 16 | Chapter 6 | No | What is the lag time between groundwater withdrawals and the time streamflow deficits are felt? And how is this "lag" consistent with criteria that use either the previous day or an average of the previous 4 days to define streamflow targets? | Note: Question 1 is Basso response is Question 13 in this document. I still think that is a useful thing to know because it points out the conflict between the regulation (as applied to groundwater) and physics. | Response: Ron Basso, Chief Hydrogeologist, SWFWMD<br>See my response to question 1. It's important not to be confused over the stated flow criteria at the gage site with the status assessment of the minimum flows and levels (MFLs) or assessment of groundwater impacts. The flow-based criteria would come into play with a direct surface water withdrawal as those would be instantaneous and |

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| | | | | | could be managed on a daily basis. On the groundwater side, we essentially use a numerical model and monitoring data to make an assessment of current groundwater withdrawal impacts over a long-term basis. |

# Appendix D
# Table 2-1. UPCHURCH Replies to SWFWMD's Peer Review Assessment Requirements

# TABLE 2-1. UPCHURCH REPLIES TO SWFWMD'S PEER REVIEW ASSESSMENT REQUIREMENTS

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments Table 2-1, Upchurch |
|---|---|---|---|
| A. Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented | 1. Supporting Data and Information: review the relevant data and information that supports the conclusion in the report to determine: | a. Data and information used was properly collected. | Hydrologic data were collected and evaluated by the USGS. Proper collection and verification must be assumed. |
| | | b. Reasonable quality assurance assessments were performed on the data and information. | Evaluations of temporal patterns in the raw flow data have not been adequately done. Uncertainties in raw data have not been evaluated. |
| | | c. Exclusion of available data was justified. | The only evident data exclusions are (1) reliance on a subset of available gage data without explaining that other gage data hove an insufficient period of record or other limitations. At least on gage (Fivay Junction gage) is mentioned in the list of gages on the river but not discussed. |
| | | d. The data used was the best information available. | This case has not been made. Use of regression and INTB modeled data is emphasized over measured data. The INTB modeled data are the best available data for background flows because the river was impacted when gaging began. However, this argument and lack of use of measured data to characterize impacted flows are not well presented. |
| | 2. Technical assumptions: review the technical assumptions inherent to the analysis used in the report to determine whether: | a. The assumptions are clearly stated, reasonable and consistent with the best available information | While it is evident that the data upon which the District relied are likely the best available data, the assumption that this is true has not been well defended. |
| | | b. The assumptions were eliminated to the extent possible, based on the available information. | (Applies to hydrologic data) Elimination of assumptions requires a list of possible assumptions and detailed discussions of each and why it is rejected. This has not been done, but may not be necessary. A thorough defense of the assumption to use the modeled data should suffice. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-1, Upchurch |
|---|---|---|---|
| | | c. Other analyses that would require fewer assumptions but provide comparable or better results are available. | Analysis using the raw, measured data is a more traditional approach to MFL development. However, this low-flow stream with historically impacted flow may not be amenable to such an analysis. The case for not using this analysis method and assumption that modeled data are better has not been adequately made. |
| | 3. Procedures and analyses: review the procedures and analyses used in the report to determine whether: | a. The procedures and analyses were appropriate and reasonable based on the best information available. | I believe that this is true but the argument that this conclusion is valid has not been adequately made. |
| | | b. The procedures and analyses incorporate all necessary factors. | (Applies to hydrologic data) This task has been met. |
| | | c. The procedures and analyses were correctly applied. | This is correct, but conditions and results are not well presented. |
| | | d. Limitations and imprecisions in the information were reasonably handled. | Uncertainties have not been adequately addressed. |
| | | e. The procedures and analyses are repeatable. | This requirement has apparently been met. |
| | | f. Conclusions based on the procedures and analyses are supported by the data. | This requirement has apparently been met. |
| B. If a proposed method used in the report is not scientifically reasonable, then please provide: | 1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies. | | Methods are scientifically reasonable and appropriate. However, results need to be better presented. Time-series and residuals analyses are lacking, and discussions of uncertainties have not been presented.<br><br>The decade-long time series modeled may be too short for incorporation of long-term extreme flows and establishment of a representative flow regime. Choice of the modeled period of record and its brevity may not be a problem. The issue has not been properly discussed and the modeled period of record has not been compared to the historical, measured flow regime. |
| | 2. Determine if the identified deficiencies can be remedied. | | Yes, these deficiencies can be remediated with revisions to reports. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-1, Upchurch |
|---|---|---|---|
| | 3. If the identified deficiencies can be remedied, then please describe the necessary remedies and an estimate of the time and effort re4quired to develop and implement each remedy. | | Assuming no unidentified uncertainties or errors in the measured data or methods of calculating the modeled data, revisions to the reports will require approximately 1 to 2 man-months. Since much of the work was done by consultants, incorporation of revisions by them will likely complicate the time line. |
| | 4. If the identified deficiencies cannot be remedied, then if possible, identify one of more alternative methods that are scientifically reasonable | | Deficiencies in the hydrologic data can be remedied. |
| C. If a given method or analysis in the report is scientifically reasonable, but an alternative method(s) is preferable, then: | 1. List and describe the alternative reasonable scientific method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s). | | From a hydrologic data perspective, the approaches used were reasonable and alternative approaches are unlikely because of the need to model baseline flows. |

# Appendix E
# Table 2-2. Dunn Replies to SWFWMD's Peer Review Assessment Requirements

# TABLE 2-2. DUNN REPLIES TO SWFWMD'S PEER REVIEW ASSESSMENT REQUIREMENTS

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-2, Dunn |
|---|---|---|---|
| A. Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented | 1. Supporting Data and Information: review the relevant data and information that supports the conclusion in the report to determine: | a. Data and information used was properly collected. | I concur that the data and information used was properly collected. This finding is based on the reports available. Data collection methods were sound. |
| | | b. Reasonable quality assurance assessments were performed on the data and information. | Yes, quality reviews appear to have been done at many levels, including extensive reviews of draft report by three key agencies: FDEP, FWC, and TBW. Dr. Ray Walton has noted that for some components of the HEC-RAS analyses quality assurance should be improved. |
| | | c. Exclusion of available data was justified. | Yes, I found this to be true. |
| | | d. The data used was the best information available. | Yes, I found this to be true. Tradeoffs had to be made in determining what was the best available data depending on analytical method, tool, or model selected. |
| | 2. Technical assumptions: review the technical assumptions inherent to the analysis used in the report to determine whether: | a. The assumptions are clearly stated, reasonable and consistent with the best available information | Yes, the full report and supporting materials in Appendices had many, many assumptions which I generally found to be clear and reasonable. In the few cases where assumptions and/or logic were not clear, I posed questions to staff. |
| | | b. The assumptions were eliminated to the extent possible, based on the available information. | Yes, I did not find that the report was filled with unwarranted assumptions. |
| | | c. Other analyses that would require fewer assumptions but provide comparable or better results are available. | Yes, I found this to be true. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-2, Dunn |
|---|---|---|---|
| | 3. Procedures and analyses: review the procedures and analyses used in the report to determine whether: | a. The procedures and analyses were appropriate and reasonable based on the best information available. | Yes, I found this to be true. |
| | | b. The procedures and analyses incorporate all necessary factors. | Yes, I found this to be true. |
| | | c. The procedures and analyses were correctly applied. | Yes, I found this to be true. |
| | | d. Limitations and imprecisions in the information were reasonably handled. | Yes, but the report lacks an integrated comprehensive treatment sources of uncertainty, and an explicit plan as to how manage uncertainty. |
| | | e. The procedures and analyses are repeatable. | Yes, I found this to be true. |
| | | f. Conclusions based on the procedures and analyses are supported by the data. | Yes, I found this to be true. |
| B. If a proposed method used in the report is not scientifically reasonable, then please provide: | 1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies. | | I found no explicit deficiencies, but did identify the important issue of how to best manage the multiple components of uncertainty. |
| | 2. Determine if the identified deficiencies can be remedied. | | A management plan for uncertainty should be developed. Specific recommendations as to how do this using and adaptive management approach are provided in my summary comments in the Discussion section of this report. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-2, Dunn |
|---|---|---|---|
| | 3. If the identified deficiencies can be remedied, then please describe the necessary remedies and an estimate of the time and effort required to develop and implement each remedy. | | Yes, the deficiencies identified by the three panelists can be remedied. |
| | 4. If the identified deficiencies cannot be remedied, then if possible, identify one of more alternative methods that are scientifically reasonable | | It is expected that sources of uncertainty can be controlled to the extent that the District uses the best available information and best available analytical tools to develop MFLs. Specific recommendations as to how do this using and adaptive management approach are provided in my summary comments in the Discussion section of this report. |
| C. If a given method or analysis in the report is scientifically reasonable, but an alternative method(s) is preferable, then: | 1. List and describe the alternative reasonable scientific method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s). | | For each of the principle components of uncertainty an approach to reduce the effect of uncertainty will be helpful for this stage of setting MFLs and for future compliance assessments. |
| | | | |

# Appendix F
# Table 2-3. Walton Replies to SWFWMD's Peer Review Assessment Requirements

# TABLE 2-3. WALTON REPLIES TO SWFWMD'S PEER REVIEW ASSESSMENT REQUIREMENTS

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments Table 2-3, Walton |
|---|---|---|---|
| A. Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented | 1. Supporting Data and Information: review the relevant data and information that supports the conclusion in the report to determine: | a. Data and information used was properly collected. | Need to improve the HEC-RAS hydraulic model. I suggest that a number of water surface elevations (say, 4-6) be measured along the reach for a range of low flows (say, 10-50 cfs), and the model re-calibrated. |
| | | b. Reasonable quality assurance assessments were performed on the data and information. | Cannot see where this was done. The RAS modelers themselves suggest that cross sections were poor. Recommend considering whether additional cross sections would improve model accuracy. |
| | | c. Exclusion of available data was justified. | Given that HEC-RAS was calibrated to a single location, it would be useful to try and use a normal depth downstream boundary conditions to determine in roughness values are reasonable in the lower portions of the upstream reach. If additional water surface profiles are collected, this becomes less important. |
| | | d. The data used was the best information available. | Yes, but not good enough for hydraulic model. |
| | 2. Technical assumptions: review the technical assumptions inherent to the analysis used in the report to determine whether: | a. The assumptions are clearly stated, reasonable and consistent with the best available information | Yes |
| | | b. The assumptions were eliminated to the extent possible, based on the available information. | The synthetic tidal record at the Main Street gauge location could have been better developed to include storm surges in the available record. This could change the salinity regression analysis a little. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| | | c. Other analyses that would require fewer assumptions but provide comparable or better results are available. | The synthetic tidal record at the Main Street gauge location could have been better developed to include storm surges in the available record. This could change the salinity regression analysis a little. |
| | 3. Procedures and analyses: review the procedures and analyses used in the report to determine whether: | a. The procedures and analyses were appropriate and reasonable based on the best information available. | The methods were OK. |
| | | b. The procedures and analyses incorporate all necessary factors. | Yes. |
| | | c. The procedures and analyses were correctly applied. | The procedures were lacking in two areas:<br>1. The calibration of the HEC-RAS model needs to be improved (1) through better data and (2) to remove the clear systematic bias in the calibration.<br>2. The synthetic tidal recorded should look at observed storm surges (as tidal residuals) to see if the different synthetic record would change the regression analyses and the criteria in the downstream reach.<br><br>The use of the HEC-RAS model is far more crucial as it goes to the critical criterion of 0.6 feet of depth being achieved by 25 cfs of flow. This criterion drives the upper reach and is significantly more crucial than the development of a criterion with a much larger flow in the downstream reach. |
| | | d. Limitations and imprecisions in the information were reasonably handled. | Not always (see previous responses). |
| | | e. The procedures and analyses are repeatable. | Yes |
| | | f. Conclusions based on the procedures and analyses are supported by the data. | Yes |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| B. If a proposed method used in the report is not scientifically reasonable, then please provide: | 1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies. | | 1. HEC-RAS could use better observations along the reach.<br>2. The distribution of Mannings *n* roughness values used was not presented or supported in the report. For example, why was the channel roughness variable when only one location was used for calibration.<br>3. The systematic bias in the HEC-RAS model results needs to be addressed and removed.<br>4. Questions about groundwater lag and its regulatory interpretation should be addressed.<br>5. The synthetic tide for the salinity regression analysis should be revisited to see if it makes a significant difference in the regressions obtained. |
| | 2. Determine if the identified deficiencies can be remedied. | | They can be, with data, budget, and re-analysis. |
| | 3. If the identified deficiencies can be remedied, then please describe the necessary remedies and an estimate of the time and effort re4quired to develop and implement each remedy. | | 1. Collect stage observations along the upper reach for a range of flows from 10-100 cfs.<br>2. Collect some additional cross sections to improve the geometry of the hydraulic model<br>3. Recalibrate HEC-RAS to better fit observations, remove bias, and reduce model uncertainty.<br>4. Redevelop the synthetic tidal at the salinity regression station and redo the analysis.<br><br>This could be accomplished within 3-6 months. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| | 4. If the identified deficiencies cannot be remedied, then if possible, identify one of more alternative methods that are scientifically reasonable | | If no additional data are collected then:<br>1. The existing HEC-RAS model should be recalibrated to remove the systematic bias and to use a different downstream boundary to assess the adequacy of downstream roughness values. This is by far the most important thing.<br>2. Re-develop the synthetic tide to include residual tidal effects (storm surges) and see if this significant changes the salinity regression equations.<br>3. For all analyses, the revised report should justified all the assumptions and statistical statements made (lag times, sqrt(flow), etc.). The reader needs to know why every statement and assumption was made. |
| C. If a given method or analysis in the report is scientifically reasonable, but an alternative method(s) is preferable, then: | 1. List and describe the alternative reasonable scientific method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s). | | Methods are generally OK. They just need to be better explained, assumptions supported, and applied. |

| | | | |
|---|---|---|---|
| Minor General Comments | | | 1. In general, the report needs an editorial review. There are a number of spelling and grammatical mistakes.<br>2. Page 9, 1st papa. "…purposes…" should be plural.<br>3. Page 9, 3rd papa. Need to explain is the "9 percent" of total of excess flow.<br>4. Page 10, 1st papa. Need to discuss is flow deficits need a proposed action or is this OK by permit.<br>5. Page 11, near bottom. Be consistent about "minimum flows" or "minimum flows and levels".<br>6. Page 20, 2nd papa. Need to add "square miles" after "kilometers".<br>7. Page 25, 3rd papa. Need to state where are the surface water withdrawals and that it is minor.<br>8. Figure 2-5. Highlight Cotee River (make bold to stand out).<br>9. Page 28, 3rd papa and Figure 2-7. Is 57.1 mgd the new "normal"? Elsewhere, the report says 74 mgd.<br>10. Page 29, 1st papa. Where is gauge #02310288 on Figure 2-2?<br>11. Figure 2-8. Add gauge number to caption. Also, figure shows that about 75% of time flow is less than 25 cfs. Need to discuss this as Q=25 cfs needed for fish passage.<br>12. Figure 2-11. Need to explain why moving gauge 1.1 miles upstream is critical for number of zero flow days.<br>13. Page 36, 4th papa. Need to edit "20142014".<br>14. Figure 2-14. Last plot needs x-axis title to be fixed.<br>15. Page 58, 1st papa. Last sentence says "…were greater at the upstream stations." Table 3-2 doesn't seem to support this while Figure 3-14 does Station kilometer 4.2 is greatest).<br>16. Page 61, last papa. Show scatter plot to reinforce "fairly well".<br>17. Page 62, 1st papa. Edit "   was it was…"<br>18. Page 62, 2nd papa. Need figure to help show "…greater than 1.6 cfs"<br>19. Page 65, 2nd papa. Explain why "flow records used for identification" considered only the one gauge and not others.<br>20. Page 65. Why are "blocks" not in order?<br>21. Table 4-2. Numbers look wrong in 4th column.<br>22. Page 68, last full papa. "USOCOE" should be "USCOE".<br>23. Page 78, 3rd papa. ".. model **to** determine…"<br>24. Table 4-3. Fix "5psu". Needs a space. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| | | | 25. Figure 5-1. Show actual river miles. Also, there is a real mixture of SI and English units throughout report.<br>26. Figure 5-10. What percent of time are flows in the "16%" range (red line to left) less than 16% line?<br>27. Figure 5-11. Need, somewhere in report, to explain why groundwater pumping is OK even though flows in days 120-180 are very small, and likely very influenced by groundwater pumping.<br>28. Page 120, 2nd papa. Is uncertainty in rainfall variation associated with temporal or spatial variability?<br>29. Page 130, 1st papa. Make numbers consistent in "…up to six and 3 feet increases." |
| CONCLUSION | | | Need to improve the HEC-RAS hydraulic model. I suggest that a number of water surface elevations be measured along the reach for a range of flows, and the model re-calibrated. This goes to the major hydraulic uncertainty in the study "is 0.6 feet of depth in the upper reach consistent with a flow of 25 cfs?" The HEC-RAS model needs to be improved to be more certain of this important conclusion, which is perhaps the major criterion of this MFL.<br><br>Finally, I believe that Sid Flannery's comments need to be addressed in full. There are many points I agree with, but I choose not to duplicate them here. |

# APPENDIX 1E

Southwest Florida Water Management District. Brooksville, Florida. 2017. District response to the Pithlachascotee River MFLs peer review. Brooksville, Florida.

# District Response to the Pithlachascotee River MFLs Peer Review

January 5, 2018

Doug Leeper, Gabriel Herrick, Ph.D., Ron Basso, P.G.,
and Yonas Ghile, Ph.D
Southwest Florida Water Management District
Brooksville, Florida

The Southwest Florida Water Management District (District) does not discriminate on the basis of disability. This nondiscrimination policy involves every aspect of the District's functions, including access to and participation in the District's programs and activities. Anyone requiring reasonable accommodation as provided for in the Americans with Disabilities Act should contact the District's Human Resources Bureau Chief, 2379 Broad St., Brooksville, FL 34604-6899; telephone (352) 796-7211 or 1-800-423-1476 (FL only), ext. 4703; or email ADACoordinator@WaterMatters.org. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1-800-955-8771 (TDD) or 1-800-955-8770 (Voice).

## Introduction

In October and November 2016, the Southwest Florida Water Management District convened a panel for the independent, scientific peer review of minimum flows proposed for the upper and lower segments of the Pithlachascotee River. The panel consisted of a Chairperson, Bill Dunn with Dunn Salsano & Vergara Consulting, LLC as a sub-contractor to Barnes, Ferland and Associates, Inc., Panelist Sam Upchurch, with Sdii Global Corporation as a sub-contractor to Interflow Engineering, Inc., and Panelist Ray Walton with West Consultants, Inc., as a sub-contractor to HSW Engineering, Inc.

To support the Panel's review, District staff provided initial verbal and written responses to numerous Panel inquiries concerning the proposed minimum flows and their development. Most of these responses were incorporated into summary tables included as appendices to the Panel's final report titled, "Pithlachascotee River MFLs Peer Review", that was submitted to the District on November 30, 2016. In some instances, the summary tables included in the Panel's final report contain Panelist references to staff's initial responses.

The Panel's final report has been posted on the District web site, made available upon request to interested parties, and will be provided to members of the District Governing Board. As directed by Section 373.042 of the Florida Statutes, the Governing Board is to give significant weight to the peer review Panel's final report when establishing minimum flows for the river system.

To further support the review process and the Governing Board's consideration of peer-review findings, staff have reproduced the Panel's final report in this document and where appropriate, inserted additional responses highlighted in blue. These additional responses address previously unanswered Panel questions or comments and describe activities that have been or will be undertaken in response to the Panels input.

Peer Review Report with Imbedded Additional Comments

# Pithlachascotee River MFLs Peer Review

**PREPARED FOR**

Southwest Florida Water Management District

WATERMATTERS.ORG · 1-800-423-1476

# Southwest Florida Water Management District

**PREPARED BY**

DSV
DUNN, SALSANO & VERGARA CONSULTING, LLC
HELPING CLIENTS MEET THEIR WATER RESOURCE NEEDS

BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

sdii GLOBAL

WEST Consultants, Inc.

**NOVEMBER 30, 2016**

## Contents

# INTRODUCTION

## Overview

The Southwest Florida Water Management District (District) has contracted with a panel of three experts to provide a technical peer review of its proposed minimum flows and levels (MFLs) for the Pithlachascotee River in Pasco County, Florida.

These proposed MFLs for the Pithlachascotee River are described by the District in a document titled *Proposed Minimum Flows for the Pithlachascotee River-Revised Draft Report for Peer Review*, August 29 2016, with a separate volume of appendices, also dated August 29, 2016. These MFLs include only minimum flows for the river.

The report is an updated version of an earlier draft produced by the District in 2014. The current draft addresses review comments provided by the Florida Department of Environmental Protection (FDEP), the Florida Fish and Wildlife Conservation Commission (FFWCC), and Tampa Bay Water (TBW). Those agency comments and the District staff's responses to those comments are included as appendices.

The District proposes two sets of minimum flows one for the upper freshwater section of the system and another for the lower, tidally influenced, estuarine section. The proposed minimum flows were developed using a percent-of-flow (POF) approach for three seasonal blocks, and with specific low and high flow thresholds.

A baseline flow record for the river was developed for the U. S. Geological Survey (USGS) gage site - Pithlachascotee River Near New Port Richey. The existing flow record was corrected for existing withdrawal impacts. The corrected baseline was then used to develop minimum flow recommendations using a POF approach. Using this POF approach, potential changes to critical environmental values, such as habitat, associated with baseline flow reductions were assessed to identify minimum flow recommendations. Other thresholds were developed in similar fashion including minimum low flow (MLF) and minimum high flow (MHF) designed specifically to address environmental features of the river's flow regime. Critical resources identified for the upper freshwater section of the river included fish passage, instream habitats for fish and invertebrates, and floodplain inundation. For the estuarine section resource evaluations were focused on potential changes to salinity distributions for surface/shoreline, bottom and water column habitats.

The District's proposed minimum flows for the upper freshwater segment of the river allow for withdrawal reductions of up to 18% of daily flow for the spring dry season (Block 1), 17% of daily flow in the fall and winter moderate flow season (Block 2), and up to 16% for the summer wet season (Block 3). In addition, to maintain sufficient inundation of the floodplain system in the upper river when daily flows in Block 3 are greater than a MHF threshold of 50 cfs, the allowable flow reduction is limited to 9% of the daily flow. A MLFs threshold of 25 cfs is applicable to potential surface water withdrawals in all seasonal blocks.

Minimum flows for the lower estuarine section of the river include withdrawal related reductions of up to 25% of daily flow in all seasonal blocks up to the MHF threshold of 60 cfs. Flow reductions of up to 35% would be allowed when the four-day average of the daily flow exceeds the MHF threshold of 60 cfs.

The District concludes that this minimum flow regime for the upper and lower sections are protective of all relevant environmental values required to be considered when establishing MFLs.

The District is committed to the independent scientific peer review of all data, methodologies, and models used in the establishment of MFLs. Accordingly, the District voluntarily engaged the services of three independent experts with collective expertise in the fields of hydrology, hydrogeology, limnology, and biology. These experts served as a peer review panel (panel) to evaluate and review information used for development of recommended MFLs for the Pithlachascotee River.

The panel includes

- Raymond Walton, Ph.D., P.E. D.WRE, WEST Consultants
- Sam Upchurch, Ph.D., P.G., Sdii Global Corporation
- Bill Dunn, Ph.D., DSV Consulting

Dr. Bill Dunn served as the panel's chair.

## PEER REVIEW PANEL'S SCOPE OF WORK

This document provides a summary of the panel's completion of its contracted scope of work, covering the following five major tasks.

Task 1—Complete conflict of interest forms.

Task 2—Review draft District MFL documents on proposed minimum flows for the Pithlachascotee River, and review relevant supporting documents.

Task 3-1—Participate in publicly noticed project kick-off meeting at District Headquarters (DHQ) in Brooksville, and a publicly noticed field trip to sites on the Pithlachascotee River.

Task 3-2—Participate in a publicly noticed panel meeting at DHQ in Brooksville.

Task 3-3—Participate in three publicly noticed teleconferences facilitated by the District to support peer review panel discussions and work efforts

Task 4—Post written review comments on District's Web Board, and collaboratively develop a single final peer review panel report for submission to District.

Task 5—Post meeting agenda, summaries and other relevant comments to the Web Board.

With the submittal of this document, the panel's final report, Tasks 1 through 5 of the panel's work effort is complete.  Tasks 2, 3-1, and 3-2 were accomplished on Friday October 21, 2016. Three publicly noticed teleconferences hosted by District staff took place on October 28, November 14 and November 28. For each meeting an agenda and meeting summary are posted on the Web Board.

# PEER REVIEW PANEL'S APPROACH

Section 373.042, Florida Statutes (F.S.), provides that minimum flows for a given watercourse represent the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area and the minimum water level is the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

Section 373.042, F.S. also provides that MFLs shall be calculated using the best information available, that the Governing Board shall consider and may provide for non-consumptive uses in the establishment of MFLs, and when appropriate, MFLs may be calculated to reflect seasonal variation. The law also requires that when establishing MFLs, changes and structural alterations to watersheds, surface waters, and aquifers shall also be considered (Section 373.0421, F.S.). The State Water Resource Implementation Rule (Chapter 62-40, Florida Administrative Code) includes additional guidance for the establishment of MFLs, providing that:

> "…consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows or levels, and environmental values associated with coastal, estuarine, aquatic, and wetlands ecology, including:
>
> a. Recreation, in and on the water;
> b. Fish and wildlife habitats and the passage of fish;
> c. Estuarine resources;
> d. Transfer of detrital material;
> e. Maintenance of freshwater storage and supply;
> f. Aesthetic and scenic attributes;
> g. Filtration and absorption of nutrients and other pollutants;
> h. Sediment loads;
> i. Water quality; and
> j. Navigation."

Section 373.042, F.S., also addresses independent scientific peer review of MFLs, specifying the review of all scientific or technical data, methodologies, and models including all scientific and technical assumptions employed in each model, used to establish a minimum flow or minimum water level. In addition, the law requires that FDEP or the governing board shall give significant weight to the final peer review panel report when establishing the minimum flow or minimum water level.

This report utilizes a tabular template for each of the three peer reviewers to meet the District's peer review requirements. Included as Appendices are two sets of summary tables to capture the key elements of each technical review. The first set of tables, the review comments tables, summarizes each panel member's individual general and specific review comments along with any recommended actions (Appendix Tables 1-1, 1-2, and 1-3). Each comment is treated as a separate row in these tables. The second set of tables, the peer review assessment criteria tables, include each panel member's comments concerning the District's peer review assessment criteria, which are described in the following outline (Appendix Tables 2-1, 2-2, and 2-3).

The District's peer review assessment criteria, addressed by each panel member in the second set of appended tables are as follows:

(A) Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented.

1. Supporting Data and Information: Review the relevant data and information that support the conclusions made in the report to determine:

   (a) the data and information used was properly collected;

   (b) reasonable quality assurance assessments were performed on the data and information;

   (c) exclusion of available data from analyses was justified; and

   (d) the data used was the best information available.

   **Note:** The peer review panelists are not expected to provide independent review of standard procedures used as part of institutional programs that have been established for collecting data, such as the USGS and District hydrologic monitoring networks.

2. Technical Assumptions: Review the technical assumptions inherent to the analysis used in the Pithlachascotee River MFLs report to determine whether:

   a. the assumptions are clearly stated, reasonable and consistent with the best information available;

   b. the assumptions were eliminated to the extent possible, based on available information; and

   c. other analyses that would require fewer assumptions but provide comparable or better results are available.

3. Procedures and Analyses: Review the procedures and analyses used in the Pithlachascotee River MFLs report to determine whether:

   a. the procedures and analyses were appropriate and reasonable, based on the best information available.

   b. the procedures and analyses incorporate all necessary factors;

   c. the procedures and analyses were correctly applied;

   d. limitations and imprecisions in the information were reasonably handled;

   e. the procedures and analyses are repeatable; and

   f. conclusions based on the procedures and analyses are supported by the data.

(B) If a proposed method used in the Pithlachascotee River MFLs report is not scientifically reasonable, the Peer Reviewers shall:

1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies;

2. Determine if the identified deficiencies can be remedied.

3. If the identified deficiencies can be remedied, then describe the necessary remedies and an estimate of time and effort required to develop and implement each remedy.

4. If the identified deficiencies cannot be remedied, then, if possible, identify one or more alternative methods that are scientifically reasonable. If an alternative method is identified, provide a qualitative assessment of the relative strengths and

weaknesses of the alternative method(s) and the effort required to collect data necessary for implementation of the alternative methods.

(C) If a given method or analyses used in the Pithlachascotee River MFLs report is scientifically reasonable, but an alternative method is preferable, the Peer Reviewers shall:

1. List and describe the alternative scientifically reasonable method(s), and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s).

# SUMMARY OF REVIEW PANEL COMMENTS/ QUESTIONS

As described, each panelist's detailed review comments are Included in Appendices as a set of two summary tables that capture the two key elements of each technical review. The first set of tables, the review comments tables, summarize each panel member's individual general and specific review comments on the MFL document along with any recommended actions (Appendix Tables 1-1, 1-2, and 1-3). Each comment is treated as a separate row in these tables. The second set of tables provide each panel member's conclusions for each of the District's peer review assessment criteria (Appendix Tables 2-1, 2-2, and 2-3).

As the three panelists conducted their individual reviews of the subject MFLs report and appendices, sets of questions/comments from each panelist were posted to the Web Board. District staff posted responses to these questions/comments as soon as they could be developed. The panelists' questions/comments as well as District staff responses are included on the appropriate tables included in the Appendix.

The three panelists are in general agreement that District staff has developed MFLs recommendations based on best available data. The three panelists also agree with the report's basic assumptions, methods of data collection, analysis and presentation, development and selection of minimum flows, and conclusions as presented in the MFLs report. The three, however, also collectively expressed concerns for the effect of uncertainty of these data (and subsequent analyses) on conclusions regarding the proposed minimum flows. Characterizing the sources of uncertainty, the magnitude of each, and their individual and collective effect on conclusions should be part of every MFLs setting process. Such analysis of uncertainty is not addressed in an explicit and integrated approach in the District's report. Panelists agree that a critical part of the MFLs process should be the development and implementation of a comprehensive adaptive management plan that, among other things, would reduce data uncertainty in the future. The panelists are particularly concerned with the uncertainty in method for estimating the fish passage criterion for the upper section of the river. For this Dr. Walton has made some very specific recommendations for reducing the uncertainty in this estimate. Finally, the panelists are also in agreement that some sections of the District's MFLs report do not flow as well as it should to be easily understandable by all readers. On this point the detailed comments in Appendix Tables 1-1, 1-2, and 1-3 highlight specific sections of the report in need of clarification."

**Additional Response:** In response to the Panel comment concerning data and analytical uncertainties, staff has, where practical, revised the draft minimum flows report to better characterize these uncertainties. Also, uncertainty assessments such as those included in the revised minimum flows report will be used for future minimum flow status assessments for the Pithlachascotee River and other priority water bodies within the District, as well as for minimum flow development scheduled for other priority water bodies.

Minimum flow status assessments, conducted annually and on a five-year basis for regional water supply planning purposes exemplify the District's adaptive management approach in its Minimum Flows and Levels Program. Similarly, the continued identification and development, through project funding, of the best available information and analyses for prioritized water bodies embraces our adaptive management approach.

Staff concur with the panelists concerns regarding application of the HEC-RAS model for the upper Pithlachascotee River used for identification of criteria associated with low-flow conditions. Based on these concerns we have determined that for the relatively low-flow Pithlachascotee River, an alternative to the wetted perimeter and fish passage criteria assessments completed using HEC-RAS results may be more appropriate for establishing a minimum low-flow threshold for the upper river. As discussed in greater detail in the additional response to comment 9 within Table 1-3 of this document, staff now recommends an alternative approach based on the Tennant (a.k.a., Montana) method that has been used extensively in environmental flow assessments. For the alternative approach, we used the Tennant method to establish a revised minimum low flow threshold at 40% of the mean annual flow. Based on the mean annual flow for daily records for full years from the baseline flow record, i.e., from 1990 through 2000, we identified an 11 cfs revised minimum low flow threshold for the upper river.

In his seminal work, Tennant indicated that maintenance of 20% and 40% of the mean annual flow in a sample of assessed streams was considered “good” for instream flow regimens for fish, wildlife, recreation and associated environmental resources for dry and wet seasons, respectively. We conservatively opted to use a 40% of the mean annual flow criterion for a revised minimum low flow threshold, which is to be applicable for potential surface water withdrawals throughout the year.

The mean annual flow used for the calculation was developed using daily records for full years from the baseline flow record, i.e., from 1990 through 2000. Although lower than the originally recommended 25 cfs minimum low flow threshold, the 11 cfs flow rate is still a relatively high flow for the river, corresponding to the $60^{th}$ exceedance percentile. Use of the Tennant method to establish the revised minimum low flow threshold obviates concerns associated with use of the existing HEC-RAS model for threshold development.

With regard to the panelist comment concerning report clarity, staff believes it has addressed, to the best of our ability, all comments included in the Panel’s Appendix Tables 1-1, 1-2, and 1-3.

## SUMMARY OF COMMENTS/QUESTIONS SUBMITTED BY DR. SAM UPCHURCH

Dr. Upchurch’s comments indicate that the District’s MFLs report is well written and use of appendices is appropriate. However, he has identified the following concerns that apply to the entire document.

1. There are logic gaps and transitions, which are noted in the tables, that need to be closed. These gaps are most pronounced in the early portions of the report where the measurement data and use of the Integrated Flow Model (IFM) are presented.

   **Additional Response:** Staff believes we have addressed these panelist concerns, as summarized in the responses and additional responses included in the Panel’s Appendix Tables 1-1 and 2-1 within this document.

   The District needs to build a case early in the report as to what constitutes “best available data” as defined in Chapter 373 F.S. There should be a thorough discussion of the quality of the measurement data and the uncertainties that result from use of these data. Building the case for use of the IFM as a data source constitutes a logic jump because the quality of the measured, as opposed to synthesized, data remains unclear.

**Additional Response:** Staff believes we have addressed these panelist concerns, as summarized in the staff responses and additional responses included in the Panel's Appendix Tables 1-1 and 2-1 within this document.

2. The report begins with a discussion of the entire Pithlachascotee River basin, including Crews Lake and the drainage upstream from the lake. It then rightly limits the MFLs to the river downstream from Crews Lake and the Fivay Junction gage. There needs to be an explanation as to why the Crews Lake reach of the river is excluded, including noting (and referencing) the separate MFLs being developed for Crews Lake. It should also be noted that the Crews Lake reach of the river is within an internally drained area from which groundwater typically goes to coast rather than the river. Therefore, there is a basis for managing the lake and its tributaries separately from the river reach.
This comment is a segue to a broader discussion that should be included in the report. With implementation of the MFLs for Crews Lake and the Pithlachascotee River and the permit conditions for the wellfields that are likely to affect flows in the river, few water bodies in Florida are as so highly managed and constrained. While all of these water-management instruments are written to stand alone, they overlap in their effects on the river. A section describing the effects of these water-management tools on water availability in the river should go a long way towards (1) mitigating concerns about river flows and the environment and (2) data uncertainties.

   **Additional Response:** Staff believes we have addressed these panelist concerns, as summarized in the staff responses and additional responses included in the Panel's Appendix Table 1-1 (see especially responses to comment 4) and 2-1 within this document.

3. Finally, the report should set up a final chapter explaining how the District will implement MFLs that deal with natural low and high flows, surface-water withdrawals that operate on short time scales, and groundwater withdrawals that operate on the time scale of months to years. This discussion is a great place to present the constraints on groundwater extraction and cooperation with Tampa Bay Water."

   **Additional Response:** A new section (Section 6.5) that addresses use of minimum flows and levels in water use permitting was added to the revised minimum flows report to address this reviewer suggestion.

## SUMMARY OF COMMENTS/QUESTIONS SUBMITTED BY DR. BILL DUNN

Dr. Dunn's review indicates that the District has done a commendable job in developing the proposed minimum flows. He agrees with basic assumptions, methods of data collection, data analysis and presentation, development and selection of minimum flows, and conclusions as presented in the MFLs report. However, managing uncertainty, which should be part of every MFLs setting process, is not addressed in an explicit and integrated approach in the District's report. Dr. Dunn believes the management of uncertainty is best accomplished as an adaptive management (AM) process and suggests that a comprehensive assessment of major sources of uncertainty and the magnitude of each source should be addressed in an explicit plan to manage the effects of uncertainty and reduce its impacts in the future using an AM approach."

On the topic of AM, Dr. Dunn points out that by their very nature MFLs are adaptive strategies for management of the District's critically important water bodies. Each adopted MFL, as well as the District's entire MFLs program define an adaptive, learn as you go management strategy. The District would benefit from an explicit adaptive management approach that is based on identifying and addressing elements of uncertainty.

The field of AM has been developed over the last several decades specifically to deal with the effects of uncertainty in making and implementing resource management decisions, such as the management of water resources through MFLs. The basic tenets of AM are:

- All resource management decisions and resource management plans have elements of uncertainty; yet, management decisions must be made.
- Decisions should be made based on the best science, knowledge, and information available, but clearly identifying sources of uncertainty and accounting for their range of impact on predicted outcomes
- Uncertainty can be characterized, its effects can be described, and it can be managed, thus allowing prudent water resource decisions using the best available information.
- Monitoring of the condition of the resource of concern and its response to change is necessary in order to make better-informed future management decisions.

AM framework has become embedded in large ecosystem management and restoration programs for the Florida Everglades, Colorado River, California Bay-Delta program, Delaware River estuarine fisheries, and many other water resource management programs across North America. The framework for AM is a goal-seeking, six-step adaptive feedback process as follows.

1. Assess the problem
2. Design a solution
3. Implement the solution's management plan (e.g. the minimum flows)
4. Monitor the resources of concern
5. Evaluate resource health/condition, and develop resource management adjustments as needed
6. Implement adjustments to the minimum flow regime

As an example, an AM approach integrated into the minimum flow regime for the Pithlachascotee Rivers would include:

- Use the proposed minimum flows as the initial condition, representing distillation of the best available information and analysis.
- Understand, describe, and quantify the sources of uncertainty affecting development of the minimum flows.
- Implement specific monitoring and compliance requirements that will reduce the effect of uncertainty and improve management decisions in the future.
- Collect and analyze monitoring data.
- Use data, analytical tools, and models to evaluate responses of resource values being tracked.
- Assess whether minimum levels are being met. If not, then revise relevant portions of the minimum flows.
- Implement changes to minimum flows as needed.

This AM approach can also encompass SWFWMD's MFLs compliance assessments done as part of both water use permitting decisions and the District's five-year water supply planning process. For MFLs, the congruence between the development of protective flows and levels for water bodies and the classic AM approach provides a framework for prudent use and protection of water resources while also providing goal seeking, adaptive strategies for dealing with uncertainty."

**Additional Response:** District staff currently implements an adaptive management approach for the development and regulatory use of minimum flows and levels. This approach is guided by legislative and rule-based directives that require used of best available information for establishing minimum flows and levels; the review and revision of adopted minimum flows and levels, as necessary; and periodic status assessments, including annual assessments and those associated with regional water supply planning. Use of established minimum flows and levels in the District's Water Use Permitting Program is similarly associated with an adaptive management approach, based on adherence to general statutory and rule-based permit issuance and renewal criteria, as well as development of site or permit-specific conditions for issuance of permits that frequently require substantial environmental monitoring and reporting.

The District's adaptive management approach for its minimum flows and level program is outlined in the draft minimum flows report and notes that the approach is also summarized in a 2010 District report titled, "Minimum flows and levels development, compliance, and reporting in the Southwest Florida Water Management District" referenced in the draft minimum flows report. Below are Dr. Dunn's list of adaptive management components for the Pithlachascotee River (in italics) with some relevant information illustrating how these components are and will be addressed.

- *Use the proposed minimum flows as the initial condition, representing distillation of the best available information and analysis*

  Relevant information: This is the intent of our Minimum Flows and Level Program, and was certainly our approach for development of the recommended minimum flows for the Pithlachascotee River.

- *Understand, describe, and quantify the sources of uncertainty affecting development of the minimum flows.*

  Relevant information: To the best of our abilities, uncertainty assessments are included in all components of our approach to minimum flows and levels development. The understanding of sources of uncertainty associated with information used for assessing the status of proposed or established minimum flows and levels is similarly undertaken. Specific uncertainty assessments supporting development of minimum flow recommendations for the Pithlachascotee River included: statistical characterization of model parameters used in regression models developed to predict isohaline locations, estimation of uncertainty associated with river flows predicted with the INTB groundwater flow model, and sensitivity analyses for characterizing uncertainties associated with the HECRAS flow estimates for floodplain habitat inundation.

- *Implement specific monitoring and compliance requirements that will reduce the effect of uncertainty and improve management decisions in the future.*
- *Collect and analyze monitoring data.*

- *Use data, analytical tools, and models to evaluate responses of resource values being tracked.*
- *Assess whether minimum levels are being met.  If not, then revise relevant portions of the minimum flows.*

  Relevant information: The District will: work the U.S. Geological Survey to ensure continued collection of appropriate hydrologic data at long-term gage stations; continue to collect and support collections of other hydrologic data for characterization of groundwater levels and rainfall for development or refinement of necessary hydrologic models; conduct or require permittees to conduct relevant hydrological and biological modeling and assessments associated with potential effects of water use on river flows and levels; and complete minimum flows and levels status assessments for the Pithlachascotee River and other minimum flows and levels water bodied on an annual basis and on a five-year cycle in concert with regional water supply planning.

- *Implement changes to minimum flows as needed.*

  Relevant information: The District's minimum flows and levels status assessment procedure is designed to determine whether minimum flow and level requirements are being met and are expected to be met based on projected water-use demand for the coming 20-years. If not met or projected not to be met based on effects associated with water withdrawals, recovery or prevention strategies designed to ensure the minimum flows and levels requirements are met are developed and implemented. If assessments suggest that minimum flows and levels may not be met based on factors other than impacts from water withdrawals, determinations for the need to review and/or revise established minimum flows and levels are undertaken.

Dr. Dunn also strongly recommends that the District strengthen the technical basis for MFLs beyond its reliance on a 15 percent allowable change in each habitat condition. Dr. Dunn acknowledges that the 15 percent change metric has much merit, has been strongly and justifiably supported in many peer reviews, and has been successfully applied to many riverine MFLs in the District. The method is, however, based on a general presumption that a 15 percent change in the given habitat condition will not result in harm to the water resource, ecological, and human use values of the riverine system. Dr. Dunn notes that specific data-based protective criteria have been developed by other Florida water management districts. He also highlights that the District has also applied this approach in developing some minimum flows for riverine systems, such as the MLF for fish passage for the Pithlachascotee River. Dr. Dunn strongly recommends that whenever possible MFLs should be based on statistically defined protective hydrological events composed of 1) a magnitude (flow and/or level), 2) continuous duration for the specific inundation or drying period, and 3) with a return interval. He points out that the St. Johns River Water Management District has defined such hydrologic event criteria for most of the water resource values of concern that the District focused on for the upper and lower sections of the Pithlachascotee River. Thus, Dr. Dunn points out that there exists a great deal of peer reviewed research, and application of event based MFLs that the District can build upon."

**Additional Response:** The District is committed to the review and consideration of well-tested and emerging approaches for establishing environmental flows. As part of this process, we will continue to explore event-based criteria to complement criteria that we have successfully used for numerous priority water bodies within the District. We, will also continue to review other habitat-based environmental flows to gain insight regarding the appropriateness of our habitat-change criteria.

## SUMMARY OF COMMENTS/QUESTIONS SUBMITTED BY DR. RAYMOND WALTON

Dr. Walton's comments 2 through 7 in Appendix Table 1-3 address questions regarding the isohaline regression analysis that is used by the District to develop minimum flows for the lower, estuarine section of the river. Overall, the District used best available data and appropriate methods, except as presented in Appendix Table 1-3 below. As such, the resolution of the questions/comments raised by Dr. Walton can affect the conclusions of the District report, specifically the minimum flows proposed for the lower Pithlachascotee River. We note, however, that resolving this uncertainty is far less important than resolving the uncertainty in the hydraulic modeling of the upper river as the lower river minimum flows are much larger than the minimum flows in the upper river."

**Additional Response:** As discussed in staff responses to the reviewer's comments 2-7 in Table 1-3 and in the revised minimum flows report, Staff notes that the regression models developed for isohaline predictions were developed using the best available information.

Dr. Walton's comments 8 through 12 in Appendix Table 1-3 raise important questions regarding the HEC-RAS modeling analysis, which is critical to the development of the minimum flow regime for the upper, freshwater section of the river. Again, best available data and appropriate methods were used. However, he is concerned about the level of uncertainty in the minimum flow resulting from the hydraulic model analyses, including the systematic bias seen in the calibration of the HEC-RAS hydraulic model. Dr. Walton particularly notes potential effects on the fish passage criterion, which defines the recommended MLF. Resolving the HEC-RAS issues raised by Dr. Walton is most critical because the minimum flows proposed for the upper river appear to be more sensitive, and thus critical for river system management, than the minimum flows for the lower river.

The concern is whether the HEC-RAS hydraulic model is sufficiently accurate to determine that a minimum flow of 25 cfs achieves the minimum depth of 0.6 feet throughout the upper river. We recommend that the hydraulic model be revisited to reduce the level of uncertainty in the fish passage analysis by:

- Measuring 4-6 water surface profiles along the upper reach for a range of flows between 10-50 cfs.
- Consider whether additional cross sections are needed to improve the accuracy and adequacy of the model's geometry
- Re-calibrate and validate the hydraulic model using the new information, specifically to remove the systematic bias seen in the current model calibration.
- Re-do the minimum flow analyses for the upper river, and incorporate into the MFL report and appendices."

**Additional Response:** District staff agree that the current HEC-RAS model would benefit from additional data collection and calibration efforts. However, given that staff no longer plans to use the model for development of a Minimum Low Flow Threshold as discussed in the additional response to reviewer's comment 9 in the Panel's Appendix Table 1-3 within this document (see also responses to comments 8 and 10 through 12 in the same table, as well as responses to comments A1(a, b, c ,d), A3 (c) and B1 through B4 in Table 2-3), we do not currently anticipate additional data collection and model calibration. Minimum flow analyses the rely on HEC-RAS model output were, therefore, not re-done.

# REFERENCES

Geurink, J. S. and R. Basso. 2013. Development, calibration, and evaluation of the Integrated Northern Tampa Bay Hydrologic Model. Report prepared for Tampa Bay Water, Clearwater, Florida, and the Southwest Florida Water Management District, Brooksville, Florida.

Munson, A. B. and Delfino, J.J. 2007. Minimum wet-season flows and levels in southwest Florida. Journal of the American Water Resources Association 43: 522-532.

SWFWMD 2016 a. Proposed Minimum Flows for the Pithlachascotee River—Revise Draft Report for Peer Review. Southwest Florida Water Management District, Brooksville, Florida

SWFWMD 2016b. Appendices for Proposed Minimum Flows for the Pithlachascotee River—Revise Draft Report for Peer Review. Southwest Florida Water Management District, Brooksville, Florida

# Appendix A

## Table 1-1. Upchurch Review Comments on MFL Documents

# TABLE 1-1. UPCHURCH REVIEW COMMENTS ON MFL DOCUMENTS

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-1, Upchurch | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| 1 | General comment | No | The District and its consultants have created a succinct and useful MFL basis report. I like the use of appendices to present the results details. This style makes review much easier.<br><br>There are editorial issues that need to be corrected, and the maps that utilize the aerial photograph as a background are very hard to read. There are also graphs where the selection of background and line colors makes them unreadable. | I suggest that the photograph be omitted and a few important landmarks (i.e., Rowan Road) be provided on a blank background for the maps. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. Editorial comments and formatting suggestions provided by the panel will be considered by staff during the report revision process.<br><br>**Additional response:** District staff thinks aerial photography included in many report figures provides useful information and does not anticipate removing this imagery from the figures. Staff agrees that inclusion of landmarks such as Rowan Road is useful and has included appropriate landmarks in report figures. |
| 2 | General comment | No | Recognizing that Chapter 373 F.S. allows for use of "best available data" for MFLs development, the case for use of the integrated model as a source of data has not been completely addressed as "best available data." The raw discharge data are not adequately addressed in the report or appendices.<br><br>It is understood that use of the integrated model to simulate pre-development flow in the river is the best source of pre-development information. However, if the simulation of flow within the 10-year interval (a short time frame for MFLs development) | The raw discharge data should be presented with an analysis of outliers, data gaps, and indications of cyclicity (seasonal, AMO related, etc.). It should be made clear where these data have been utilized, including 1) relationship of the modeled, predevelopment discharge and current discharge to these data, 2) use of the physical data to verify the integrated model, including analyses of residuals and goodness of fit, and 3) comparison of the modeled data to the physical data showing relationship of the modeled data to hydrologic cycles, etc. | **Response:** Ron Basso, Chief Hydrogeologist, SWFWMD. Tampa Bay Water and SWFWMD have collaborated on the calibration and use of the INTB model which was successfully peer reviewed in 2013 by a three-member panel of model experts with one member of the model peer review panel (Ray Walton) currently serving as a panelist for the Pithlachascotee MFLs peer review. We began this collaboration in the late-1990s as a result of litigation between the agencies over wellfield impacts and the partnership plan between the two agencies that reduced the 11 central system facility withdrawals |

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| | | | that was modeled is problematic, then the flow simulated by eliminating the groundwater pumpage component in the model will also be problematic. | The modeled data should be compared to the actual data, outliers and residuals should be analyzed, and the context of the modeled data relative to seasonal and long-term hydrologic cycles should be explicitly provided.<br><br>Finally, explain to the reader what portions of the physical data and modeled flows constitute "best available data" and why. Explain why a 10-year time series is suitable for MFLs development.<br><br>Response Ron Basso Comment: I realize that this is the case. My issue is that none of the data is presented or evaluated in this report. I'm not suggesting that the fine work done by the District and TBW be repeated or even critiqued. I am suggesting that the report should stand alone and not require the reader to review the work previously completed. | from 150 mgd to a maximum of 90 mgd. Both SWFWMD and TBW agreed to work together to develop one model to assess the hydrologic conditions in the Tampa Bay wellfield area.<br>A complete assessment of the calibration and verification of the model from 1989-2006 is contained with Geurink and Basso (2013). We can make this report available for the Panel's review if requested. We can also provide the peer review report on the INTB application that was completed by Ray Walton, EJ Wexler, and Norm Crawford in 2013. Based on this information, we (TBW and SWFWMD) believe that the INTB model is a part of the "best available information" discussed in the statute.<br><br>We recognize the difficulties in numerical model prediction results for a predevelopment (pumps off) condition. In fact, TBW funded a study by the University of South Florida (Ross and Trout, 2017) to examine the INTB "pumps off" simulation to note any deficiencies with that approach. The results of that study are summarized with the following statement *"Looking at the overall performance and findings from the model when pumping is turned off within the CWCFGWB (groundwater basin), no unreasonable findings from the model were found."* No predevelopment calibration was performed with the INTB model as this would be difficult due to lack of observed data prior to the 1930s in the area. Withdrawals were initiated at the Cosme-Odessa wellfield in the 1930s. The flows recorded by the USGS at the NPR gage only go back to the 1960s and Eldridge-Wilde and the Section 21 wellfields were already pumping by that time. |

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| | | | | | One of the limitations discussed in the response to questions posed by Ray Walton is the rainfall that actually fell during the simulation period from 1996-2006 –which was drier than average. Hundreds of rainfall realizations conducted by TBW using the INTB model for the same period based on the historical range of rainfall in the area suggest that predicted impact to flow from groundwater withdrawn can vary by 0.6 cfs depending upon the climatic conditions of the period.<br><br>The climatic variability, uncertainty in the “pumps off” simulation, model error, and varying pumping distributions all play a role in predicted impacts to the system. These factors are why staff did not exclusively rely on model results but determined that the minimum flows were being met with supplemental data as measured in the field over the last 5-6 years. Flow observations and aquifer water levels in the area both show that they are similar to background conditions during the last 5 to 6 years.<br><br>We think the 10-year time period used for MFLs development is suitable because it incorporated extremes in the climatic record, including the 2000 drought and the 2004 rainfall associated with multiple hurricanes that serve as surrogate for variation expected over a much longer time-frame. Due to the complexities previously discussed, it represented a suitable period to conduct the MFL analysis, given the long history of wellfield withdrawals in the area and limitations of predevelopment data. |

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| | | | | | **Additional response:** Sections 2.8 and 2.9, 4.2 and 6.2 have amended in the revised report to address the reviewer's comments. In addition, a new appendix to the minimum flows report that summarizes the INTB model calibration has been included.<br><br>Finally, the following citation information for the document cited in original staff response above: Ross, M., and K. Trout, 2017, University of South Florida, Assessment of the Integrated Northern Tampa Bay Model No Groundwater Pumping Scenarios. |
| 3 | General comment | No | The multiple linear regression analyses used to simulate flow need to be better explained and analyzed. For example, one of the two regression equations presented in the report and appendix utilizes 150-day lagged pumpage from regional wellfields as a variable. How was this term identified? Did you use stepwise multiple regression? What were the variables that were eliminated? Use of a 150-day lagged term suggests that the signal from a pumping event arrives at the river in 150 days. While this lag may well be reasonable, it suggests a management problem.<br><br>The MFL is written is such a way as to allow for management of surface water withdrawals over short time intervals. The groundwater component with a 150-day delay suggests a different management process. The report should, but does not, address each of these management issues and how they will be implemented. | Explain what data were used in the regressions, model-derived or actual? I may have missed it, but please be sure explanation is provided and that residuals analyses are provided.<br><br>If it takes 150 days for actions at the nearby wellfields to be manifested in river flow, describe how this delay will be anticipated? Finally, how will these management issues be considered vis a vis low flow during droughts?<br><br>Response to Doug Leeper: Provide a short paragraph explaining to the reader, how you got there. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>District staff is in the process of discussing the panelist's questions with the consulting firm, Janicki Environmental, Inc., that developed a regression for predicting baseline flows. Interim responses to the questions are provided below; development of additional responses is ongoing.<br><br>The 150-day lagged term for withdrawals from the Starkey-North Pasco wellfield was used for developing Equation 1 in the draft minimum flows report was based on consideration of various lag terms, including 7-day, 14-day, 30-day, 60-day, 90-day, 120-day, 150-day and 180-day moving average pumping values for individual wellfields in the area. Wellfield pumping values for the various lag-times and wellfield combinations (Cross Bar-Cypress Creek, Eldridge-Wilde, South Pasco, Section 21 and Cosme-Odessa) that did not exhibit statistical significance were excluded from model development. Staff notes that as explained in the draft report, elimination of |

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| | | | | | the lagged-term for combined withdrawals from the Starkey and North Pasco wellfields (see Equation 2 in the draft report) yielded predicted baseline flows that were similar to those predicted using Equation 1.<br><br>For development of both regression equations, modeled values derived from INTB model simulations were used for baseline and impacted flows. For the lagged-pumpage term in Equation 1, measured pumpage data were used. For predicting of baseline flows, measured (i.e., reported or observed) flows at the NPR gage were substituted for INTB-modeled impacted flows in Equation 1 and were used along with reported lagged-pumpage values to predict baseline flows. Very low baseline flows, specifically those less than 1.6 cfs were, however, predicted using values derived from the INTB model simulation.<br><br>Minimum flow rules are developed to specify daily withdrawal rates that can be used for short-term surface water withdrawal management and associated water use permit conditions. In contrast, based on the more diffuse and temporally variable effects of groundwater withdrawals on streamflow, evaluations for requested groundwater withdrawals and for assessment regarding whether minimum flows are being met are conducted on a long-term basis. That is, they are typically conducted using long-term mean and/or median flows predicted with numerical or other models with supporting evidence provided by monitoring data. Drought conditions are expected to be incorporated into analyses supporting minimum flow development, and as noted in response to item 1 above, this was the case for the |

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| | | | | | analyses supporting development of proposed minimum flows for the Pithlachascotee River. In addition, District rules include provisions for management actions that can be implemented during water shortages that may occur as a result of drought or other factors.<br><br>**Additional response:** Some information contained in Staff's original response above was included in Section 4.2 of the revised minimum flows report. |
| 4 | General comment | No | The MFL is being developed for the Pithlachascotee downstream from Crews Lake. Crews Lake, the Mazaryktown Canal, Jumping Gully and portions of the Cross Bar Ranch Wellfield are within the river basin (Figure 2-2). There should be a discussion of the reason for exclusion of the basin upstream of the Crews Lake outfall from this MFL. The Crews Lake MFL should be cited, and I think it would be helpful to the reader to explain that the basin upstream from the Crews Lake outfall is part of a second groundwater basin with internal drainage that flows to the coast, not the river. | Add a discussion of the reason for exclusion of the basin upstream of the Crews Lake outfall from this MFL. The Crews Lake MFL should be cited, and I think it would be helpful to the reader to explain that the basin upstream from the Crews Lake outfall is part of a second groundwater basin with internal drainage that flows to the coast, not the river.<br><br>This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Ron Basso, Chief Hydrogeologist and Doug Leeper, MFLs Program Lead, SWFWMD. There is some ambiguity in reference to the actual drainage basin delineation, as some reference sources terminate the drainage basin Prior to Crews Lake (see figure below).<br><br>Much of the system becomes internally drained under deep water table conditions near Crews Lake and areas surrounding the lake. This transition area becomes a mostly unconfined Floridan aquifer, deep water table, highly karst-dominated, and high recharge environment near the boundary of the Central and Northern West-Central Florida Groundwater Basins which is represented well in the INTB model. Regardless of the drainage basin delineation, the INTB model covers a 4,000 square-mile area. Groundwater impact scenarios were simulated by zeroing out all withdrawals in the Central Groundwater Basin (included all of Cross Bar wellfield withdrawals even though northern portion of the wellfield is outside the basin). |

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| | | | | | We can add the discussion to the report regarding the change in the system going from a shallow water table, leaky Upper Floridan aquifer (UFA) to a deep water table largely unconfined UFA. The District is in the process of establishing minimum levels for Crews Lake and reference to these MFLs or their ongoing development will be incorporated into revisions of the draft report addressing minimum flows development for the Pithlachascotee River. Other established MFLs located in the basin upstream of Crews Lake, including those adopted for several lakes and a few isolated wetlands in the southern portion of the Cross Bar Ranch wellfield will also be identified in the revised document.<br><br>**Additional response:** Minimum levels were established for Crews Lake in December 2016 and this information as well as other text concerning the upstream portion of the basin has been included in the revised minimum flows report. |
| 5 | 10, P 2 | No | There should be a comma after river in first sentence. | Insert comma | **Additional response:** This recommended formatting change has been included in the revised minimum flows report. |
| 6 | 10, P 4 | No | Bay is misspelled | Change Bat to Bay | **Additional response:** This error has been corrected in the revised minimum flows report. |
| 7 | 15, P 4 | No | The 15 percent change criterion should be referenced. | Reference Section 1.4.6. Consider moving this section up to immediately deal with the 15 percent criterion when first mentioned. | **Additional response**: District staff chose to not make this change, given that paragraph 4 on page 15 is a general discussion of significant harm that also describes threshold-based and percentage change criteria that are used to identify significant harm. |

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| 8 | 16, P 1 | No | I like this discussion of conditions. However, subsequent sections do not adequately discuss the AMO, etc. in the context of the measured or modeled data. This lack of discussion cuts to my concerns about extreme flows and cycles in the data sets. | Need to discuss the measured and modeled time-series data in terms of adequacy and representation as best available data. There is a need for a discussion of extreme conditions and patterns in the measured and modeled data. | **Additional response:** One of the limitations previously discussed is the rainfall that actually fell during the minimum flow evaluation period, which was drier than average. Hundreds of rainfall realizations conducted by Tampa Bay Water using the INTB model for the same period based on the historical range of rainfall in the area suggest that predicted impact to flow from groundwater withdrawn can vary by 0.6 cfs depending upon the climatic conditions of the period.<br><br>We think the 10-year time period used for minimum levels development is suitable because it incorporated extremes in the climatic record, including the 2000 drought and the 2004 rainfall associated with multiple hurricanes that serve as surrogate for variation expected over a much longer time-frame. Due to the complexities previously discussed, it represented a suitable period to conduct the minimum flows analysis, given the long history of wellfield withdrawals in the area and limitations of predevelopment data.<br><br>Staff have updated the rainfall section in the report that describes the AMO and more recent rainfall history for the system. |
| 9 | 17, S 1.4.6 | No | This is the discussion of the 15 percent criterion that should have been presented on page 15. The last paragraph is good in that it allows for groundwater withdrawals. | See above. | **Additional response:** District staff chose to retain this section of the report in its original "location" within the revised report because we think it is necessary to discuss both threshold-based and percentage change criteria that are used to identify potential significant harm. We note that discussion of minimum flow thresholds precedes the section on the percent-of-flow method and 15% change criteria. |

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| 10 | 18, P 3 | No | "…continuing to us the 15…. Use is misspelled. | Change us to use. | **Additional response**: This error has been corrected in the revised minimum flows report. |
| 11 | 20, S 2.2 | No | This section is a good discussion of the entire Pithlachascotee basin. The section tends to mislead the reader later on, however. There should be a discussion of the hydrologic reasons why the Crews Lake reach is not considered in the MFL here. See general comments. | Add discussion. | **Additional response:** Section 4.1 addressing the study area has been modified in the revised minimum flows report to indicate that areas upstream of the gage near Fivay Junction, e.g., Crews Lake, and the tributary, Five Mile Creek, were not directly assessed as part of the analyses supporting minimum flows development for the upper river. The modified text notes that these upstream areas were, however, implicitly assessed for baseline flow development and the evaluation of withdrawal impacts based on their contributions to downstream flow |
| 12 | 21ff, S 2.3 | Yes | The only rainfall data presented is a graph showing the average monthly rainfall. The reader is not told what gage data are included and how close the gage(s) is to the Pithlachascotee. Also, there is no discussion of long-term rainfall, trends in rainfall over time, the AMO, data quality, etc. | Add discussion. | **Additional response:** The rainfall section of the report has been updated to address the reviewer's concerns. |
| 13 | 22, P. 2 | No | The physiographic province discussion is fine. However, there should be a discussion of karst in the basin, especially as relates to the exclusion of the Crews Lake reach from the MFL. | Add discussion | **Additional response:** The hydrogeology section of the report has been updated to address the reviewer's suggestion. |
| 14 | 22, P 2 | No | Stratigraphic nomenclature has long since been changed. The Bone Valley is now a member of the Peace River Formation and the Alachua is no longer recognized. Neither is recognized as a formation. | Read Arthur, et al., 2008. Hydrogeologic Framework of the Southwest Florida Water Management District. Florida Geological Survey Bulletin 68 and revise report accordingly. | **Additional response:** The physiography section of the report has been updated to address this issue. |
| 15 | 22, P 2 | No | The Bone Valley and Alachua are mentioned here, but neither is of any importance in the basin. What | Add discussion. | **Additional response:** The hydrogeology section of the report has been updated to address this issue. |

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| | | | about the strata that form the surficial aquifer (SAS), where present, and the Floridan strata (Ocala, Suwannee, Avon Park)? | | |
| 16 | 23, P 1 | No | The SAS, intermediate aquifer and confining unit (IAS) and UFA are mentioned here. There is controversy as to whether the SAS exists in much of the basin because the clay residuum from the IAS is often missing (as suggested in this paragraph). There is essentially no discussion of the UFA, which is important when dealing with the groundwater component of the MFLs. | Add discussions. | **Additional response:** The hydrogeology section of the report has been updated to address this issue. |
| 17 | 24, F 2-4 | No | These maps should be in chronological order. Also, they are too small to study. Strongly suggest that a boundary between the Crews Lake reach and MFL reach be shown. | Modify maps. Consider omitting the Crews Lake reach from the maps to allow for magnification of the view. | **Additional response:** District staff notes that the maps are ordered in time (in reverse chronological order). We also note that major changes in land use/land cover are easily discernible. For example, differences in the extent of Urban and Built-up classes and Agriculture lands among years are readily identified and provide spatial context for the summary information presented in Table 2-1. Finally, we chose not to eliminate the upper portion of the watershed, as factors, such as downstream flow, that are integral to the development of minimum flows for the river, are potentially affected by conditions in the upper watershed. |
| 18 | 27, P 1 | No | The recovery strategy is important to the MFL. This is a good place to discuss the effects of implementation of the recovery plan on groundwater levels and surface water flows. | Add discussion. | **Additional response:** Implementation of recovery strategies for the Northern Tampa Bay Water Use Caution Area is discussed in other District documents, e.g., the District Regional Water Supply and strategic plans. A detailed discussion of recovery in the region is therefore not included in the Pithlachascotee River minimum flows report. |
| 19 | 30, S 2.8.1 | No | Prior to discussion of flow rates and river hydrology and while groundwater is still the topic of concern, | Add discussions. | **Additional response:** The hydrogeology section of the report has been updated to address this issue. |

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| | | | suggest that recharge be discussed, including a map. With the changes in land use just discussed, recharge patterns have changes and will have impacts of river hydrology. This assist in discussions of river hydrology in this section. | | |
| 20 | 30, S 2.8.1 | Yes | This report does a poor job of discussing the measured flows in the MFL basin. | Add discussions of measured flow data, data gaps, data uncertainties, periods of record, records of extreme events (low and high flow, droughts, etc.), absence of baseline data and why, District's ability to utilize data for MFL development, etc. | **Additional response:** Section 2.8 has been updated in revised report. |
| 21 | 30, S 2.8.1 | Possibly | I am a fan of use of unit discharge (Q/drainage basin area). However, with the karst in the area, unit discharge measurements can be deceiving. Are the basin areas all tributary to the river or are some internally drained? How are the Crews Lake reach and basin treated, are they include in the areas, or they ignored? | Add discussion. | **Additional response:** Section 2.81 has been updated in the revised report to address the reviewer's comments. |
| 22 | 30, F 2-8 | Yes | The flow duration curve (FDC) needs to be backed up by presentation of the data. The reader needs to see the times of no flow and extreme flow in order to understand the FDC. | Add discussion. | **Additional response:** District staff notes that the time-series of daily flow records (data) used to generate the flow duration curve in Figure 2-8 is presented in Figure 2-10. Therefore, we do not see the need to revise the report section. |
| 23 | 30, P 3 | No | This discussion of the unusually low runoff rates is important. However, the recharge map mentioned in Comment 15 is important here. Also, some of Cobie's conclusions deal with the deep sands and low water table in the Crews Lake reach, not in the MFL basin. In much of the MFL basin, the depths to the water table are very similar to those in the Anclote, especially as one approaches the Gulf. | Rewrite and expand paragraph. | **Additional response**: Section 2.81 has been updated in the revised report to address the reviewer's comments. |
| 24 | 31, S 2.8.2 | Possibly | The discussion of seasonality is important in order to define the blocks used for MFL development. However, it is not supported by a good discussion of the raw rainfall data. | Add discussion. | **Additional response:** We have updated the rainfall section of the report. Also, we note that the purpose of section 2.8.2 is to compare seasonality in flow with seasonality in rainfall, and to highlight the lag in |

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| | | | | | flow due to seasonality in evapotranspiration and storage. A citation for county rainfall data has been added to the figure in the section that illustrates the lagged flow response. |
| 25 | 32, P 1 | No | Use of has is incorrect in 3rd line. | Change has to have. Wellfields is plural. | **Additional response:** This error has been corrected in the revised minimum flows report. |
| 26 | 32, F 2-10 | No | This is an important graph. The reader needs to be informed about the data, particularly the semi-diurnal nature of the tide cycle, location of the head of tides in the river, extreme events, etc. This will help explain the changes in the tidal river when the gage location was changed (Figures 2-10 and 2-11). | Add discussion. | **Additional response:** Daily flows for gage 02310300 are shown in the figure included in section 2.8.3. This gage is located in the upstream, freshwater portion of the river, where tidal cycles are not seen. Tidal influences on flow are shown in Figure 3-2 and discussed in section 3.2. |
| 27 | 36, S 2.9.2 | No | After reviewing the model-development reports, most of my concerns about the model were answered. Please be sure to reference these reports often to steer the reader to these discussions. | Add references. | **Additional response:** We added text and an appendix that summarizes INTB model calibration. |
| 28 | 36, P 3-5 | Yes | The model-development reports present some of the data required for presentation in this MFL report, the MFL report is in serious need of improvement in order to establish that model-derived data constitute best available data. | Assuming that the measured flow data have been previously discussed, add graphs comparing the model-derived data and measured flow data, discuss ability to fit the raw data, patterns in residuals, and completeness of the record. | **Additional response:** We added text and an appendix that summarizes INTB model calibration. |
| 29 | 36, P 3-5 | Yes | The defense for use of the "pumps off" scenario results as background data needs strengthening. | I agree that these data are the best available, but there should be a separate section here presenting the case in clear terms, including the facts that development in the basin and of local wellfields pre-date streamflow data collection. | **Additional response:** We added text and an appendix that summarizes INTB model calibration. This issue is also addressed in general comment response no. 2 of this document. |
| 30 | 36, P 4 | Yes | The statements about predicted flows might be clearer if graphs can be used here. | Consider adding a graph showing predicted reductions in flow with different wellfield extraction scenarios. | **Additional response:** Response is included in the technical memorandum included as Appendix 2B of the minimum flows report. In addition, new graphs (figures) were added to Section 6 of the revised report. |

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| 31 | 36, P 5 | No | 2014 is repeated in line 3. | Delete repeat. | **Additional response:** This error has been corrected in the revised minimum flows report. |
| 32 | 39, F 2-14 | Probably not | The bottom graph suggests that a regression equation was fit to the top graph. Please discuss; why is this important? | Add the regression, equation, and coefficient of determination to top graph or text. Move bottom graph to middle position and discuss residuals. | **Additional response:** The bottom panel in the original Figure 2-14 was incorrect. It erroneously showed a plot based on specific conductance values. The figure panel has been replaced with the correct information, which shows residuals from DO values regressed against flow (information shown in the middle panel of the figure) plotted by time. The significant trend in the residuals is identified in Table 2-3. Based on this summary, we believe it will confuse the reader to include a regression line and equation for the top panel in the figure, as the residuals plotted in the bottom panel are not associated with that regression. We have, however, updated the discussion of temporal trends in water quality to improve clarity. |
| 33 | 39, P 1 | No | The assumption that dissolved phosphate and o-PO4 are the same is functionally correct. | No action needed. | **Additional response:** No further action required. |
| 34 | 40, P 1 | No | The assumption that NO3 and NO3+NO2 are the same is probably safe, but they are not the same. NO2 is relatively unstable in an oxygenated environment, so it is probably de minimus. | No action required. | **Additional response:** No further action required. |
| 35 | 40, P 3 | No | Define NOx for the reader. Chemically NOx is functionally NO3+NO2. | Define. | **Additional response:** $NO_x$ has been identified as $NO_2 + NO_3$ in the revised minimum flows report. |
| 36 | 41, F 2-15 | No | See comment 28 and apply to phosphorus graphs here. The graphs suggest that there were varying detection limits in the data and that they were treated as measurements. If this is true, it should be discussed. | See comment 28. Discuss role of detection limits in these graphs. | **Additional response:** A statement of detection limits was added to section 2.10.2.2. |
| 37 | 42, F 2-16 | No | See comment 32. | See comment 32. | **Additional response:** Please refer to additional response for comment 32 above. |

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| 38 | 43, P 4 | No | The statement that DO is negatively correlated with flow appears to disagree with the middle graph in Figure 2-14. Also, use of correlations required that the line (I assume it is linear), equation, and coefficient of determination be presented in either the graph or a separate table. | Address as indicated. | **Additional response:** Section 2.10.3 of the report address relationships between DO and flow in the lower portion of the river, downstream of Rowan Road. In contrast, the discussion of DO and other water quality parameters in Section 2.10.2.1 is based on data collected in the upper segment of the river at the USGS Pithlachascotee River near New Port Richey, FL. Gage. A footnote to Table 2-4 has been included in the revised report to alert the reader to the location of the river zones identified by river kilometers. Also, the figure panels have been updated to include regression lines, equations and coefficient of determination values. |
| 39 | 45, F 3-1 and forward | No | The maps that utilize an aerial photograph for background are all very hard to read and the background is distracting. | Suggest use of a plain background with a few landmarks (gage locations; roads, esp. Rowan Rd. & US 19; or other landmarks for reference. | **Additional response:** District staff thinks aerial photography included in Figure 3-1 and other report figures provides useful information and did not remove this information from the figures. Staff notes that the landmark location of Rowan Road is included in Figure 3-1. |
| 40 | 46, S 3.2 | No | Glad to see a discussion of tides here. To complete the discussion, suggest addition of spring and neap tides and storm surges. | Address as necessary. | **Additional response:** District staff have not included additional text addressing spring and neap tides or storm surges. Staff notes, however, that Figure 3-3 included in the report provides useful information on tide seasonality and amplitude. |
| 41 | 46, P 3 | No | Suggest a map comparing the head of tides versus extent of saline water. | Consider adding this. Not critical. | **Additional response:** District staff has not included this suggested figure in the revised minimum flows report. |
| 42 | 47, F 3-3 | No | Horizontal lines representing the medians are not visible. | Change background color in boxes. | **Additional response:** District staff has not revised the figure in the revised minimum flows report. |

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| 43 | 48, F 3-4 | No | As mentioned above, the dark aerial photograph background makes this figure unreadable, especially in the stream segment upgradient from the bay. | Remove the background and add a few landmarks. Bathymetry in the riverine segment will still be unreadable. The figure could be broken in a series of panels that would make the riverine part more easily read. Also, consider including a long profile of the river so that one can get a sense of the bathymetry of the river reaches. | **Additional response:** District staff has not updated the figure in the revised minimum flows report and notes that the figure includes the Rowan Road landmark. |
| 44 | 49, F 3-5 | No | Label for horizontal axis misrepresents data. | Change to Area, Volume. As written the title suggests a fraction rather than two different metrics. | **Additional response:** District staff updated the figure in the revised minimum flows report to address the title and axis labeling issues. |
| 45 | 52, F 3-7 | No | See comments on maps with aerial photo backgrounds. | See above. | **Additional response:** District staff has not updated the figure in the revised minimum flows report and notes that the figure includes the Rowan Road landmark. |
| 46 | 60, P 3<br>61, F 4-1 | No | This paragraph says that Crews Lake and Five Mile Creek were also evaluated. They are not included in descriptions in Section 3.<br>Figure 4-1 does not show or suggest evaluation of Crews Lake, etc. | Reconcile Sections 3 and 4 relative to what data are included and what are excluded. | **Additional response:** District staff has modified paragraph 3 in Section 4.1 of the revised minimum flows report to indicate that Crews Lake and other upstream portions of the watershed were not directly assessed as part of the analyses supporting minimum flows development for the upper river. In addition, the revised report indicates that the upstream areas were implicitly assessed for baseline flow development and the evaluation of withdrawal impacts based on their contributions to downstream flow. |
| 47 | 61, P 3 | Yes | Last sentence in bottom paragraph states that the measured and modeled data fit “fairly well” and that there were “short-term differences.” | These terms suggest problematic uncertainty. It is critical that these differences be documented as suggested in Comment 16 and elsewhere, it is | **Additional response**: Additional information on modeled versus measured responses was included in Appendix 2A and can be found in Geurink and Basso |

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| | | | | important (1) to present and discuss the measured data, including data gaps, extreme events, etc., and (2) to compare the modeled and measured data, especially with respect to residuals and how extreme events are modeled. Finally, (3) the uncertainties represented in the measured data and in the modeled data must be discussed.<br>Much of this can be in Appendix 4B, and if the data are presented in other documents in such a way as to deal directly with the Pithlachascotee MFL, references can be used. Referenced data should deal specifically with the river downstream from the Fivay Junction gage. | (2013) and the peer review report of the INTB model application (West el al. 2013). |
| 48 | 62, P 1 | Yes | As noted above, a graph comparing the measured and modeled time series and showing the residuals should be included and discussed here. | Add graphs and discussion. | **Additional response**: Additional information on modeled versus measured responses was included in Appendix 2A and can be found in Geurink and Basso (2013) and the peer review report of the INTB model application (West el al. 2013). |
| 49 | 61, S 4.2 | Yes | This is the last location in the report where, in my opinion, the justification for use of modeled data as opposed to measured can be made. | Please insure that this argument is included prior to this section. | **Additional response**: Additional information on modeled versus measured responses was included in Appendix 2A and can be found in Geurink and Basso (2013) and the peer review report of the INTB model application (West el al. 2013). |
| 50 | 62, Eq. 1 | Yes | The 1.15 constant in the equation suggests a systematic difference in modeled baseline and modeled impacted flow. Is this the long-term impact of groundwater extraction or a short-term difference related to climatic cycles? | Discuss meaning of the constant and implications to the MFL. | **Additional response**: The constant (-1.15) is the value of the modeled baseline flow when the modeled impacted flow is zero. The constant implies a constant impact throughout the modeled time period. This would not be due to climatic cycles because baseline and impacted flows are modeled over same time period. |
| 51 | 62, Eq. 1 | No | Units for use in the equation (I assume they are daily estimated cfs) should be added. | Add units. | **Additional response**: Information on units was added for equations 1 and 2. |

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| 52 | 62, Eq. 1 | Yes | The use of the 150-day average term causes confusion for several reasons.<br>1. Are $Q_{base}$ and $Q_{imp}$ daily calculated values?<br>2. Is $Q_{pump150}$ a moving average with 1 one-day time step?<br>3. How was the 150 average term withdrawal identified? Stepwise multiple regression? If so, what variables were dropped and what did they contribute to the coefficients of determination? | Address questions posted in Column A. | **Additional response (item 1):** The $Q_{base}$ and $Q_{imp}$ variables are daily INTB-modeled values. As noted in the additional response to comment 51 above, units for the variables were added to equations 1 and 2 in the revised minimum flows report.<br><br>**Additional response (item 2):** The $Q_{pump150}$ variables are moving average values with 1 one-day time step. As noted in the additional response to comment 51 above, units for the variable was added to equations 1 in the revised minimum flows report.<br><br>**Additional response (item 3):** The 150-day lagged term for withdrawals from the Starkey-North Pasco wellfield that was used for developing Equation 1 in the draft minimum flows report was based on consideration of various lag terms, including 7-day, 14-day, 30-day, 60-day, 90-day, 120-day, 150-day and 180-day moving average pumping values for individual wellfields in the area. Wellfield pumping values for the various lag-times and wellfield combinations (Cross Bar-Cypress Creek, Eldridge-Wilde, South Pasco, Section 21 and Cosme-Odessa) that did not exhibit statistical significance were excluded from model development. Staff notes that as explained in the minimum flows report, elimination of the lagged-term for combined withdrawals from the Starkey and North Pasco wellfields (see Equation 2 in the report) yielded predicted baseline flows that were similar to those predicted using Equation 1. |

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| | | | | | For development of both regression equations, modeled values derived from INTB model simulations were used for baseline and impacted flows. For the lagged-pumpage term in Equation 1, measured pumpage data were used. For predicting of baseline flows, measured (i.e., reported or observed) flows at the Pithlachascotee River near New Port Richey gage were substituted for INTB-modeled impacted flows in Equation 1 and were used along with reported lagged-pumpage values to predict baseline flows. Very low baseline flows, specifically those less than 1.6 cfs were, however, predicted using values derived from the INTB model simulation.<br><br>Information contained in this additional response has been included in Sections 4.2 and 6.3.5 of the revised minimum flows report. |
| 53 | 62, P 4 | Yes | There is a need for a graph showing the $Q_{base}$ data, regression line, and coefficient of determination. | Add graph and discuss as necessary. | **Additional response:** The regression is discussed as having over 3,000 observations and a coefficient of determination of 0.97 and a p-value of less than 0.0001. There is no technical need for a figure with greater than 3,000 points plotted, as all statistical properties are discussed in Section 4.2 of the MFLs report and statistical model output is included in Appendix 1 to Appendix 4A (JEI, Inc. 2001) of the minimum flows report.<br><br>To improve presentation of baseline flow information, a new time-series plot has been included in Section 4.2 of the revised report This new plot shows the baseline flow record developed with equation 1 and gaged flow records as well as the gaged records |
| 54 | 62, Eq. 2 | Yes | 1. Units for use in the equation (I assume they are daily estimated cfs) should be added. | Add graph and discussion. | **Additional response:** The $Q_{base}$ and $Q_{imp}$ variables are daily INTB-modeled values. As noted in the additional |

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| | | | 2. Are $Q_{base}$ and $Q_{imp}$ daily calculated values? | | response to comment 51 above, units for the variables were added to equations 1 and 2 in the revised minimum flows report. |
| 55 | 63, P 2 | Possibly | Last sentence says that staff considered use of gaged flows to incorporate short-term flow variation into the baseline record. This is a problematic statement. What does it mean? Explain? Does the modeled $Q_{base}$ not include short-term variability? Define short-term variability. This is very important to understanding what the MFL is representing. If short-term variability is not included in $Q_{base}$ and $Q_{imp}$, how do you deal with it? Why is it not significant? | Answer questions in a thorough discussion of the meaning of this sentence. | **Additional response:** The sentence identified by the panelist has been eliminated from the revised minimum flows report to improve clarity. In addition, a new figure, depicting time-series of gaged flows and INTB-modeled impacted flows has been added to the report section to illustrate that the INTB-modeled impacted record incorporates the temporal variability evident in the gaged record. This figure, along with the summary information included in Table 4-1 and the associated report text is intended to support the District's decision to use gaged flow records with the regression used to develop the baseline flow records used in the minimum flow analyses. |
| 56 | 63, P 3 | Yes | In this paragraph, good agreement between gaged and modeled flows is asserted. This statement needs to be backed up with data. | Insert graph showing time series for gage data, $Q_{imp}$ and residuals. Discuss correspondence and residuals. | **Additional response:** Correspondence between gaged and INTB-modeled, impacted flows is illustrated using flow-percentiles presented in Table 4-1. New figures showing relationships between gaged flows and INTB-modeled impacted flows (an x-y plot and a time-series plot) have also been included in the revised report section. |
| 57 | 63, P 3 | Possibly | Use of the flow duration curves to compare data is fine once the data are validated. FDCs should not be used to assert that two data populations in time series agree because individual values may not correspond. | See Comment 52 and couch this discussion on comparison of the FDCs on the populations of data, not correspondence of day-to-day variability, which is implied herein. | **Additional response:** Correspondence between gaged and INTB-modeled, impacted flows is illustrated using flow-percentiles presented in Table 4-1 Also, two additional figures included in the section illustrate the correspondence between gaged flows, INTB-modeled impacted flows, and regression modeled baseline flows. |

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| 58 | 64, last P | Yes | In this paragraph the period of record (POR) for $Q_{base}$ and $Q_{imp}$ is said to have been moderately dry with high groundwater withdrawals.<br><br>Is it appropriate to develop a MFL on a POR that does not include extreme climatic events, such as severe droughts and high rainfall events? Why? | As noted in several comments above, the context of the modeled PORs, esp. $Q_{imp}$, must be established. Questions should be addressed. | **Additional response:** District staff developed a baseline flow record to account for expected natural variation in flows using all appropriate, available data. |
| 59 | 65, S 4.3 | No | Use of the flow blocks concept is useful and well explained herein. | No action required. | **Additional response:** No further action is required. |
| 60 | 66, F 4-4 | Yes | In block 2, the modeled flow is systematically less than measured flow, why? During block 3 the measured flow is often less than modeled. In one period near the end of the block 3 period, the measured is significantly higher than modeled. Please explain. This figure suggests that the modeled data (Qimp) do not always adequately capture high-flow events. | Explain the differences in $Q_{imp}$ and measured flow and how these differences affect the MFL. | **Additional response:** Figure 4-4 compares baseline (unimpacted) flows to gaged (impacted) flows. Impacted flows are typically less than unimpacted flows due to pumping impacts. Baseline flow is, however, less than gaged flow on some days because the period of record for the gaged flows is longer than the period of record for the baseline flows. Based on differences between the gaged and baseline records, both were used to identify seasonal block start/end dates. |
| 61 | 69, F 4-5 | No | See previous comments about readability of maps using aerial photographs as background. | See previous comments. | **Additional response:** District staff has not updated the figure in the revised minimum flow report and believes it adequately conveys location information for HEC-RAS cross-sections and U.S. Geological Survey gage sites used for hydraulic model development. |
| 62 | 73, F 4-6 | No | Comment about the background of figure and low visibility of the transect locations apply. Labels of Veg transects should be related to the floodplain "study sites" in caption. | Change background, etc. State in caption what Veg 1, etc. represent. This is evident, but not good style. | **Additional response:** District staff has not updated the figure background in the revised minimum flow report, but has revised the figure caption to better identify labeling used for the figure. |
| 63 | 83, Eq. 3 | Possibly | As with equations 1 and 2, the regression is presented without a discussion of how it was derived and the uncertainties associated with it. | See comments on Equations 1 and 2 for recommended issues to be addressed. It is important to explain how the t+3 time lag was identified and | **Additional response**: As discussed in section 4.5.2, tide data availability was limited for the Main street gage and a regression model was developed to |

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| | | | | why measured stage data and modeled stage are mixed in the equation. Goodness of fit should be discussed. Some of this information is in Appendix 4E, but it also should be included in the main report. | generate 15-minute tidal prediction. Various lead-times were considered and the t+3 lead-time was chosen because it yielded the best model fit. |
| 64 | 115, F 6-2 | No | The pumps off hydrograph is illegible. | Revise graph background or line color and weight. | **Additional response:** The figure has been updated and enlarged to improve clarity. |
| 65 | 116, F 6-3 | No | See above. | See above. | **Additional response:** The figure has been updated and enlarged to improve clarity. |
| 66 | 123, F 6-7 & 6-8 | No | See above. | See above. | **Additional response:** The figures are considered legible and were not modified. |
| 67 | 124, F 6-9 & 6-10 | No | See above. | See above | **Additional response:** The figures are considered legible and were not modified. |
| 68 | 128. P 1 & F 6-14 | Possibly | Fitting polynomials to time series is tricky and usually ends up with artifacts of the data behavior at the beginning and end of the time series. Such is the case here. There is an upward trend in the data from mid-2009 forward, but the polynomial appears to be “over fitting” it. | The graph and discussion would be better if a simple moving median is calculated. This should fit only the data and be insensitive to the tails of the time series. The patter looks like a climatic cycle with a change in the late 1980s. | **Additional response:** The figure is considered appropriate and was not modified. |
| 69 | Section 6 | Possibly | The presentation in Section 6 is excellent for the most part. I especially appreciate the discussion on sea-level rise.<br><br>As mentioned in our teleconferences, I believe there should be a subsection at the end of this section discussing how the MFLs will be managed. This section clearly sets the stage for dual criteria; one for groundwater withdrawals which operate on a time scale of moths to years and the other for surface water which operates on a time scale of days to months. The stakeholders should have this dichotomy in MFL implementation carefully | Add a subsection to function as a conclusion on how this complex MFL will be managed. | **Additional response:** A new section (Section 6.5) has been added to the revised minimum flows report to address this reviewer concern. The added section notes that District water use permits include, among other conditions, requirements that permitted water use will not lead to violation of adopted minimum flows and levels. Ongoing, periodic status assessments, like those described in Chapter 6 of the report will be an important component of the implementation of minimum flows that are to be adopted for the river. |

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| | | | explained. The data are in this section; just pull it together in a summary. | | Routine assessments of predicted flows based on updated groundwater modeling results will be critical to assessing most potential withdrawal effects on the river. Gaged flows will also be critical for minimum flows implementation, with varying allowable percentages of flows for the lower river dependent upon lagged-flow recorded at the U.S. Geological Survey's Pithlachascotee River near New Port Richey, FL gage. Similarly, observed flow at the gage site will be used to potentially limit permitted surface water withdrawals from the upper river. |
| Comments on Appendix 4A | | | | | |
| 1 | General | Yes | Appendix 4A is well written and provides important background information concerning quality and use of measured and modeled data. However, it does not provide the comprehensive evaluation and analysis of the measured flows in the Pithlachascotee basin. For example, there are at least seven historical stream flow gages in the basin. Data from many are of little use for MFL development because of short periods of record. Others are mentioned in the main report but not dealt with in this appendix. For example, the main report uses the Fivay Junction gage as the upper end of the MFL reach of the river. I had hoped that presentations and evaluations of the gage data would be in the appendix since they were not in the main report. Unfortunately, this appendix also falls short for measured data evaluation and building a case for use of the modeled data as being "best available." | Somewhere, main report of [sic] here, the discussion about measured data quality and utility must be included in order to bolster use of the modeled data as being best available. | **Additional response:** District staff does not think that presentation of summary information on all gage sites in the watershed is necessary for the development of minimum flows for the upper and lower river. |
| 2 | General | No | Inclusion of the Brooker Creek analysis is distracting since this appendix is being proffered to support the Pithlachascotee MFL. | It is probably too late to change this. | **Additional response:** District staff understands this comment but notes that the appendix is a completed deliverable required by a contractual agreement that included work on both the Pithlachascotee River and |

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| | | | | | Brooker Creek. As such, the deliverable will continue to be included in full as an appendix to the revised minimum flow report. |
| 3 | 2-1, P 1 | Unknown | The first sentence mentions that the data have been "altered." How? Why? | Insert explanation. | **Additional response:** District staff notes that the referenced phrase in the appendix is intended to indicate flows at the two investigated gage sites in the Pithlachascotee River and Brooker Creek have been altered as a result of water withdrawals. |
| 4 | 2-1, P 2 | Possibly | The report is limited to analysis of the data from the Pithlachascotee River near New Port Richey FL (02310300) gage. What about the other gages on the river? | Insert explanation as to why this analysis is limited to one gage. | **Additional response:** The appendix is a deliverable for contractual work intended to develop baseline flows for the Pithlachascotee River and Brooker Creek. For the Pithlachascotee River, the project goal was to develop a baseline flow record at the single U.S. Geological Survey gage site that was to be used for minimum flow analyses. |
| 5 | 2-1, P 3 | No | Third sentence gives the drainage basin area as 182 $mi.^2$. Does this area include or exclude the Crews Lake reach of the river? | Annotate sentence. | **Additional response**: District staff notes the drainage area citation refers to the U.S. Geological Survey's web site. It is presumed that this drainage area represents all contributing upstream areas. The relevant text in the appendix will not be amended. |
| 6 | 2-1, P 4 ff | No | I like the analysis of flows using FDCs. However, the raw data must also be presented so the reader can see how the flow patterns changed. Are changes systematic or random, for example. | Add analysis of raw data. | **Additional response:** The report included as Appendix 4A is a deliverable completed under contract by a consultant. The District does not expect the consultant to complete the additional recommended analyses. |
| 7 | 2-1, P 4 | Possibly | "…changes are more pronounced at the lower end of the curves…." This statement indicates that low-flow conditions have changed. How? Why? | Add clarification. Table 2-1 can be used to explain. | **Additional response:** The deliverable included as an appendix to the minimum flows report was completed under contract by a consultant. The District will not require the consultant to complete the additional recommended analyses as it is |

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| | | | | | expected to have no effect on the recommended minimum flows. We note, however, that the differences in flows at the lower end of the curves shows included in Figure 2-1 of the appendix illustrates that, as expected, groundwater withdrawals impact during low flow conditions is greater than that during high flow conditions. |
| 8 | 2-5, S 2.2.2 | Possibly | Last paragraph on page suggests that the cloud of data around the 1:1 line in cross plots shows that the modeled data area a "reasonable fit." Figure 2-5 indicates that at flows below 100 cfs, the uncertainty of modeled flow can be almost 100%. This much uncertainty is hardly a reasonable fit. This statement must be defended. | Add defense of the reasonable fit argument. Use plots of the measured and modeled time series and explain the behaviors of the residuals. FDCs do not provide this information. | **Additional response:** The deliverable included as an appendix to the minimum flows report was completed under contract by a consultant. The District will not require the consultant to complete the additional recommended revisions. Staff has, however, included a new figure in Section 4.2 of the revised minimum flows report that shows the relationship between daily flows at the U.S. Geological Survey's Pithlachascotee River near New Port Richey gage and INTB-modeled daily impacted flows in the revised report. A regression equation and associated coefficient of determination are included in the added figure. |
| 9 | 2-6, F 2-4 & 2-5 | No | The conventional way of plotting measured versus derived data even when regression is not invoked is to plot the measured data on the horizontal axis to indicate that these data are assumed to be more-or-less error free and that the modeled data (vertical axis) contain any uncertainty. In these graphs, the implication is that the modeled data are correct and the measured data contain the error. | Reverse axes and replot. | **Additional response:** District staff appreciates this recommendation regarding standard approaches to plotting measured and modeled data, but given that the report included as Appendix 4A is a completed deliverable prepared by a consultant and is comprehensible as presented, staff does not think it is necessary to revise the referenced figures. |
| 10 | 3-2, S 3.1 | Yes | See comments about these regressions in the main report. | See above. | **Additional response**: Please refer to responses addressing regression comments in the table above for the main report. |

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| 11 | 3.3, F 3-1 & 3-2 | Possibly | The fact that the INTB modeled data and the regressed data fit better than the INTB data versus the measured data suggests that the regression is removing some of the natural variability in the measured data. In other words, the regression is not reproducing the raw data. This is problematic, at least. | Include time series graphs to compare measured data, INTB modeled data, and regressed data. Also, plot the residuals and discuss any patterns, uncertainties, or outliers. | **Additional response:** District staff appreciates this recommendation, but given that the report included as Appendix 4A is a completed deliverable prepared by a consultant, we do not think it is necessary to develop the identified figures/information. Time-series plots showing impacted gaged flow, INTB-modeled impacted flows, INTB-modeled baseline flows and regression-modeled baseline flows were examined and found to be inadequate for conveying useful information. However, a time-series plot showing correspondence between regression-modeled and gages flows was included in Section 4.2 of the revised minimum flows report to indicate that the baseline flow approach permitted maintenance of much of the variability associated with the gaged flow record. |
| 12 | 4-1, F | Yes | 1. Again, use of FDCs hides uncertainties in time-series data because the FDCs mask relationships of synchronous data.<br>2. This graph shows a substantial difference between the measured data and both forms of modeled data. Taken at face value, I would assume that neither set of modeled data fit the actual measured data. The time series analysis or another approach is needed to validate the modeled data. Unlike the statements concerning the coefficients of determination ($R^2$s), this graph does not support statements about the good quality of the data! | Add time-series data analyses and uncertainties analyses as suggested above. Then, if the uncertainties are minimal and one can assume that data points on each FCD are synchronous, the FDCs can be used to compare the raw and modeled data.<br><br>These analyses are a must. Then, include a thorough discussion as to why the District used the modeled data and why it is the best available data. | **Additional response:** District staff notes that the referenced Figure 4-1 in Appendix 4A depicts measured (gaged) flows, INTB-predicted Baseline (pumps-off) and regression-predicted baseline flows. Both sets of predicted flows are expected to deviate from the gaged flows, with much of the expected deviation associated with groundwater withdrawal effects. To repeat, neither set of modeled data is expected to fit the actual measured data because modeled flows are for unimpacted scenario, while actual flows represent impacted scenario. There are not measured, actual baseline flows because pumping has occurred, and we can't make an alternate reality where pumping has not occurred, except through modeling. The predicted flows are intended for use as a baseline condition to support minimum flow analyses involving modeled flow reductions and associated environmental changes. |

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| 13 | Graphs following conclusions | Possibly | There are graphs of residuals and FDCs attached to the report. They are unlabeled as to which creek they apply and there is no analysis of content. These are useless. | Label and discuss graphs in their appropriate locations in text. | **Additional response:** District staff notes that the referenced regression diagnostics included as the two appendices to the deliverable included as Appendix 4A to the minimum flows report are grouped by water body. Appendix 1 includes summary information for the Pithlachascotee River. Furthermore, staff understands that the summary information addresses regression residuals and includes comparisons with INTB (also NTB)-modeled baseline (i.e., pumps-off) flows. |

# Appendix B

## Table 1-2. Dunn Review Comments on MFL Documents

# TABLE 1-2. DUNN REVIEW COMMENTS ON MFL DOCUMENTS

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| 1 | General comment | Yes, possibly | Report should have an explicit, integrated treatment of sources of uncertainty with evaluation of magnitude of each source, effect on the proposed minimum flows, and recommendations for how to reduce effect of each source in the future. | Consider developing an overarching adaptive management approach and narrative for this MFL, and the District's MFL program itself. A detailed recommendation as to how this can be accomplished is provided in Dr. Dunn's summary comments in Discussion section of this report. | **Additional response:** District staff believes we currently implement an adaptive management approach for the development and regulatory use of minimum flows and levels. This approach is guided by legislative and rule-based directives that require used of best available information; the review and revision of adopted minimum flows and levels, as necessary; and periodic status assessments, including annual assessments and those associated with regional water supply planning. Staff thinks the District's adaptive management approach for its minimum flows and level program is outlined in the draft minimum flows report and notes that the approach is also summarized in a 2010 District report titled, "Minimum flows and levels development, compliance, and reporting in the Southwest Florida Water Management District" referenced in the draft minimum flows report. |
| 2 | General comment | Yes, possibly | The percent of flow method has many inherent assumptions. Whenever possible the District should develop specific event based criteria with defined magnitude (flow or level), continuous duration (inundation or drying), and return interval. | Consider using an event based statistical approach for some criteria. Also, consider a comparative analysis. A detailed recommendation as to how this can be accomplished is provided in Dr. Dunn's summary comments in Discussion section of this report. | **Additional response:** District staff will continue to investigate use of event-based, threshold-based and other types of environmental criteria that may be used for minimum flows development. However, staff does not currently anticipate use of these |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn<br>A. Reviewer's Specific Comments | <br>B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | To be completed by Report Author(s)<br>C. Action to be Taken in Response to Comment |
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| | | | | | additional criteria to support minimum flows establishment for the Pithlachascotee River. |
| 3 | General comment | No | In several parts of the document the authors state that all the relevant water resource, ecological, and human use values are protected by a given minimum flow. It is hard for a reader to reach this conclusion on their own | Include a summary table that gives a short explanation as to how each water resource criteria is explicitly, or implicitly covered. | **Additional response:** District staff thinks the reviewer's comment has some merit. However, we note that environmental values listed in the Water Resource Implementation Rule for consideration when developing minimum flows and levels are discussed in association with assessed criteria for the upper, freshwater and lower, estuarine river segments, respectively, in Sections 4.4.1 and 4.5.1 of the draft minimum flows report. Also, protection of environmental values associated with the proposed minimum flows for the upper and lower river are discussed in Sections 5.4 and 5.7 of the report. Based on presentation of this information in the current draft report, staff do not anticipate development and inclusion of a summary table addressing environmental values in the revised minimum flows report. |
| 4 | Section1.4 Overview of Methods and Assumptions, pages 14-18 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | **Additional response:** No further action is needed. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| 5 | 1.4.1 Fundamental Assumptions, page 15 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | **Additional response:** No further action is needed. |
| 6 | 1.4.3 Baseline flows and conditions, page 16 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | **Additional response:** No further action is needed. |
| 7 | 1.4.4 Building Block Approach, pages 16-18 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | **Additional response:** No further action is needed. |
| 8 | 1.4.6 Percent-of-Flow Method and 15% Change Criteria, pages 17-18 | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | **Additional response:** No further action is needed. |
| 9 | Section 2.10 Water Quality, pages36-44. | No | Material is clearly stated, and I concur with assumptions made. | No further action required. | **Additional response:** No further action is needed. |
| 10 | Section 4.4 Resources of Concern for Upper River, pages 66-68 | No | Material is clearly stated, and I concur with choice of critical resources. | No further action required. | **Additional response:** No further action is needed. |
| 11 | Section 4.4.2 Methods for the Upper River, pages 68-79 | No | Material is clearly stated, and I concur with choice of critical resources. | No further action required. | **Additional response:** No further action is needed. |
| 12 | Section 4.5 Resources of Concern for the | No | Material is clearly stated, and I concur with choice of critical resources. | No further action required. | **Additional response:** No further action is needed. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | **A. Reviewer's Specific Comments** | **B. Reviewer's Specific Recommended Corrective Action** (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **C. Action to be Taken in Response to Comment** |
| | lower River, pages 79-81 | | | | |
| 13 | Section 4.5.2 Methods for the Lower River, pages 81-87 | No | Material is clearly stated, and I concur with choice of methods. | No further action required. | **Additional response:** No further action is needed. |
| 14 | Section 5.2.1 Minimum Low Flow Threshold, pages 88-90 | No | I concur with the selection of the fish passage as the defining criterion. The plot in Figure 5-1 (page 89) very clearly demonstrates this. | No further action required. | **Additional response:** No further action is needed. |
| 15 | Section 5.2.2 Instream PHABSIM Results, pages 90- | No | District's MFL team have used PHABSIM for other MFLs. The use of PHABSIM as a best available aquatic habitat assessment tool has also been accepted by previous peer reviews. Was the PHABSIM application for the Pithlachascotee River done in standardized approach, comparable to how it has been applied to other river systems in the District? Were there any significant variations from the District's standard PHABSIM data collection, or analysis? | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>The approach used for application of PHABSIM analyses for the Pithlachascotee River was comparable to previous use of the model suite for determining minimum flows for flowing freshwater systems within the District. There were no significant variations from previous PHABSIM data collection or analysis activities. Staff notes, however, that the District has used differing approaches for summarization and use of PHABSIM results supporting minimum flow development.<br><br>**Additional response:** District staff included language in the response above in Section 4.4.2.3 of the revised minimum flow report, where PHABSIM methods are first introduced/discussed. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| 16 | Section 4.4.2.3 covering PHABSIM methods, pages 71-75. | No | Have previous MFL peer reviews assessed the suite of embedded PHASIM tools (i.e., hydraulic model, TSLIB, etc.)? If so, have the models been deemed appropriate for use with rivers in the District? Were any cautions or limitations highlighted by other peer reviewers? | Response provided by This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. Doug Leeper adequately addresses the question. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>All peer reviews conducted for the District to date have supported the use of PHABSIM analyses as a component of the District's development of minimum flows. Some review panel reports have identified Draft, Page 9 weakness associated with the PHABSIM tools and recommended that enhanced hydraulic modeling tools (e.g., 2-D models or hydrodynamic models) could be considered to improve habitat-based assessments.<br><br>**Additional response:** District staff has included a modified version of the language above in Section 4.4.2.3 of the revised minimum flow report, where PHABSIM methods are first introduced/discussed. |
| 17 | Table 5-1, page 92 | No | Overall results of the PHABSIM analyses are summarized in Table 5-1 (page 92) of the report. It is not clear how the summary in Table 5-1 are derived from the plots in Appendix 5B. Please provide a step wise description. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>Plots of WUA (weighted usable area per 1,000 linear feet) as a function of flow are presented for each taxon/life history stage/guild in Appendix 5-B. This information was used in the PHABSIM analyses to calculate site-specific habitat availability gains/losses relative to baseline condition by month for various flow reduction scenarios (10%, 20%, 30% and 40%), using WUA values for each taxon/life history stage/guild. These "gain/loss" results are presented as the bar charts included in the appendix. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| | | | | | stage/guild. These "gain/loss" results are presented as the bar charts included in the appendix.<br>The summary results presented in Table 5-1 are based on changes in WUA for the study reach that were developed using composited WUA values for the three assessed PHABSIM sites.<br>The process used for the analysis and reporting included:<br>a. Identifying the WUA by month for each taxon/life history stage/guild for each PHABSIM site for the baseline and four flow reduction simulations.<br>b. Compositing (adding together) the WUA values for the three PHABSIM sites to develop taxon/life history stage/guild WUA values for the study reach for the baseline and flow reduction scenarios.<br>c. Determining percent changes from the composited, baseline WUA values for each flow reduction scenario by month.<br>d. Identifying flow reductions associated with a 15% decrease in the WUA values, typically through linear interpolation of results for the 10%, 20%, 30% and 40% flow reduction scenarios.<br>e. Identifying monthly flow reductions associated with the 15% decrease in WUA values by Block (May and June results for Block 1 and October through April results for Block 2) and identifying the most restrictive, blocks-specific monthly value for each taxon/life history stage/guild.<br>f. Summarizing (in Table 5-1) block-specific responses associated with 15% habitat availability changes that |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn<br>A. Reviewer's Specific Comments | <br>B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | To be completed by Report Author(s)<br>C. Action to be Taken in Response to Comment |
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| | | | | | were less than the maximum 40% flow reduction scenario.<br><br>**Additional response:** District staff included a modified version of the language above in Section 4.4.2.3 of the revised minimum flow report, where PHABSIM methods are first introduced/discussed. In addition, a table of combined weighted usable area values for species/life stage/guilds has been included at the end of Appendix 5B. The table summarizes development of allowable percent-of-flow reductions for each species/life stage/guild by block (i.e., for Blocks 1 and 2). |
| 18 | Table 5-1, page 92 | No | Table 5-1 indicated and the supporting text in report say that the PHABSIM analyses were done separately for flow regime Blocks 1 & 2. I did not see comparative plots for Blocks I and 2 by taxon in Appendix 5. How can I verify the summary values for Blocks 1 & 2 in Table 5-1? | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>Draft, Page 10 The habitat gain/loss plots included in Appendix 5-B illustrate how monthly PHABSIM results can be represented graphically. As noted in the response to question 4 above, determination of block-specific allowable percent-of-flow reductions simply involves identification of the most sensitive monthly response for each block. However, as also noted in the previous response, the plots shown in Appendix 5-B depict site-specific results and the summary information presented in Table 5-1 is based on composited, study-reach results. It may be useful to prepare habitat gain/loss plots similar to those included in the appendix to show gains/losses associated with the composted WUA values. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | **A. Reviewer's Specific Comments** | **B. Reviewer's Specific Recommended Corrective Action** (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **C. Action to be Taken in Response to Comment** |
| | | | | | Alternatively, this information could be presented in tabular format.<br><br>**Additional response:** As noted in the additional response to the reviewer's previous comment (number 17), staff included additional language in Section 4.4.2.3 of the revised minimum flow report to clarify how the PHABSIM analyses were conducted. In addition, a table of combined weighted usable area values for species/life stage/guilds has been included in Appendix 5B. The table summarizes development of allowable percent-of-flow reductions for each species/life stage/guild by block (i.e., for Blocks 1 and 2). |
| 19 | Table 5-1, page 92 | No | For the critical values in Table 5-1---can the threshold be exceeded by a single month's excursion. Please explain. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>As noted in the response to questions 4 and 5 above, the allowable, block-specific percent-of-flow reductions identified in Table 5-1 were developed based on the most sensitive monthly response within each block, i.e., within Block 1 and within Block 2.<br><br>**Additional response**: The use of the most sensitive monthly response values has been described in the methodological language added to Section 4.4.2.3 of the revised minimum flow report. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| 20 | Table 5-1, page 92 | No | I understand that maximum allowable percent flow reductions presented in Table 5-1 were calculated using mean monthly value for river flows for baseline versus incremental percent flow reductions. Mean monthly flow values were in turn used to estimate mean monthly habitat values, and percent change from baseline. The explanation for this analysis in Appendix 4C was unclear. Please provide a step-wise description as to how the final maximum allowable flow reductions values in Table 5-1 were calculated. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD.<br>Please see the process description provided above in response to question 4.<br><br>**Additional response:** A step-by-step description of the methods used for processing the PHABSIM results has been added to Section 4.4.2.3 of the revised minimum flow report. |
| 21 | | No | District's MFL team have used a criterion for floodplain inundation for other MFLs. The use of floodplain has also been accepted by previous peer reviews. Was the floodplain inundation for the Pithlachascotee River done in standardized approach, comparable to how it has been applied to other river systems in the District? Were there any significant variations from the District's standard or typical floodplain inundation analysis, or data collection? | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>The approach used for the floodplain inundation criterion is a standard approach that has been used for nearly all of the minimum flow recommendations developed for freshwater river segments within the District. The minimum flows developed for the Gum Slough Spring Run provide the exception to our use of the approach. Data limitations precluded use of floodplain inundation criteria in the Gum Slough Spring Run analyses. The approach used for the Pithlachascotee River did not include any significant variations from previous applications of the approach that have been used to set other minimum flows.<br><br>**Additional response:** Language indicating the floodplain inundation approach used for the |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | | | Pithlachascotee River is a standard approach that has been subjected to numerous peer-reviews has been included in Section 4.4.2.5 of the revised minimum flow report. |
| 22 | Section 5.2.4.3 Floodplain Inundation Results and Proposed Minimum High Flow Threshold for the Upper River, pages 99-102 | No | Analyses use mean elevation of the various floodplain features. Did staff consider using a more conservative, more protective elevation value like the 80th percentile, or higher? Has the use of mean elevations of flood indicators been evaluated in other peer reviews for riverine system MFLs? | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>Consideration of mean vs. other elevations associated with floodplain features has not been previously addressed by panel's reviewing proposed minimum flows for District rivers/streams, although the panel that reviewed minimum levels proposed for the middle segment of the Peace River suggested it may be reasonable to consider flow-related inundation patterns associated with target elevations that include specified water depths for particular floodplain features. Staff believes that by assessing potential changes in the inundation of a variety of floodplain features which occur across the range of floodplain elevations (e.g. refer to features listed in Table 5-4 in the minimum flows report), the allowable, Block-3 percent-of-flow reductions included in the proposed minimum flows are protective of all environmental values associated with the "higher-end" of the flow regime.<br><br>**Additional response:** Language indicating the floodplain inundation approach involved assessment |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn<br>A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | To be completed by Report Author(s)<br>C. Action to be Taken in Response to Comment |
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| | | | | | of floodplain features occurring across the range of floodplain elevations has been included in Section 4.4.2.5 of the revised minimum flow report. |
| 23 | Page 99 | No | In paragraph 2 of page 99 the report states that analysis sought to identify the percent of flow reduction that could occur without reducing the number of days of inundation of the respective features and habitats at each cross-section by 15 percent or more. Please provide an explanation as to how the change in days of inundation were determined. For instance, was this done by summing the number of daily exceedances over the complete time series (period of record)? | Response provided by Doug Leeper adequately addresses the question. Please add this description to the document. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>The total number of days of inundation of the specified floodplain elevations was calculated by summing the number of daily exceedances of flows associated with inundation of the feature elevations for the entire period of record used for the minimum flow analyses.<br><br>**Additional response:** District staff notes that the method for "counting" days of inundation of floodplain features for the period of record is described in Section 4.4.2.5 or the methods chapter. This text has been slightly modified to indicate that days of inundation were counted or summed for the entire baseline flow period of record. Staff adds that Section 5.2.4.3 in the results chapter indicates that the long-term inundation analyses were conducted using the baseline flow record, which was described/ characterized in an earlier section of the draft minimum flows report. |
| 24 | | No | Regarding the floodplain inundation analysis, the report focuses on a simple duration of inundation, | Response provided by Doug Leeper raises other approaches that could be used to set minimum flows | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD. |

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| | | | defined as number of days, presumably over the time series. In contrast the SJRWMD MFLs team's methods use magnitude of inundation, plus continuous inundation periods of critical duration (days) and return intervals (years) to define minimum events that they have determined are required to maintain the floodplain feature. The method used in this report is simply limits allowable change in number of days of inundation over the time series. As such it does not address two important components of hydrologic events—critical periods of continuous inundation with defined return intervals. Please answer whether the floodplain protection criterion used provides reasonable protection of floodplain resources, despite not also quantifying periods of continuous inundation and return intervals. Is it possible in the future for staff define critical maintenance hydrologic events in terms of magnitude (flow and/ or stage), duration of continuous inundation, and with a return interval? | or levels for floodplain systems. So, it appears that the methodologies may evolve in future applications. | Staff believes the exceedance-dependent criterion is protective of floodplain habitats and associated processes as have peer-review panels that have previously considered the District's use of the criterion for minimum flows development. Recently staff have begun exploring inundation of floodplain habitat on a spatial-temporal basis by coupling water level (i.e., stage) predictions from hydraulic models with topographic GIS data layers to create daily time-series of inundated floodplain habitat area. Changes in area associated with flow reductions can then be evaluated to identify changes in inundated habitat on spatial basis. As an example, this approach has been used to support development of currently proposed minimum flows for the Rainbow River System. Interestingly Munson and Delfino (2007) have shown that temporal-based criterion may yield more conservative results than those based on flow-related spatial habitat reductions.<br><br>**Additional response:** No further action is needed. |
| 25 | Section 5.2.4.3 pages 99-101 | No | A key part of the method is setting a minimum high flow threshold. Setting this threshold is covered in Section 5.2.4.3 on pages 99-101. The explanation of the values used to set the high flow threshold is given in the third paragraph on page 99. This paragraph is difficult to follow. Two points need to | Response provided by Doug Leeper still makes it sound like the selection of the 25th percentile is a professional judgement call. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>The 9% allowable flow reduction for higher flows in Block 3 is the mean of the allowable flow reduction percentages calculated for target floodplain elevations that are inundated with flows greater than |

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| | | | **A. Reviewer's Specific Comments** | **B. Reviewer's Specific Recommended Corrective Action** (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | **C. Action to be Taken in Response to Comment** |
| | | | be explained more clearly. First, staff state that values "tended to stabilize around 9 percent for moderate to high flows (Figure 5-10)." Does this mean that a regression was line was fit? How was the 9 percent value arrived at? Next, the report states in sentence 2 of that paragraph "an additional allowable percent of flow reduction that may be applicable…. for Block 3, was developed. Based on the 25th percentile exceedance." It is not at all clear to me how and why the 25th percentile value is deemed appropriate. Please provide a more complete explanation. | | the Minimum High Flow Threshold of 50 cfs, which is defined for the Pithlachascotee River near New Port Richey gage. The 50 cfs Minimum High Flow Threshold was established based on identification of this flow as the out-of-bank flow associated with the gage site. As noted in the minimum flows report, staff identified a second allowable flow reduction for periods when flows during Block 3 are less than the Minimum High Flow Threshold. This second allowable percent-of-flow reduction was established at the 25th percentile of the allowable flow reduction identified for targeting floodplain features in association with flows of less than 50 cfs at the near New Port Richey gage. The 25th percentile was selected as a reasonable, allowable flow reduction that is comparable to the allowable flow reductions associated with the lower flow Blocks 1 and 2. It is considered protective of relevant environmental values during periods of lower flows that may occur during Block 3.<br><br>**Additional response:** District staff notes that the methods used for determining the allowable percent-of-flow reductions for use during Block 3 are described in Section 4.4.2.5 of the methods chapter of the draft minimum flows report. The last paragraph in that section has been modified in the revised minimum flows report to clarify selection of |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn<br>A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | To be completed by Report Author(s)<br>C. Action to be Taken in Response to Comment |
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| | | | | | the allowable flow reduction percentage identified for lower flows that may occur during Block 3. Staff has also added text to Section 5.2.4.3 in the results section of the revised minimum flows report to indicate that the allowable 16% flow reduction identified for periods of lower flows that may occur during Block 3 was considered reasonable based on its similarity to allowable flow reductions identified for Blocks 1 and 2 that were developed from PHABSIM analyses. |
| 26 | | No | Table 5-4 (p. 100) lists 16 floodplain features that were measured in the field across the 15 cross-sectional transects. Are all 16 features considered equally important? Or are there one of more that the District finds more useful for this type of analysis. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>We have found all of these floodplain features to be useful for characterization of target elevations associated with floodplain habitat. We believe that assessing how inundation of a range of floodplain target elevations may change as a function of flow reductions and limiting the magnitude of this change is a reasonable means to promote persistence of floodplain structure and function and prevent significant harm.<br><br>**Additional response:** A modified version of the response above has been added to Section 5.2.4.3 in the revised minimum flows report. |

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| 27 | Figure 5-10, page 101 | No | In Figure 5-10 (p. 101) the data points plotted appear to represent multiple types of floodplain features. Since Table 5-4 on the previous page lists 16 different features, I ask is it correct to assume that all features have equal value, and therefore there is no need to differential them in this plot? Intuitively I suspect that all 16 features should not get equal weight. Please respond. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br>Please see the response to the several questions above, which describe our focus on protecting habitats and representative features across the range of floodplain elevations. We further note that for some previous minimum flow determinations we have also examined potential allowable percent-of-flow reductions for the range of flows that may be expected, selecting a suite of percentiles or some other array of flows for the assessment. That approach is equivalent to assessing changes in inundation of the full range of elevations that can be associated with floodplain features, including specific features such as wetland plant assemblage distributions and ecotones, and more generally, ground elevations across the floodplain from the top of bank to the upper edge of the floodplain. We believe this perspective furthers our support for assessing potential change in inundation of the all relevant floodplain habitats.<br><br>**Additional response:** Information included in staff's initial response above has been incorporated into Section 5.2.4.3 within the revised minimum flows report. |

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| 28 | Figure 5-10, page 101 | No | On Figure 5-10, two red lines are added one at 16% for flows less than 50cfs, and the other at 9% for flows greater than 50 cfs. Please describe how these lines were determined. Also, would it be useful to also include confidence intervals, such as 90% or 95%, for each line? Some measure of statistical significance would be helpful. | Response provided by Doug Leeper adequately addresses the question. This paragraph, with a few modifications, inserted in the report, would suffice to address my comment. | **Response**: Doug Leeper, MFLs Program Lead, SWFWMD.<br><br>Derivation of the allowable 9% and 16% flow reductions for periods when flows during Block 3 are, respectively, above or below the Minimum High Flow Threshold of 50 cfs is described above in response to question 5. The 9% allowable reduction for periods of higher flows was based on a mean value. The standard deviation for the 91 percentage values used to determine the mean allowable 9% flow reduction is 3.5%. The 16% allowable flow reduction for periods of low flows during Block 3 was set at a 25th percentile value for the 81 allowable flow reductions calculate for the lower Block 3 flows that, as illustrated in Figure 5-10 within the minimum flows report, ranged from 13% to 40%.<br>For regulatory application of minimum flows, staff believes it is appropriate to identify block and/or flow-specific allowable percent-of-flow reductions rather than a range of flow reductions bounded by a confidence or prediction interval or some other variance/range descriptor.<br><br>**Additional response:** Information concerning the mean and standard deviation of the identified 9% allowable flow reductions for Block 3 flows greater than 50 cfs has been incorporated into Section 5.2.4.3 within the revised minimum flows report. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| | | | | | |
| 29 | Section 5.3 Summary of Proposed Minimum Flows for the Upper River, page 101 | No | I agree with the summary, add detail | No further action required. | **Additional response:** No further action is needed. |
| 30 | Section 5.4 page 103 | No | Text states that all relevant water resource and human use values for the upper river are protected. It may be more persuasive to the reader if a tabular summary was provided. | Provide a summary table listing each of the criteria, and a statement as to how that criterion is protected, or is not relevant to the upper of lower segments of the Pithlachascotee River. | **Additional response:** District staff thinks the reviewer's comment has some merit. However, staff notes that environmental values listed in the Water Resource Implementation Rule for consideration when developing minimum flows and levels are discussed in association with assessed criteria for the upper, freshwater and lower, estuarine river segments, respectively, in Sections 4.4.1 and 4.5.1 of the draft minimum flows report. Also, protection of environmental values associated with the proposed minimum flows for the upper and lower river are discussed in Sections 5.4 and 5.7 of the report. Based on presentation of this information in the current draft report, staff do not anticipate development and inclusion of a summary table addressing environmental values in the revised minimum flows report. |
| 31 | Section 5.5 Results for the Lower River, pages 104-110 | No | Ray Walton has reviewed the salinity regressions and posed questions for staff. | Staff will respond to questions posed by Dr. Ray Walton. | **Additional response:** No further action is needed. |

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| 32 | Section 5.5.2 page 109 | No | It is not clear from the text how the 60 cfs flow threshold was determined. How can the reader review and verify? | Please provide clarification. | **Additional response:** Section 5.5.2 has been modified in the revised minimum flows report to clarify the identification of the 60 cfs minimum high flow threshold for the lower river. |
| 33 | Table 5-5, page 102 | No | This is a very helpful tabular summary. I agree with the three identified criteria for the upper river: fish passage for all seasonal blocks, PHABSIM for Blocks 1 and 2, and floodplain inundation for Block 3. | No further action required. | **Additional response:** No further action is needed. |
| 34 | Section 5.6 paragraph 2, page 110 | No | I concur with the conclusion that the approach used is a conservative one. | No further action required. | **Additional response:** No further action is needed. |
| 35 | Table 5-10 page 110 | No | I concur with the summary of evaluated and selected criteria for the lower, estuarine segment of the river. | No further action required. | **Additional response:** No further action is needed. |
| 36 | Section 5.6 Summary of Proposed Minimum Flows for the Lower River, pages 110-112 | No | I concur. | No further action required. | **Additional response:** No further action is needed. |
| 37 | Section 5.7 page 112 | No | Text states that all relevant water resource and human use values for the upper river are protected. It may be more persuasive to the reader if a tabular summary was provided. | Provide a summary table listing each of the criteria, and a statement as to how that criterion is protected, or is not relevant to the upper of lower segments of the Pithlachascotee River. | **Additional response:** District staff thinks the reviewer's comment has some merit. However, staff notes that environmental values listed in the Water Resource Implementation Rule for consideration when developing minimum flows and levels are discussed in association with assessed criteria for the upper, freshwater and lower, estuarine river segments, respectively, in Sections 4.4.1 and 4.5.1 of |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| | | | | | the minimum flows report. Also, protection of environmental values associated with the proposed minimum flows for the upper and lower river are discussed in Sections 5.4 and 5.7 of the report. Based on presentation of this information in the current draft report, staff do not anticipate development and inclusion of a summary table addressing environmental values in the revised minimum flows report. |
| 38 | Table 6-1, Page 115 | No | Good point, summarizing the relative effect of individual wellfields | No further action required. | **Additional response:** No further action is needed. |
| 39 | Table 6-2, Page 116 | No | Good point, summarizing the relative effect of individual wellfields for the current pumping @ 74.3 mgd versus 90 mgd | No further action required. | **Additional response:** No further action is needed. |
| 40 | Figure 6-3, page 116 | No | Figure clearly shows that there is little difference in monthly streamflow impact to the river at 74.3 mgd compared to 90 mgd. | No further action required. | **Additional response:** No further action is needed. |
| 41 | Table 6-3, page 177 | No | Comparison of mean and median flows in PR shows relatively small differences between the current and MFL flows for the upper river. Indicates that either the MFL is just being met, or that it may only be slightly above or slightly below the proposed minimum flows. | Enhance the point that the upper river's flow regime appears to be close to its minima. | **Additional response:** Text referencing Table 6-3 in Section 6.2.2 of the draft minimum flows report has been modified to indicate that the mean of the current flows is equivalent to the mean of the minimum flow assessment flows. |
| 42 | Table 6-4, page 118 | No | Same comment as immediately above. | Same action as immediately above. | **Additional response:** Text referencing Table 6-4 in Section 6.2.2 of the draft minimum flows report has been modified to indicate that the mean of the |

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| | | | | | current flows is equivalent to the mean of the minimum flow assessment flows. |
| 43 | Figure 6-4 and 6-5 (page 119) and supporting text, pages 118-119. | No | This is a very helpful coverage of statistical confidence. | As above, enhance the point that the upper river's flow regime appears to be close to its minima. | **Additional response:** Text referencing Figure 6-4 in Section 6.2.2 of the draft minimum flows report has been modified to indicate that current and predicted future flows are near the allowable minima associated with the proposed minimum flows. |
| 44 | Section 6.2.3 INTB model uncertainty, page 120 | No | Uncertainty is a major issue in this report, and in general for the process of setting MFLs. | Consider developing a comprehensive management plan for uncertainty. | **Additional response:** The draft minimum flows report includes information on uncertainty and has been modified to include additional information pertaining to uncertainty. However, staff believes that development of a "comprehensive management plan for uncertainty" is not necessary. |
| 45 | 6.3 Other supporting information | No | Additional information was very helpful in covering related water management activities in the watershed, especially those addressing the response of surface and groundwater resources to reduced pumping from adjacent and nearby wellfields. | No further action required. | **Additional response:** No further action is needed. |
| 46 | 6.3 Other supporting information, pages 120-130 | No | Range of topics covered added solid supporting evidence: changes to PR flow (6.3.1), aquifer levels (6.3.2), INTB model drawdown (6.3.3), PR flow changes and rainfall (6.3.4), and Area MFLs status and wetland recovery near Starkey Wellfield (6.3.5). | No further action required. | **Additional response:** No further action is needed. |

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-2, Dunn | | To be completed by Report Author(s) |
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| 47 | 6.3.6 consideration of sea level rise, pages 130-135. | No | Sea level rise must be considered in water use and water resource management decisions for coastal systems, such as the PR. Section 6.3.6 does a good job of covering recent trends u=in sea level rise along the northern Gulf Coast of the District. | No further action required. | **Additional response:** No further action is needed. |
| 48 | Section 6.3.6.5 Sea Level Rise Analysis Discussion, pages 134-135 | No | Based on the analysis presented in Section 6.3, I concur with the conclusion in Section 6.3.6.5 that sea level rise will have a negligible effect on amplifying the consequences of flow reduction on salinity based habitats. | No further action is required. | **Additional response:** No further action is needed. |
| 49 | | No | | | **Additional response:** No further action is needed for this formatting error in original report. |
| 50 | 6.4 Summary of MFLs Status, page 135 | No | Report concludes that the MFLs proposed for the upper and lower segments of the PR are currently being met and are expected to be met during the coming 20-year planning period. While I generally agree with this, I think it prudent to note that the compliance assessments show that the MFLs are close to being exceeded. | Consider stating that there while the MFLs are being met, there are also clear signs that there is little freeboard in the river's flow regime. | **Additional response**: Text has been added to Section 6.4 in the revised minimum flows report to indicate that current and predicted flows in the river are near the minima associated with the proposed minimum flows for the upper river. |

# Appendix C
# Table 1-3. Walton Review Comments on MFL Documents

# TABLE 1-3. WALTON REVIEW COMMENTS ON MFL DOCUMENTS

| Comment No. | Figure, Table, or Page and Paragraph Number | Does Comment Directly and Materially Affect Conclusions of Report? (Yes/No) | To be completed by Reviewer(s) Table 1-3, Walton | | To be completed by Report Author(s) |
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| | | | A. Reviewer's Specific Comments | B. Reviewer's Specific Recommended Corrective Action (Comments in red are in response to District's responses in column C (Action to be Taken in Response to Comment) of this table) | C. Action to be Taken in Response to Comment |
| 1 | App. 4E | No | It would be useful to include data used for statistical analyses in this appendix. | Add data as a table<br><br>Response acceptable if table added | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. Staff will consider including the tabular data in the appendix.<br><br>**Additional response**: Data used for regression model development have been included in a new, Appendix 4E to the revised minimum flows report. Staff notes that Appendix 4E to the original minimum flows report is included as Appendix 4F to the revised report. |
| 2 | App. 4F | Yes | How was 4-day average of flow arrived at? Why not look at travel times to determine averaging period? | Response did not answer question. Higher flows will have shorter travel times. There is no information in the report how 4 days was arrived at. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. The four-day mean flows were developed and used for model construction to account for recent flow history of the river.<br><br>**Additional response:** We believe that the antecedent condition of the flow, not the travel time (residence time) was the relatively more important factor to consider for model development. Various preceding lead-times were examined, and a four-day average flow was found to be the best fit, based on r2 values and distribution of residuals. Staff notes that Appendix 4F to the original minimum flows report is included as Appendix 4G to the revised report. |

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| 3 | App. 4F | Yes | Why not use predicted tides and add residually (observed-predicted) from a nearby gauge? Approach used misses storm surge effects which might be important. | There is no way to know unless this is tested. As noted, the approach could miss tidal surges, which could influence the analysis. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. Staff acknowledges this could be done, but believes the regression models are sufficient for assessing long-term salinity trends.<br><br>**Additional response**: The lack of available tide stage data in the area is the reason why a regression model was developed. Staff acknowledges modeling limitations concerning extreme low and high tides, but believes the models are sufficient for assessing long-term mean salinity trends. In addition, we note that measured tide values were also used in the location of isohaline simulations. Staff notes that Appendix 4F to the original minimum flows report is included as Appendix 4G to the revised report. |
| 4 | App. 4F | Yes | Why is sqrt(flow) used as "flow" variable? Why not flow, or log(flow), etc.? Suggest that you plot flow versus isohaline position and fit functions to determine "best" function. I know that this ignores tidal effects, but they are added back to the statistical analyses. | Need to show analysis that shows sqrt(flow) is better than other flow variable.<br><br>Response does not answer the question. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. The regression models were developed to produce the best available information for the District's minimum flow analyses.<br><br>**Additional response**: To model relationships between isohaline locations and flow, the consultant (HDR, Inc.) evaluated various flow-data transformations including logs but found the square root transformation produced the best results, which are indicated as shown in Table 4-4 of the minimum flows report. Staff notes that Appendix 4F to the |

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| | | | | | original minimum flows report is included as Appendix 4G to the revised report. |
| 5 | App. 4F | Yes | Why did you develop synthetic tide at Main Street rather than use observations from New Port Richey directly? Why is Main Street the focus of the tide and not another location? | Response accepted. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. Synthetic tide stage data at the Pithlachascotee River at Main Street were developed and used in conjunction with measured tide stage at the gage site so that tide stage from a single, consistent location could be used to develop regression models for predicting isohaline location.<br><br>The isohaline regressions were constructed using salinity profile data collected from March 1985 to April 1987 and from May 2008 to September 2009. Although tide stage records for the earlier data collection period were available for the Pithlachascotee River at New Port Richey gage, 15-minute data did not become available for the site until October 1987. Similarly, tide stage data were not available for the Pithlachascotee River at Main Street site for the early data collection period, although they were available for the more recent salinity-data collection period.<br><br>To promote a consistent tide stage record for regression model development, staff worked with HDR Engineering, Inc. to first, create synthetic tide stage records for the Pithlachascotee River at New Port Richey gage for the period from January 1, 1985 |

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| | | | | | through August 31, 2010. The regression model presented as Equation 3 in the minimum flows report was developed to predict tide stage at the Pithlachascotee River at Main Street site using the data synthesized for the at New Port Richey site. As discussed during a recent Panel teleconference, Equation 3 in the draft minimum flows report erroneously refers to the Pithlachascotee River near New Port Richey gage, rather than the Pithlachascotee River at New Port Richey gage – this error will be corrected when the report is revised. For isohaline regression model development, measured tide stage values at the Main Street site for the 2008-2009 salinity-sampling period were combined with predicted missing values for the site derived using Equation 3. For the 1985-1987 salinity-sampling period, Equation 3 was used to predict all tide stage values at the Main Street gage.<br><br>The Main Street Site was selected based on its historical and recent implementation and general utility for developing isohaline regressions.<br><br>**Additional response:** No further action is needed. However, staff notes that Appendix 4F to the original minimum flows report is included as Appendix 4G to the revised report. |

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| 6 | App. 4F | Yes | Explain the 45-minute lag used for tides. Based on water depths, I think that the wave speed between these two locations would be faster (therefore shorter lag time). | Response does not answer the question. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. Again, staff notes the regression models were developed to produce the best available information for the District's minimum flow analyses.<br><br>**Additional response**: We agree that water depth information suggests the potential for shorter lag-times between water levels at the two assessed sites. We note, however, that It would be difficult to determine the wave speed between the two identified locations without employing a wave-model. We further note that use of 45-minte lagged data yielded a regression model that was suitable for predicting needed tide stage records. Staff notes that Appendix 4F to the original minimum flows report is included as Appendix 4G to the revised report. |
| 7 | Eq. 3, main report | Yes | The equation feels wrong. Generally, one would expect the offset at high tide to be smaller (flatter water surface) than the offset nearer low tide. If the tidal prism extends farther upstream than both stations, then the water surface would be generally quite flat when the tidal range is small (e.g., 3 feet) and wave travel times much faster than the tidal half period (about 6 hours). | Response does not answer the question. | **Response:** Doug Leeper, MFLs Program Lead, SWFWMD. Please see response to question 4 above for discussion of the error in Equation 3<br><br>**Additional response**: As described in the minimum flow report and in staff responses to reviewer comments 5 and 6 above, the regression model was simply used to define the relationship between to water level records using the best available information, and was considered suitable for the District's minimum flow analyses. |

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| 8 | App. 4B | Yes | What were the final calibration values of Manning's n (channel and overbank) at each cross section? | The channel values seem high at larger flows. The model should be re-calibrated to remove the systematic bias. As it stands, there is little way to know if Q=25 cfs is a "good" flow to give 0.6 feet of depth for fish passage.<br><br>Also, it is not clear why there is variation in Mannings *n* with lower values upstream and lager values downstream. Generally, it is the other way around. | **Response:** Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. and Yonas Ghile, Senior Environmental Scientist, SWFWMD. The final Manning's n values vary at each cross section as summarized in Table (not included here)<br><br>**Additional response**: The Manning's n values for the model are summarized in Table 3-1 of Appendix C of the 2010 HEC-RAS report prepared by Engineering & Applied Science, Inc. Individual values for each cross section in the model are not, however, provided in the appendix. With the exception of the two culvert areas, the channel "n" values are 0.1 and the banks' values are 0.18. So, generally all cross sections have the same manning values. These values are within the range of recommended values provided by the U.S. Army Corps of Engineers. We note that channels weren't changed with flow changes in the model. On the side banks, the "n" values are higher with lower flows than with larger flows, as expected. We acknowledge, however, that there are biases in the model calibration. |
| 9 | App. 4B | Yes | What sensitivity analyses were performed to demonstrate that this was the "best" calibration? | A sensitivity analysis should be done. Specifically, the District needs to know (1) what is the acceptable | **Response:** Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. Per the original project scope of work, no sensitivity analyses were included in the model calibration task. |

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| | | | | accuracy of the model (accurate to xx feet), (2) what parameters will change the results? | **Additional response**: The HECR-RAS model was originally used to: develop a minimum low flow threshold for the upper river and identify allowable percent-of-flow reductions associated with instream woody habitats and inundation of floodplain habitat.<br><br>For the floodplain habitat analysis, which was used for identifying allowable percent-of flow reductions for the high flow, Block 3 period, the mean elevation for various wetland indicators was determined at 15 transects. Then, the HEC-RAS was used to estimate the flows required to inundate these elevations. The estimated flows from HEC-RAS were assumed to have some errors due to the biases in the calibration.<br><br>To assess the significance of errors on the allowable percent-of-flow reductions determined for Block 3, staff conducted sensitivity analysis by increasing and decreasing the flows estimated from HEC-RAS at each transect by 5, 10 and 20%. For each of these flow change scenarios, the allowable percent-of-flow reduction was computed as was done for the original analyses presented in the draft minimum flows report<br><br>Comparison of these results with the percent-of-flow reductions associated with the unmodified baseline flow record (see the table below) indicated the relative insensitivity of the assessed flow variation on |

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| | | | | | potential Block 3 percent-of-flow reductions. Baseline flow changes of 5% resulted in no or a 1% change, respectively, in potentially allowable percent-of-flow reductions for flows greater than and less than 50 cfs. Greater baseline flow modifications, resulted in up to 2% differences in potentially allowable flow reductions. This relative insensitivity in allowable percent-of-flow reductions identified for Block 3 is based on the direct relationship of the allowable-percent-of-flow reductions to the flow exceedance curve, which is, of course for the range of higher flows, approximated by flows needed to inundate floodplain features. |

| Flow Scenario | Allowable Percent-of-flow reduction for flows ≤50 cfs | Allowable Percent-of-flow reduction for flows >50 cfs |
|---|---|---|
| Baseline flows increased 20% | 16 | 10.0 |
| Baseline flows increased 10% | 15 | 8.8 |
| Baseline flows increased 5% | 17 | 9.3 |
| Unmodified baseline flows | 16 | 9 |
| Baseline flows reduced 5% | 16 | 9.2 |

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| | | | | | <table><tr><td>Baseline flows reduced 10%</td><td>18</td><td>9.2</td></tr><tr><td>Baseline flows reduced 20%</td><td>17</td><td>10.7</td></tr></table><br><br>We believe these results indicate the existing HEC-RAS model is suitable for identifying the allowable percent-of-flow reductions for Block 3 that were incorporated into the proposed minimum flows for the upper river.<br><br>The HECR-RAS model was also used to assess woody habitat inundation for development of potentially allowable percent-of-flow reductions for the medium flow, Block 2 period in the upper river. However, PHABSIM analyses of flow-related instream habitat changes yielded more conservative results, so the HEC-RAS based woody habitat inundation results were not incorporated into the proposed minimum flows. Similarly, the allowable percent-of-flow reduction for the low flow period (Block 1) was based on PHABSIM results and did not rely on HEC-RAS modeling.<br><br>The HECR-RAS model was also used to develop an originally recommended minimum low flow threshold for the upper river through assessment of fish passage and lowest wetted perimeter inflection |

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| | | | | | point criteria. Based on consideration of peer review comments regarding limitations for HEC-RAS model predictions under low flow conditions and the relatively low-flow nature of the system, staff now agrees the fish passage and lowest wetted perimeter inflection point standards may not be appropriate for use on the upper Pithlachascotee River. We therefore decided to use alternative approach to develop a minimum low flow threshold.<br><br>The alternative approach is based on the Tennant or Montana method, which has been used extensively in environmental flow assessments. For the alternative approach, we used the Tennant method to establish a revised minimum low flow threshold at 40% of the mean annual flow. Based on the mean annual flow for daily records for full years from the baseline flow record, i.e., from 1990 through 2000, we identified an 11 cfs revised minimum low flow threshold for the upper river.<br><br>Although lower than the originally recommended 25 cfs minimum low flow threshold, the 11 cfs threshold is still a relatively high flow for the upper river, corresponding to the 60$^{th}$ flow exceedance percentile. Use of the Tennant method to establish the revised minimum low flow threshold obviates |

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| | | | | | concerns associated with use of the existing HEC-RAS model for threshold development. |
| 10 | App. 4B | Yes | Table 3.1 (in Appendix 4B) shows a 1-ft range for the "calibration targets" but a 1.5-ft range for the model results. This "error" is systematic (low at low flows, and high at high flows). Could this model "bias" influence the conclusions drawn from the various uses of the HEC-RAS model results, especially estimating the minimum flows needed for fish passage? | The model should be re-calibrated to remove the systematic bias. As it stands, there is little way to know if Q=25 cfs is a "good" flow to give 0.6 feet of depth for fish passage.<br><br>There is only one location for model calibration, and the results here are used for fish passage depths throughout the reach. Recommend that additional data be collected to measurement water surface elevations along the reach for a range of flows, and then re-calibrate the RAS model to these observations to ensure that the model is working everywhere and can give more confidence that fish passage depths can be achieved throughout the reach based on the hydraulic model. | **Response:** Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. The model calibration targets were derived from a polynomial regression curve, which was developed on the basis of the USGS flow measurement data (since USGS stage-flow rating curve is unavailable at this location). The model calibration targets and calibration results may vary depending on the regression curve selected and future flow measurement data available for the analysis, particularly for the low flow conditions. Since the differences between the simulated stages and calibration targets fall within the calibration criteria of +/- 0.5 foot and the simulated model results fall in the historic USGS gage data, the HEC-RAS model was considered to be well calibrated and could be used as a useful tool for the subsequent ecological study.<br><br>**Additional response**: District staff agree that the current HEC-RAS model would benefit from additional data collection and calibration efforts. However, given that staff no longer plans to use the model for development of a minimum low flow threshold as discussed in the additional response to reviewer's comment 9 above, we do not currently |

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| | | | | | anticipate additional data collection and model calibration. |
| 11 | App. 4B | Yes | Is the model sensitive to the number and placement of cross sections (part of sensitivity analyses)? | A sensitivity analysis should be done, and focus on whether the RAS model can achieve sufficient accuracy to model fish passage depths along this reach. At a minimum, we should understand how certain we are that Q=25 cfs is a good value. | **Response:** Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. Per the original project scope of work, no sensitivity analyses were included in the model calibration task. Please note that the cross section data were provided by the District, including a stormwater model created for the Baker Creek and Pithlachascotee River Watershed Management Plan project and the vegetation transects survey by the District. No new cross section survey data was collected during the HEC-RAS modeling project.<br><br>**Additional response**: See response to reviewer's comments 9 and 10 above. |
| 12 | App. 4B | Yes | Did the modeling group consider using a downstream "normal depth" boundary condition to allow comparison of the observed and modeled downstream rating curve through model calibration (rather than model specification)? | I suggest that this be tried as it could provide a second calibration location. It might help identify the vertical range of Mannings *n* values needed to remove the system bias in the results. | **Response:** Jiangtao (J.T.) Sun, P.E., Project Manager, Environmental Consulting & Technology, Inc. No. Per the original project scope of work and discussions with the District, the boundary conditions should use a flow-stage rating curve. This approach has been previously used in other HEC-RAS modeling projects by the District.<br><br>**Additional response**: This recommended approach could be done. However, potentially the analysis could introduce an additional source of error, i.e., |

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| | | | | | the error associated with energy slope estimation. Too improve model results, we think more calibration transects would be required between the U.S. Geological Survey gages. As mentioned in our response to reviewer's comment 9, the use of HEC-RAS is now limited to Block 3 flows, which are less sensitive to inherent model uncertainties |
| 13 | Fig 4-3 | No | Did District consider the number of days of flow deficits, rather than just comparison to mean and median flows? The gauge record shows that more than 70% of "natural" flows are less than 25 cfs (see Figure 4-3 in main report, for example)? | Given that the lag time is generally long, it is probable that using the "long-term average and median flow changes" is OK. However, it would be useful to provide consistency with this assumption. However, if "compliance" is assessed based on the previous day or the previous 4-days, then the results should run through this filter. While I agree that this filter is probably not physically realistic for groundwater response, one should be consistent with the other. | **Response:** Ron Basso, Chief Hydrogeologist, SWFWMD<br><br>As briefly discussed during the initial peer review panel meeting, impacts to streamflow are primarily determined based on long-term average and median flow changes using numerical models – this is essentially done for all assessments of groundwater impacts to streamflow in the District since the time scale of impact is often several years due to a long-term lowering of the water table. For the Pithlachascotee River, the mean and median flow change over an 11-year period from 1996-2006 between non-pumping and pumping conditions was simulated using the INTB (results reported at the U.S. Geological Survey Pithlachascotee River near New Port Richey gage, i.e., at the NPR gage). Roughly 46 percent of the simulated stream flow record is less than 5 cfs for this period. As I noted during our initial peer review panel meeting, we did not attempt to calibrate to flow values less than 5 cfs for the |

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| | | | | | Pithlachascotee River or other low-flow rivers in the INTB application. Staff at Tampa Bay Water (TBW) and the District recognize the limitations of using the sub-regional INTB model at these very low river flow rates and therefore did not want to exceed the limitations of the model.<br><br>**Additional response:** District staff notes that minimum flow requirements associated with the previous day or previous four-day flows would be applicable to surface water withdrawals. |
| 14 | p. 61 | No | Does the District have plots of IHM model results versus observations at the Cotee River gauges? Useful plots would include time histories and scatter plots. | A plot of the results (such as a scatter plot) would reinforce this. | **Response:** Ron Basso, Chief Hydrogeologist, SWFWMD<br><br>The calibration and verification statistics from 1989-2006 between simulated flows and observed values are included in Geurink and Basso (2013). A plot of the average monthly streamflow at the NPR gage between non-pumping and pumping conditions is shown in the draft minimum flows report with mean and median flow change for the 11-year simulation period. A plot of the P5-P95 range of daily flow impact is also shown in the report. Staff can provide the daily time series of simulated values and observations from the NPR gage for the period of interest. As a reminder, the INTB model is being run in scenario mode based on a well-calibrated model. TBW wellfield quantities are adjusted for a particular |

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| | | | | | scenario with all other users pumping from 1996-2006 – therefore there is no direct apples-to-apples comparison of measured streamflow as simulated for the scenario runs.<br><br>**Additional response:** A scatterplot of gage flows at the Pithlachascotee River near New Port Richey station vs. INTB modeled impacted flows from Janicki Environmental, Inc. (2011) has been included in the revised report. |
| 15 | Section 6.2.2 | No | Can the District shed light on why groundwater abstractions of 74.3 mgd cause a deficit of 0.7 feet and abstractions of 90 mgd cause a deficit of 0.8 feet? What groundwater abstraction would cause zero deficit? | I did mean "cfs" and not "feet". Response is accepted. | **Response:** Ron Basso, Chief Hydrogeologist, SWFWMD<br><br>I believe you meant 0.7 cfs and 0.8 cfs median flow change from the INTB model as simulated at the NPR gage for those two specific pumping scenarios – those are the projected deficits between the median flow rate under non-pumping conditions with adjustments for allowable decline due to the proposed minimum flows and the current pumping scenario. The largest flow change is associated with the Starkey wellfield that is withdrawing approximately 4 mgd. Previous simulations with the INTB model that isolated individual wellfield impact has shown the greatest impact to Pithlachascotee River flows are from wellfields closest to or within the river basin with much less to essentially zero flow impacts from more distant wellfields. The reason |

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| | | | | | that the impact only changes by 0.1 cfs between TBW pumping at 90 mgd versus 74 mgd is that Starkey and the North Pasco wellfields are pumping about the same for both scenarios.<br><br>We're not sure what groundwater withdrawals would be predicted to cause zero deficit. The location and magnitude of withdrawals would play a large factor in that determination. Staff did run one scenario where one mgd was redistributed from the northwest corner of Starkey wellfield to the eastern side. The results reduced the predicted deficit by 0.5 cfs. The rainfall that actually fell during the 1996-2006 period was also a factor in the predictions. Tampa Bay Water has conducted hundreds of rainfall realizations during the 1996-2006 period using the INTB model. That analysis indicated predicted withdrawal impact can vary up 0.6 cfs based on the range of historical climate conditions in the area.<br><br>**Additional response:** No further action is needed. |
| 16 | Chapter 6 | No | What is the lag time between groundwater withdrawals and the time streamflow deficits are felt? And how is this "lag" consistent with criteria that use either the previous day or an average of the previous 4 days to define streamflow targets? | Note: Question 1 is Basso response is Question 13 in this document. I still think that is a useful thing to know because it points out the conflict between the regulation (as applied to groundwater) and physics. | **Response**: Ron Basso, Chief Hydrogeologist, SWFWMD<br><br>See my response to question 1. It's important not to be confused over the stated flow criteria at the gage site with the status assessment of the minimum flows and levels (MFLs) or assessment of |

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| | | | | | groundwater impacts. The flow-based criteria would come into play with a direct surface water withdrawal as those would be instantaneous and could be managed on a daily basis. On the groundwater side, we essentially use a numerical model and monitoring data to make an assessment of current groundwater withdrawal impacts over a long-term basis.<br><br>**Additional response:** The impacts to wetlands, lakes, and streamflow in the Tampa Bay wellfield area has occurred over a time scale of decades of sustained groundwater extraction. Impacts to surface features that are not directly connected to the Upper Floridan aquifer occur over a much longer time horizon. In their Optimized Regional Operations Plan reports, Tampa Bay Water has shown that water levels within the surficial aquifer generally take from one to two years to reach equilibrium conditions after withdrawals are eliminated from the Upper Floridan aquifer. |

# Appendix D
# Table 2-1. UPCHURCH Replies to SWFWMD's Peer Review Assessment Requirements

# TABLE 2-1. UPCHURCH REPLIES TO SWFWMD'S PEER REVIEW ASSESSMENT REQUIREMENTS

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-1, Upchurch |
|---|---|---|---|
| A. Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented | 1. Supporting Data and Information: review the relevant data and information that supports the conclusion in the report to determine: | a. Data and information used was properly collected. | Hydrologic data were collected and evaluated by the USGS. Proper collection and verification must be assumed.<br><br>**Additional response:** No further action is needed. |
| | | b. Reasonable quality assurance assessments were performed on the data and information. | Evaluations of temporal patterns in the raw flow data have not been adequately done. Uncertainties in raw data have not been evaluated.<br><br>**Additional response:** District staff does not think this is necessary. Raw flow data is reported by and quality assurance done by the USGS. Evaluations of flow data are in Section 2.8. District staff do not think further evaluations are needed. |
| | | c. Exclusion of available data was justified. | The only evident data exclusions are (1) reliance on a subset of available gage data without explaining that other gage data hove an insufficient period of record or other limitations. At least on gage (Fivay Junction gage) is mentioned in the list of gages on the river but not discussed.<br><br>**Additional response:** No further action is needed. |
| | | d. The data used was the best information available. | This case has not been made. Use of regression and INTB modeled data is emphasized over measured data. The INTB modeled data are the best available data for background flows because the river was impacted when gaging began. However, this argument and lack of use of measured data to characterize impacted flows are not well presented.<br><br>**Additional response:** District staff notes that wellfield withdrawal impacts on measured flow data are discussed in the last paragraph of Section 2.8.3, 2.9.2, 4.2 and Appendix 2B. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-1, Upchurch |
|---|---|---|---|
| | 2. Technical assumptions: review the technical assumptions inherent to the analysis used in the report to determine whether: | a. The assumptions are clearly stated, reasonable and consistent with the best available information | While it is evident that the data upon which the District relied are likely the best available data, the assumption that this is true has not been well defended.<br><br>**Additional response:** District staff believes the best available information was used and described in the draft minimum flows report. |
| | | b. The assumptions were eliminated to the extent possible, based on the available information. | (Applies to hydrologic data) Elimination of assumptions requires a list of possible assumptions and detailed discussions of each and why it is rejected. This has not been done, but may not be necessary. A thorough defense of the assumption to use the modeled data should suffice.<br><br>**Additional response:** No further action is needed. |
| | | c. Other analyses that would require fewer assumptions but provide comparable or better results are available. | Analysis using the raw, measured data is a more traditional approach to MFL development. However, this low-flow stream with historically impacted flow may not be amenable to such an analysis. The case for not using this analysis method and assumption that modeled data are better has not been adequately made.<br><br>**Additional response:** District staff believes the best available information was used and described in the draft minimum flows report. Raw, measured data was used for minimum flows development. There is no measured data for an alternate timeline in which withdrawal impacts did not exist. Thus, baseline flows are calculated based on modeled impacts which are in turn based on measured data from pumping and groundwater levels, as well as measured, actual flows. |
| | 3. Procedures and analyses: review the procedures and analyses used in the report to determine whether: | a. The procedures and analyses were appropriate and reasonable based on the best information available. | I believe that this is true but the argument that this conclusion is valid has not been adequately made.<br>**Additional response:** District staff believes the best available information was used and described in the draft minimum flows report. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-1, Upchurch |
|---|---|---|---|
| | | b. The procedures and analyses incorporate all necessary factors. | (Applies to hydrologic data) This task has been met.<br><br>**Additional response:** No further action is needed. |
| | | c. The procedures and analyses were correctly applied. | This is correct, but conditions and results are not well presented.<br><br>**Additional response:** No further action is needed. |
| | | d. Limitations and imprecisions in the information were reasonably handled. | Uncertainties have not been adequately addressed.<br><br>**Additional response:** Staff recognizes the uncertainty in INTB model predictions. It's why we didn't use model results verbatim but combined them with data analysis based on the last 5-6 years to evaluate the status of the proposed minimum flows. |
| | | e. The procedures and analyses are repeatable. | This requirement has apparently been met.<br><br>**Additional response:** No further action is needed. |
| | | f. Conclusions based on the procedures and analyses are supported by the data. | This requirement has apparently been met.<br><br>**Additional response:** No further action is needed. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-1, Upchurch |
|---|---|---|---|
| B. If a proposed method used in the report is not scientifically reasonable, then please provide: | 1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies. | | Methods are scientifically reasonable and appropriate. However, results need to be better presented. Time-series and residuals analyses are lacking, and discussions of uncertainties have not been presented.<br><br>The decade-long time series modeled may be too short for incorporation of long-term extreme flows and establishment of a representative flow regime. Choice of the modeled period of record and its brevity may not be a problem. The issue has not been properly discussed and the modeled period of record has not been compared to the historical, measured flow regime.<br><br>**Additional response:** Staff believes we have addressed this issue in our response to previous general comments. |
| | 2. Determine if the identified deficiencies can be remedied. | | Yes, these deficiencies can be remediated with revisions to reports.<br><br>**Additional response:** No further action is needed. |
| | 3. If the identified deficiencies can be remedied, then please describe the necessary remedies and an estimate of the time and effort re4quired to develop and implement each remedy. | | Assuming no unidentified uncertainties or errors in the measured data or methods of calculating the modeled data, revisions to the reports will require approximately 1 to 2 man-months. Since much of the work was done by consultants, incorporation of revisions by them will likely complicate the time line.<br><br>**Additional response:** No further action is needed. |
| | 4. If the identified deficiencies cannot be remedied, then if possible, identify one of more alternative methods that are scientifically reasonable | | Deficiencies in the hydrologic data can be remedied.<br><br>**Additional response:** No further action is needed. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-1, Upchurch |
|---|---|---|---|
| C. If a given method or analysis in the report is scientifically reasonable, but an alternative method(s) is preferable, then: | 1. List and describe the alternative reasonable scientific method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s). | | From a hydrologic data perspective, the approaches used were reasonable and alternative approaches are unlikely because of the need to model baseline flows.<br><br>**Additional response:** No further action is needed. |

# Appendix E
# Table 2-2. Dunn Replies to SWFWMD's Peer Review Assessment Requirements

# TABLE 2-2. DUNN REPLIES TO SWFWMD'S PEER REVIEW ASSESSMENT REQUIREMENTS

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-2, Dunn |
|---|---|---|---|
| A. Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented | 1. Supporting Data and Information: review the relevant data and information that supports the conclusion in the report to determine: | a. Data and information used was properly collected. | I concur that the data and information used was properly collected. This finding is based on the reports available. Data collection methods were sound.<br>**Additional response:** No further action is needed. |
| | | b. Reasonable quality assurance assessments were performed on the data and information. | Yes, quality reviews appear to have been done at many levels, including extensive reviews of draft report by three key agencies: FDEP, FWC, and TBW. Dr. Ray Walton has noted that for some components of the HEC-RAS analyses quality assurance should be improved.<br>**Additional response:** No further action is needed. |
| | | c. Exclusion of available data was justified. | Yes, I found this to be true.<br>**Additional response:** No further action is needed. |
| | | d. The data used was the best information available. | Yes, I found this to be true. Tradeoffs had to be made in determining what was the best available data depending on analytical method, tool, or model selected.<br>**Additional response:** No further action is needed. |
| | 2. Technical assumptions: review the technical assumptions inherent to the analysis used in the report to determine whether: | a. The assumptions are clearly stated, reasonable and consistent with the best available information | Yes, the full report and supporting materials in Appendices had many, many assumptions which I generally found to be clear and reasonable. In the few cases where assumptions and/or logic were not clear, I posed questions to staff.<br>**Additional response:** No further action is needed. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-2, Dunn |
|---|---|---|---|
| | | b. The assumptions were eliminated to the extent possible, based on the available information. | Yes, I did not find that the report was filled with unwarranted assumptions.<br>**Additional response:** No further action is needed. |
| | | c. Other analyses that would require fewer assumptions but provide comparable or better results are available. | Yes, I found this to be true.<br>**Additional response:** No further action is needed. |
| | 3. Procedures and analyses: review the procedures and analyses used in the report to determine whether: | a. The procedures and analyses were appropriate and reasonable based on the best information available. | Yes, I found this to be true.<br>**Additional response:** No further action is needed. |
| | | b. The procedures and analyses incorporate all necessary factors. | Yes, I found this to be true.<br>**Additional response:** No further action is needed. |
| | | c. The procedures and analyses were correctly applied. | Yes, I found this to be true.<br>**Additional response:** No further action is needed. |
| | | d. Limitations and imprecisions in the information were reasonably handled. | Yes, but the report lacks an integrated comprehensive treatment sources of uncertainty, and an explicit plan as to how manage uncertainty.<br>**Additional response:** No further action is needed. |
| | | e. The procedures and analyses are repeatable. | Yes, I found this to be true.<br>**Additional response:** No further action is needed. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-2, Dunn |
|---|---|---|---|
| | | f. Conclusions based on the procedures and analyses are supported by the data. | Yes, I found this to be true.<br><br>**Additional response:** No further action is needed. |
| B. If a proposed method used in the report is not scientifically reasonable, then please provide: | 1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies. | | I found no explicit deficiencies, but did identify the important issue of how to best manage the multiple components of uncertainty.<br><br>**Additional response:** No further action is needed. |

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| | 2. Determine if the identified deficiencies can be remedied. | | A management plan for uncertainty should be developed. Specific recommendations as to how do this using and adaptive management approach are provided in my summary comments in the Discussion section of this report.<br><br>**Additional response:** District staff currently implements an adaptive management approach for the development and regulatory use of minimum flows and levels. This approach is guided by legislative and rule-based directives that require used of best available information for establishing minimum flows and levels; the review and revision of adopted minimum flows and levels, as necessary; and periodic status assessments, including annual assessments and those associated with regional water supply planning. Use of established minimum flows and levels in the District's Water Use Permitting Program is similarly associated with an adaptive management approach, based on adherence to general statutory and rule-based permit issuance and renewal criteria, as well as development of site or permit-specific conditions for issuance of permits that frequently require substantial environmental monitoring and reporting.<br><br>The District's adaptive management approach for its minimum flows and level program is outlined in the draft minimum flows report and notes that the approach is also summarized in a 2010 District report titled, "Minimum flows and levels development, compliance, and reporting in the Southwest Florida Water Management District" referenced in the draft minimum flows report. Below are Dr. Dunn's list of adaptive management components for the Pithlachascotee River (in italics) with some relevant information illustrating how these components are and will be addressed.<br><br>• *Use the proposed minimum flows as the initial condition, representing distillation of the best available information and analysis*<br><br>Relevant information: This is the intent of our Minimum Flows and Level Program, and was certainly our approach for development of the recommended minimum flows for the Pithlachascotee River.<br><br>• *Understand, describe, and quantify the sources of uncertainty affecting development of the minimum flows.*<br><br>Relevant information: To the best of our abilities, uncertainty assessments are included in all components of our approach to minimum flows and levels development. The understanding of sources of uncertainty associated with |

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| | | | information used for assessing the status of proposed or established minimum flows and levels is similarly undertaken. Specific uncertainty assessments supporting development of minimum flow recommendations for the Pithlachascotee River included: statistical characterization of model parameters used in regression models developed to predict isohaline locations, estimation of uncertainty associated with river flows predicted with the INTB groundwater flow model, and sensitivity analyses for characterizing uncertainties associated with the HECRAS flow estimates for floodplain habitat inundation.<br><br>• *Implement specific monitoring and compliance requirements that will reduce the effect of uncertainty and improve management decisions in the future.*<br>• *Collect and analyze monitoring data.*<br>• *Use data, analytical tools, and models to evaluate responses of resource values being tracked.*<br>• *Assess whether minimum levels are being met. If not, then revise relevant portions of the minimum flows.*<br><br>Relevant information: The District will: work the U.S. Geological Survey to ensure continued collection of appropriate hydrologic data at long-term gage stations; continue to collect and support collections of other hydrologic data for characterization of groundwater levels and rainfall for development or refinement of necessary hydrologic models; conduct or require permittees to conduct relevant hydrological and biological modeling and assessments associated with potential effects of water use on river flows and levels; and complete minimum flows and levels status assessments for the Pithlachascotee River and other minimum flows and levels water bodied on an annual basis and on a five-year cycle in concert with regional water supply planning.<br><br>• *Implement changes to minimum flows as needed.*<br><br>Relevant information: The District's minimum flows and levels status assessment procedure is designed to determine whether minimum flow and level requirements are being met and are expected to be met based on projected water-use demand for the coming 20-years. If not met or projected not to be met based on effects associated with water withdrawals, recovery or prevention strategies designed to ensure the minimum flows and levels requirements are met are developed and implemented. If assessments suggest that minimum flows and levels may not be met |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-2, Dunn |
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| | | | based on factors other than impacts from water withdrawals, determinations for the need to review and/or revise established minimum flows and levels are undertaken. |
| | 3. If the identified deficiencies can be remedied, then please describe the necessary remedies and an estimate of the time and effort required to develop and implement each remedy. | | Yes, the deficiencies identified by the three panelists can be remedied.<br><br>**Additional response:** No further action is needed. |
| | 4. If the identified deficiencies cannot be remedied, then if possible, identify one of more alternative methods that are scientifically reasonable | | It is expected that sources of uncertainty can be controlled to the extent that the District uses the best available information and best available analytical tools to develop MFLs. Specific recommendations as to how do this using and adaptive management approach are provided in my summary comments in the Discussion section of this report.<br><br>**Additional response:** No further action is needed. |
| C. If a given method or analysis in the report is scientifically reasonable, but an alternative method(s) is preferable, then: | 1. List and describe the alternative reasonable scientific method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s). | | For each of the principle components of uncertainty an approach to reduce the effect of uncertainty will be helpful for this stage of setting MFLs and for future compliance assessments.<br><br>**Additional response:** In response to the Panel comment concerning data and analytical uncertainties, staff has, where practical, revised the draft minimum flows report to better characterize these uncertainties. Uncertainty assessments such as those included in the revised minimum flows report will be used for future minimum flow status assessments for the Pithlachascotee River and other priority water bodies within the District, as well as for minimum flow development scheduled for other priority water bodies. |

# Appendix F
# Table 2-3. Walton Replies to SWFWMD's Peer Review Assessment Requirements

# TABLE 2-3. WALTON REPLIES TO SWFWMD'S PEER REVIEW ASSESSMENT REQUIREMENTS

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| A. Determine whether the conclusions in the Pithlachascotee River MFLs report are supported by the analyses presented | 1. Supporting Data and Information: review the relevant data and information that supports the conclusion in the report to determine: | a. Data and information used was properly collected. | Need to improve the HEC-RAS hydraulic model. I suggest that a number of water surface elevations (say, 4-6) be measured along the reach for a range of low flows (say, 10-50 cfs), and the model re-calibrated.<br><br>**Additional response:** Based on the demonstrated utility of the HEC-RAS model output for development of allowable percent-of-flow reductions for Block 3; use of PHABSIM model results rather than HEC-RAS results for development of allowable percent-of-flow reductions for Block 1 and 2; and development of a revised low-flow threshold based on baseline flows rather than HEC-RAS model output that is summarized in response to reviewer's comment 9 in Table 1-3, staff does not think collection of additional cross-section data and HEC-RAS model re-calibration is necessary. |
| | | b. Reasonable quality assurance assessments were performed on the data and information. | Cannot see where this was done. The RAS modelers themselves suggest that cross sections were poor. Recommend considering whether additional cross sections would improve model accuracy.<br><br>**Additional response:** Please refer to response A.1.a above. |
| | | c. Exclusion of available data was justified. | Given that HEC-RAS was calibrated to a single location, it would be useful to try and use a normal depth downstream boundary conditions to determine in roughness values are reasonable in the lower portions of the upstream reach. If additional water surface profiles are collected, this becomes less important.<br><br>**Additional response:** This could be one way to improve the biases in the model even though it could introduce additional uncertainty associated with energy slope estimation. However, based on use of the HEC-RAS model output for only the percent-of-flow reductions associated with minimum flow recommendations for Block 3 and the utility of these results, as described in response to reviewer comment 9 in Table 1-3 above staff does not think additional effort associated with addressing roughness value assessments is currently necessary. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| | | d. The data used was the best information available. | Yes, but not good enough for hydraulic model.<br><br>**Additional response:** The best available data was used for the HEC-RAS modeling even though the data were not adequate to fully calibrate the model. Given the increased uncertainty associated with model-predicted low-flow conditions, the HEC-RAS results were used only for Block 3 minimum flow analyses. The floodplain-based criterion used for identifying allowable flow reductions for Block 3 is less sensitive to under/over estimation of flows by HECRAS. Model results are therefore considered appropriate for the Block 3 analyses. |
| | 2. Technical assumptions: review the technical assumptions inherent to the analysis used in the report to determine whether: | a. The assumptions are clearly stated, reasonable and consistent with the best available information | Yes<br><br>**Additional response:** No further action is needed. |
| | | b. The assumptions were eliminated to the extent possible, based on the available information. | The synthetic tidal record at the Main Street gauge location could have been better developed to include storm surges in the available record. This could change the salinity regression analysis a little.<br><br>**Additional response:** Including storm surges would add an element of realism, and eliminate the false assumption that these storm surges did not occur, but would likely be subject to the same uncertainties as the synthetic record that already exists. We also note that the minimum flows are developed based on difference between baseline and withdrawal scenarios, so model biases that could be associated with not using storm surge information may be expected to minimally affect the minimum flow recommendations as the biases exist in both the baseline and withdrawals scenarios. |
| | | c. Other analyses that would require fewer assumptions but provide comparable or better results are available. | The synthetic tidal record at the Main Street gauge location could have been better developed to include storm surges in the available record. This could change the salinity regression analysis a little.<br><br>**Additional response:** Please refer to the response to comment 2b above. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
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| | 3. Procedures and analyses: review the procedures and analyses used in the report to determine whether: | a. The procedures and analyses were appropriate and reasonable based on the best information available. | The methods were OK.<br><br>**Additional response:** No further action is needed. |
| | | b. The procedures and analyses incorporate all necessary factors. | Yes.<br><br>**Additional response:** No further action is needed. |
| | | c. The procedures and analyses were correctly applied. | The procedures were lacking in two areas:<br>1. The calibration of the HEC-RAS model needs to be improved (1) through better data and (2) to remove the clear systematic bias in the calibration.<br>2. The synthetic tidal recorded should look at observed storm surges (as tidal residuals) to see if the different synthetic record would change the regression analyses and the criteria in the downstream reach.<br><br>The use of the HEC-RAS model is far more crucial as it goes to the critical criterion of 0.6 feet of depth being achieved by 25 cfs of flow. This criterion drives the upper reach and is significantly more crucial than the development of a criterion with a much larger flow in the downstream reach.<br><br>**Additional response (item 1):** As described in response to review comment 9 in Table 1-3, the current staff recommendation to use the HEC-RAS model output for only the percent-of-flow reductions associated with minimum flow recommendations for Block 3 and not for the minimum low flow determination, staff does not think collection of additional cross-section data and model re-calibration is necessary.<br><br>**Additional response (item 2):** Please refer to the response to comment 2b above. |
| | | d. Limitations and imprecisions in the information were reasonably handled. | Not always (see previous responses).<br><br>**Additional response:** Refer to additional responses provided by staff for reviewer comments in this table |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| | | e. The procedures and analyses are repeatable. | Yes<br><br>**Additional response:** No further action is needed. |
| | | f. Conclusions based on the procedures and analyses are supported by the data. | Yes<br><br>**Additional response:** No further action is needed. |

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| B. If a proposed method used in the report is not scientifically reasonable, then please provide: | 1. List and describe scientific deficiencies and, if possible, evaluate the error associated with the deficiencies. | | 1. HEC-RAS could use better observations along the reach.<br>2. The distribution of Mannings *n* roughness values used was not presented or supported in the report. For example, why was the channel roughness variable when only one location was used for calibration.<br>3. The systematic bias in the HEC-RAS model results needs to be addressed and removed.<br>4. Questions about groundwater lag and its regulatory interpretation should be addressed.<br>5. The synthetic tide for the salinity regression analysis should be revisited to see if it makes a significant difference in the regressions obtained.<br><br>**Additional response (item 1):** District staff agrees that collection of additional cross-section and stage-flow data along the river segment would be useful, but as noted in other staff responses in this table, thinks the existing model is sufficient for identification of allowable percent-of-flow reductions for Block 3.<br><br>**Additional response (item 2):** The Manning's n values for the model are summarized in Table 3-1 of Appendix C of the 2010 HEC-RAS report prepared by Engineering & Applied Science, Inc. Individual values for each cross section in the model are not, however, provided in the appendix. With the exception of the two culvert areas, the channel "n" values are 0.1 and the banks' values are 0.18. So, generally all cross sections have the same manning values. These values are within the range of recommended values provided by the U.S. Army Corps of Engineers. We note that channels weren't changed with flow changes in the model. On the side banks, the "n" values are higher with lower flows than with larger flows, as expected. We acknowledge, however, that there are biases in the model calibration.<br><br>**Additional response (item 3):** Based on use of the HEC-RAS model output for only the percent-of-flow reductions associated with minimum flow recommendations for Block 3 and the utility of these results for that assessment that are described in response to reviewer comment 9 in Table 1-3 above, staff does not think additional data collection and model re-calibration is necessary. |

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| | | | **Additional response (item 4):** The 150-day lagged term for withdrawals from the Starkey-North Pasco wellfield that was used for developing Equation 1 in the draft minimum flows report was based on consideration of various lag terms, including 7-day, 14-day, 30-day, 60-day, 90-day, 120-day, 150-day and 180-day moving average pumping values for individual wellfields in the area. Wellfield pumping values for the various lag-times and wellfield combinations (Cross Bar-Cypress Creek, Eldridge-Wilde, South Pasco, Section 21 and Cosme-Odessa) that did not exhibit statistical significance were excluded from model development. Staff notes that as explained in the draft report, elimination of the lagged-term for combined withdrawals from the Starkey and North Pasco wellfields (see Equation 2 in the draft report) yielded predicted baseline flows that were similar to those predicted using Equation 1.<br><br>For development of both regression equations, modeled values derived from INTB model simulations were used for baseline and impacted flows. For the lagged-pumpage term in Equation 1, measured pumpage data were used. For predicting of baseline flows, measured (i.e., reported or observed) flows at the Pithlachascotee River near New Port Richey gage were substituted for INTB-modeled impacted flows in Equation 1 and were used along with reported lagged-pumpage values to predict baseline flows. Very low baseline flows, specifically those less than 1.6 cfs were, however, predicted using values derived from the INTB model simulation.<br><br>Minimum flow rules are developed to specify daily withdrawal rates that can be used for short-term surface water withdrawal management and associated water use permit conditions. In contrast, based on the more diffuse and temporally variable effects of groundwater withdrawals on streamflow, evaluations for requested groundwater withdrawals and for assessment regarding whether minimum flows are being met are conducted on a long-term basis. That is, they are typically conducted using long-term mean and/or median flows predicted with numerical or other models with supporting evidence provided by monitoring data. Drought conditions are expected to be incorporated into analyses supporting minimum flow development, and this was the case for the analyses supporting development of proposed minimum flows for the Pithlachascotee River. In addition, District rules include provisions for management actions that can be implemented during water shortages that may occur as a result of drought or other factors. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
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| | | | Finally, we not that some of the information contained in this addional response was included in Section 4.2 of the revised minimum flows report.<br><br>**Additional response (item 5):** Please refer to the response to comment 2b above. |
| | 2. Determine if the identified deficiencies can be remedied. | | They can be, with data, budget, and re-analysis.<br><br>**Additional response:** District staff agrees, but thinks the additional analyses that have resulted in a revised minimum low-flow threshold are sufficient for the development and implementation of the recommended minimum flow. |
| | 3. If the identified deficiencies can be remedied, then please describe the necessary remedies and an estimate of the time and effort re4quired to develop and implement each remedy. | | 1. Collect stage observations along the upper reach for a range of flows from 10-100 cfs.<br>2. Collect some additional cross sections to improve the geometry of the hydraulic model<br>3. Recalibrate HEC-RAS to better fit observations, remove bias, and reduce model uncertainty.<br>4. Redevelop the synthetic tidal at the salinity regression station and redo the analysis.<br><br>This could be accomplished within 3-6 months.<br><br>**Additional response (items 1, 2 and 3):** Based on use of the HEC-RAS model output for only the percent-of-flow reductions associated with minimum flow recommendations for Block 3 and the utility of these results for that application as described in response to reviewer comment 9 in Table 1-3 above, staff does not think that collection of additional cross-section and stage-flow data followed by re-calibration of the HEC-RAS model is necessary.<br><br>**Additional response (item 4): Additional response (item 5):** Staff does not currently anticipate redoing the minimum flow analyses for the lower river. Please refer to the response to comment 2b above for comments concerning uncertainty associated with not using tidal surge data for development of regressions used to predict isohaline locations. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
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| | 4. If the identified deficiencies cannot be remedied, then if possible, identify one of more alternative methods that are scientifically reasonable | | If no additional data are collected then:<br><br>1. The existing HEC-RAS model should be recalibrated to remove the systematic bias and to use a different downstream boundary to assess the adequacy of downstream roughness values. This is by far the most important thing.<br>2. Re-develop the synthetic tide to include residual tidal effects (storm surges) and see if this significant changes the salinity regression equations.<br>3. For all analyses, the revised report should justified all the assumptions and statistical statements made (lag times, sqrt(flow), etc.). The reader needs to know why every statement and assumption was made.<br><br>**Additional response (item 1):** Based on use of the HEC-RAS model output for only the percent-of-flow reductions associated with minimum flow recommendations for Block 3 and the utility of these results as described in response to reviewer comment 9 in Table 1-3 above, staff does not think that re-calibration of the HEC-RAS model is necessary.<br><br>**Additional response (item 2):** Staff does not currently anticipate redoing the minimum flow analyses for the lower river using regressions developed using synthetic tidal data that incorporates storm surges. Please refer to the response to comment 2b above for comments concerning uncertainty associated with not using tidal surge data for development of regressions used to predict isohaline locations.<br><br>**Additional response (item 3):** Staff believes assumptions and statistical statements included in the revised minimum flows report have been addressed in the report, the report appendices and this staff response document, which will be included as an appendix to the final report. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| C. If a given method or analysis in the report is scientifically reasonable, but an alternative method(s) is preferable, then: | 1. List and describe the alternative reasonable scientific method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s). | | Methods are generally OK. They just need to be better explained, assumptions supported, and applied.<br><br>**Additional response:** No further action is needed. |

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| Minor General Comments | | | 1. In general, the report needs an editorial review. There are a number of spelling and grammatical mistakes.<br>**Additional response:** Spelling and grammatical errors have been corrected to the best of our ability in the revised minimum flows report.<br><br>2. Page 9, 1st papa. "…purposes…" should be plural.<br>**Additional response:** This error has been corrected in the revised minimum flows report.<br><br>3. Page 9, 3rd papa. Need to explain is the "9 percent" of total of excess flow.<br>**Additional response:** District staff thinks this sentence in the Executive Summary is adequate.<br><br>4. Page 10, 1st papa. Need to discuss is flow deficits need a proposed action or is this OK by permit.<br>**Additional response:** The reviewer's comment/question is addressed in the subsequent paragraph of the Executive Summary, in which status assessment information is summarized and the conclusion that the proposed minimum flows are currently being met and are expected to be met during a 20-year planning horizon.<br><br>5. Page 11, near bottom. Be consistent about "minimum flows" or "minimum flows and levels".<br>**Additional response:** The referenced text addressed the section of the Florida Statutes that concerns minimum flows and levels. The "and levels" phrase in the text has been included in parentheses in the revised minimum flows report to alert the reader to legal requirements concerning minimum flow and minimum levels.<br><br>6. Page 20, 2nd papa. Need to add "square miles" after "kilometers".<br>**Additional response:** This addition has been included in the revised minimum flows report.<br><br>7. Page 25, 3rd papa. Need to state where are the surface water withdrawals and that it is minor.<br>**Additional response:** Quantities of surface water (88 mgd) and groundwater (334 mgd) withdrawals in 1993 included in the 1996 Northern Tampa Bay WRAP report are listed in |

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| | | | the referenced paragraph. This information indicates that surface water withdrawals in the Northern Tampa Bay area are not minor, so the report will not be modified to indicate that area surface water withdrawals are minor. The area surface withdrawals are primarily from the Hillsborough River and Tampa Bypass Canal in Hillsborough County and Section 2.7 of the revised minimum flows report has been modified to include this information.<br><br>8. Figure 2-5. Highlight Cotee River (make bold to stand out).<br>**Additional response:** A label was added to the figure to highlight the location of the Pithlachascotee River.<br><br>9. Page 28, 3rd papa and Figure 2-7. Is 57.1 mgd the new "normal"? Elsewhere, the report says 74 mgd.<br>**Additional response:** Not sure where the 74 mgd number is referenced in the report. Those wellfields averaged 57.3 mgd from 2008-2016. The highest single year was 61.5 mgd in 2008. So yes 55 to 60 mgd appears to be the new normal.<br><br>10. Page 29, 1st papa. Where is gauge #02310288 on Figure 2-2?<br>**Additional response:** Gage 02310288 has been added to Figure 2-2 in the revised MFLs report.<br><br>11. Figure 2-8. Add gauge number to caption. Also, figure shows that about 75% of time flow is less than 25 cfs. Need to discuss this as Q=25 cfs needed for fish passage.<br>**Additional response:** The gage number has been added to Figure 2.8 caption (and also the Figure 2.9 caption and others, as appropriate) in the revised minimum flows report. Staff acknowledges that the fish passage criterion is associated with a relatively high flow for the generally, low-flow Pithlachascotee River. As noted in previous responses to reviewer comments, staff is recommending a revision of the recommended minimum low flow threshold, so no discussion of a 25 cfs minimum low flow threshold will be included in text associated with Figure 2-8. |

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| | | | 12. Figure 2-11. Need to explain why moving gauge 1.1 miles upstream is critical for number of zero flow days.<br>**Additional response:** The figure caption has been modified in the revised minimum flows report to indicate that the pre-and post-relocation flow records not equivalent due to changes in the base flow characteristics between the two locations and due to temporal differences in groundwater withdrawals.<br><br>13. Page 36, 4th papa. Need to edit "20142014".<br>**Additional response:** This error has been corrected in the revised minimum flows report.<br><br>14. Figure 2-14. Last plot needs x-axis title to be fixed.<br>**Additional response:** Figure panel has been corrected in the revised minimum flows report.<br><br>15. Page 58, 1st papa. Last sentence says "…were greater at the upstream stations." Table 3-2 doesn't seem to support this while Figure 3-14 does Station kilometer 4.2 is greatest).<br>**Additional response:** Differences between the maximum value at depth and the mean maximum salinities are generally greatest at sites 7.7 and upstream, although a relatively large difference is also evident at river kilometer 3.1 (see summary table below). The text referenced by the reviewer has been modified in the revised minimum flows report to indicate this pattern using the phrase "generally greatest." |

| Station Kilometer | Maximum Mean Value (psu) | Maximum Value at Any Depth (psu) | Difference; Max Value at Depth minum Maximum Mean Value (psu) |
|---|---|---|---|
| 0 | 32.9 | 33.3 | 0.4 |
| 2 | 31.2 | 31.6 | 0.4 |
| 3.1 | 28.4 | 29.6 | 1.2 |
| 4.2 | 27.1 | 27.3 | 0.2 |
| 5.6 | 25.2 | 25.3 | 0.1 |
| 6.7 | 22.3 | 23.2 | 0.9 |
| 7.7 | 17.3 | 19.3 | 2 |
| 8.2 | 14.6 | 16.2 | 1.6 |
| 9 | 11.6 | 12.8 | 1.2 |
| 9.5 | 10.2 | 11.2 | 1 |
| 10.5 | 5.9 | 7.8 | 1.9 |

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| | | | 16. Page 61, last papa. Show scatter plot to reinforce "fairly well". **Additional response:** A new figure was added to the revised report to show the relationship between gaged flows and INTB-modeled, impacted flows at the Pithlachascotee River near New Port Richey gage.<br><br>17. Page 62, 1st papa. Edit " was it was…" **Additional response:** This error has been corrected in the revised minimum flows report.<br><br>18. Page 62, 2nd papa. Need figure to help show "…greater than 1.6 cfs" **Additional response:** Staff do not think the addition of a new figure is necessary for this section of the minimum flows report.<br><br>19. Page 65, 2nd papa. Explain why "flow records used for identification" considered only the one gauge and not others. **Additional response:** Flow records for the Pithlachascotee River near New Port Richey gage site were used for seasonal block identification because flows at the site were used for the baseline flow record used in the minimum flow analyses. Staff do not think this section of the report needs to be modified to reflect this information.<br><br>20. Page 65. Why are "blocks" not in order? **Additional response:** The "ordering" of the seasonal flow blocks used for the Pithlachascotee River minimum flow recommendations is based on the sequential ordering of general flow rates, from lowest (Block 1), through intermediate (Block 2), to highest (Block 3) flows. As you've noted, this flow-based ranking does not correspond with the temporal ordering that occurs based on our approach for delineating the blocks – it's basically an artifact that we will continue to "live with" based on the need for continuity between newly developed minimum flow rules and the numerous rules that exist for other flowing water bodies within the District.<br><br>21. Table 4-2. Numbers look wrong in 4th column. **Additional response:** All values included in Table 4-2 were checked and several were corrected. |

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| | | | 22. Page 68, last full papa. "USOCOE" should be "USCOE".<br>**Additional response:** The zcronym used for the United States Army Corps of Engineers has been changed to USACE in the revised minimum flows report. Also, the acronym has been added to the list of abbreviations and acronyms table included in the report.<br><br>23. Page 78, 3rd papa. ".. model **to** determine…"<br>**Additional response:** The word "to" has been added to the sentence in Section 4.4.2.5 of the revised minimum flows report.<br><br>24. Table 4-3. Fix "5psu". Needs a space.<br>**Additional response:** This error has been corrected in the revised minimum flows report.<br><br>25. Figure 5-1. Show actual river miles. Also, there is a real mixture of SI and English units throughout report.<br>**Additional response:** District staff understands how use of actual river miles for the x-axis labels would be helpful, but does not think this change is necessary. Staff acknowledges the use of SI and English units in the report and will include cross-references to equivalent units where necessary within the revised minimum flows report.<br><br>26. Figure 5-10. What percent of time are flows in the "16%" range (red line to left) less than 16% line?<br>**Additional response:** The allowable 16% flow reduction for block three was established at the 25th percentile of the flows that were less than or equal to 50 cfs.<br><br>27. Figure 5-11. Need, somewhere in report, to explain why groundwater pumping is OK even though flows in days 120-180 are very small, and likely very influenced by groundwater pumping.<br>**Additional response:** Minimum flow criteria are evaluated on a long-term average basis because groundwater withdrawal impacts on surficial features that are not directly connected to the Upper Floridan aquifer typically take many years to become evident, and based on the need to capture the full variation of climatic conditions that can occur over several decades. Drought conditions are expected to be incorporated into analyses supporting minimum flow development, and this was the case for development of |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
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| | | | proposed minimum flows for the Pithlachascotee River. We note also that District rules include provisions for management actions that can be implemented during water shortages that may occur as a result of drought or other factors<br><br>28. Page 120, 2nd papa. Is uncertainty in rainfall variation associated with temporal or spatial variability?<br>**Additional response:** Mostly all spatial due to the localized convective nature of summer rainy season storm events.<br><br>29. Page 130, 1st papa. Make numbers consistent in "…up to six and 3 feet increases."<br>**Additional response:** The number "3" has been changed to the word "three" in the revised minimum flows report. |

| Task | Subtask | Sub-subtask | Reviewer's Specific Comments<br>Table 2-3, Walton |
|---|---|---|---|
| CONCLUSION | | | Need to improve the HEC-RAS hydraulic model. I suggest that a number of water surface elevations be measured along the reach for a range of flows, and the model re-calibrated. This goes to the major hydraulic uncertainty in the study "is 0.6 feet of depth in the upper reach consistent with a flow of 25 cfs?" The HEC-RAS model needs to be improved to be more certain of this important conclusion, which is perhaps the major criterion of this MFL.<br><br>**Additional response:** Based on the demonstrated utility of the HEC-RAS model output for development of allowable percent-of-flow reductions for Block 3; use of PHABSIM model results rather than HEC-RAS results for development of allowable percent-of-flow reductions for Blocks 1 and 2; and development of a revised low-flow threshold based on baseline flows rather than HEC-RAS model output that is summarized in response to reviewer's comment 9 in Table 1-3, staff does not think collection of additional cross-section data and HEC-RAS model re-calibration is necessary.<br><br>Finally, I believe that Sid Flannery's comments need to be addressed in full. There are many points I agree with, but I choose not to duplicate them here.<br><br>**Additional response:** Staff responses to comments submitted by Sid Flannery have been addressed in a separate response document that will be included as an appendix to the revised minimum flows report. |

# APPENDIX 1F

Flannery, S. 2016. Memorandum to Doug Leeper, Minimum Flows and Levels Program Lead, dated November 10, 2016. Subject: Technical comments on the report – Proposed minimum flows for the Pithlachascotee River – revised draft report for peer review, August 20, 2016. Prepared for the Peer Review Panel and the Southwest Florida Water Management District. Brooksville, Florida.

**November 10, 2016**

**To:** Doug Leeper, Minimum Flows and Levels Program Lead
**From:** Sid Flannery, retired Chief Environmental Scientist, SWFWMD
**Subject**: Technical comments on the report - *Proposed Minimum Flows for the Pithlachascote River - Revised Draft Report for Peer Review, August 29, 2016*

**Overview**

These comments are being submitted to the District as public comment as part of the peer review process for the report titled *Proposed Minimum Flows for the Pithlachascotee River - Revised Draft Report for Peer Review*, dated August 29, 2016. I am requesting that my comments be submitted to scientific peer review panel for their consideration.

In August 2014, I retired from a position as a Chief Environmental Scientist at the Southwest Florida Water Management District, where I worked on minimum flows projects for over twenty-nine years. I was one of the principal staff working on the minimum flows project for the Pithlachascotee River and was the senior author of the draft minimum flows report for the river that was dated August 26, 2014.

Before listing my specific comments on the report, I want to commend the District for its minimum flows work on the Pithlachascotee and its revision of the 2014 draft report to produce a succinct and informative report. The District has been a leader in the field of minimum flows and the Pithlachascotee presented a new, challenging river for minimum flows analysis because the effects of human water use on flows in the river have changed over time.

I also want to commend Tampa Bay Water for the timely implementation of the recovery strategy and comprehensive plan for the Northern Tampa Bay Water Use Caution Area. The dramatic reduction in groundwater withdrawals associated with the recovery strategy and comprehensive plan is unprecedented in the state and has significantly reduced withdrawal related impacts to the Pithlachascotee River and other wetland and aquatic resources in the region.

I agree with the conclusion of the report that a minimum flows recovery strategy for Pithlachascotee that goes beyond the requirements of the existing recovery strategy and comprehensive plan for the Northern Tampa Bay Water Use Caution Area is not needed at this time. However, I think the conclusion that the river is meeting its minimum flows needs to be more carefully stated with some qualification. I believe the findings regarding minimum flow compliance are mixed and there should be careful monitoring of hydrologic variables associated with the river and its drainage basin. Pending the findings of such monitoring, the question of whether the Pithlachascotee River is meeting its adopted minimum flows could be reexamined sometime during the 20-year planning horizon.

My comments on the report listed by page number (p) below. In addition, comments for four general topics are grouped under sub-headings with corresponding discussions. For brevity, I have omitted the mention of a number of grammatical edits I expect District staff have noticed and will address.

p 16 - Last sentence under section 1.4.4. Additional references are needed for the statement supporting the seasonal component of the building block approach. Based on estuarine resources, the cited article by Flannery et al. (2002) mentions that withdrawals should be most restrictive in the springtime, but it was written before the District had formalized its approach using three seasonal blocks. There are several other District minimum flows reports that can be cited that clearly describe the seasonal block approach.

**Watershed and streamflow characteristics of the Pithlachascotee River**

Compared to the 2014 draft report, the 2016 report downsized the description of the watershed characteristics of the Pithlachascotee River and deleted a number of long-term hydrographs and the findings of streamflow trend analyses. The District states this was done to streamline the report, and after reviewing the 2016 draft report, I believe approach may be suitable. However, a couple of other options might be feasible to enhance the presentation of the streamflow characteristics of the river, considering the factors below.

In addition to the long-term gage on the river near New Port Richey, the 2014 draft report presented hydrographs and flow statistics for the upstream gage on the river at Fivay Junction and Fivemile Creek, the latter a tributary to the upper river. A hydrograph and discussion of water levels in Crews Lake, which periodically contributes flow to the upper reaches of the river, were also presented along with a hydrograph of flows in Jumping Gully, a tributary to Crews Lake.

The presentation of data from these other water courses is not critical to the determination of minimum flows for the designated reach of the river between the gages at Fivay Junction and near New Port Richey. However, the data from these water courses are informative for describing the overall hydrologic setting of the Pithlachascotee River, and with relevance to minimum flows, how high flows in the river and the inundation of floodplain habitats may be influenced by water levels in the upper regions of the watershed and outflows from Crews Lake. Similarly, as described in the 2014 report, Fivemile Creek sometimes contributes more flow to the upper river than is measured at the gage on the river at Fivay Junction.

These upstream water courses are shown in a map of the Pithlachascotee River basin in the 2016 report (Figure 2-2). On page 29, the 2016 report includes a very brief discussion of these water courses. This discussion of these upstream watercourses could be adequate, but at its meeting on November 1, 2016, the review panel suggested that some additional discussion of the upstream areas of the watershed could be included and mention that minimum levels are being determined for Crews Lake.

For any river where minimum flows are being determined, I think it is valuable to discuss the long-term streamflow characteristics and any flow trends for that river early in the report. This is especially important where there have been known anthropogenic effects to streamflow. The District has taken this approach in other minimum flows reports to describe trends where human factors have caused flows to increase (Myakka and Little Manatee), decline (Upper Peace), or rise and then later decline due to changes in point source discharges (Alafia). Hydrographs and trend analyses of various flow components (seasonal flows, yearly percentile flows) can be presented to show how the flow regime of the river may have changed over time.

One problem with presenting hydrographs and trend analyses is that the results can change with the collection of more recent data. The 2014 draft report for the Pithlachascotee presented analyses of flow data collected through water year 2013, which ended September 30, 2013. Since that time, data from 2014 and 2015 have become available which show a strong rebound in flows in the Pithlachascotee, due to two years of above average rainfall and cutbacks in groundwater use.

The 2016 report presents a hydrograph of yearly mean flows from 1964 to 2015 in Chapter 6 to make the point that flows are rebounding in the river and a minimum flows recovery strategy is not needed. As described below, I think these results should be moved up to Chapter 2.

A couple of options could be available for presenting updated hydrologic data in the 2016 report. Optimally, the hydrographs and trend analyses presented in the 2014 report could be revisited to include the more recent data, along with a discussion of the role of climate and the effects of changes in groundwater use on long-term changes in flows. This should be presented in Chapter 2 in the characterization of flow regime of the river. However, such an update this would require additional work by the District. Having said that, the inclusion of several hydrographs (yearly mean flows, dry and wet season flows, five or so yearly percentile flows) with corresponding trend analyses might be a reasonable task.

Another option would be to separately provide the 2014 analyses to the review panel for their consideration. Or, the 2014 analyses could be included as an Appendix to the report. However, I do not suggest that, as publishing the results of outdated trend analyses would be misleading, especially given the high flows that have occurred since 2014.

The final option would be some modest expansion of the streamflow characterization discussion in the 2016 report. I think some long-term hydrographs should be included in Chapter 2 of the report. At a minimum, the hydrograph of mean yearly flows for 1964 to 2015 that is now presented in Chapter 6, plus the corresponding rainfall graph and discussion, should be moved up to the discussion of flow characteristics in Chapter 2. Those results could then be later referenced in Chapter 6 in the discussion of the minimum flows status assessment. Again, I think that hydrographs of several yearly flow parameters would also be valuable.

As previously discussed, the current report could also include more discussion of the upstream tributaries, including an updated hydrograph of water levels in Crews Lake and a plot of water levels in Crews Lake vs. flow in the river at the Fivay Junction gage, similar to what was included in the 2014 report.

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p 30, last two paragraphs. This discussion of low runoff in the Pithlachascotee drainage basin was taken from the 2014 report. However, that report also mentioned that part of the reported low runoff value calculated for the Pithlachascotee basin is simply due to the large watershed size reported by the USGS, which includes the drainage basin to Crews Lake. That point should be repeated. That upstream area frequently does not contribute flow to the river at Fivay Junction, so the 2014 report examined runoff for the drainage area between the Fivay Junction and New Port Richey gages and found the runoff (7.6 inches) was more comparable, but still somewhat lower, than runoff in the Anclote River (10.6 inches) for the same period. The District should consider incorporating that discussion in the 2016 report.

p 36, last paragraph before Section 2.10 - Accounting for the typo, this paragraph discusses results from 2008 to 2014. Where these results taken from Appendix 2B, or instead from the analyses performed for the minimum flows assessment that are described in Chapter 6? It seems those analyses used a different method for calculating wellfield impacts than the method presented in Appendix 2B. The method that was used to determine the values presented in this paragraph should be clarified.

p 43, last paragraph. The 2016 report says the dissolved oxygen (DO ) concentrations in the uppermost zone of the lower river were weakly correlated with flow and reported an $r^2$ value of 0.25; p,.0001). The 2014 report reported a correlation coefficient value (r) of 0.53 for this zone, but also showed the results of a regression that had an $r^2$ value of 0.28. The 2014 report showed a scatter plot for this regression, discussed its large confidence interval, and then applied the regression to predict that a reduction in flow of one cfs would result in a reduction in DO of only 0.024 mg/l. With less explanation, the 2016 report makes this same point.

I suggest the 2016 report be slightly revised to report the r value (0.53) and say a regression was fitted to the data, report the $r^2$ and significance value for the regression, then make the statement about a one cfs flow reduction resulting in a 0.024 mg/l reduction in DO. Given the small reductions in flow represented by the minimum flows at low flows (when occasional hypoxia in the upper zone was observed), it is not expected that there will be ecologically significant effect of minimum flows implementation on DO in the lower river.

p 50, first paragraph. An introductory sentence would be helpful to tell the readers that Water & Air Research conducted a study of benthic sediment composition and macroinvertebrate populations in the lower river before jumping into the results. As now written, the transition from the first to the second paragraph is too abrupt and the reader (me) wondered if the District was talking about the same study. The section heading says benthic substrates and organisms, but an introductory sentence would help.

p 65, last paragraph - change "Table 4-1" to "Table 4-2" p 83, second paragraph from bottom. The isohaline regressions were developed by HDR Engineering Inc. under contract to the District, not by District staff.

p 107, first paragraph, first sentence. Water column isohalines, not surface water isohalines, were used to calculate reductions in salinity based water volumes. This is stated in the methods (p 86) and also mentioned in the next sentence on page 107.

p 109, third paragraph, last sentence. The 2014 report included graphics that indicated the linear interpolation of the results for mean reductions in habitat was a valid approach. This does not need to be included in the 2016 report, but can be provided if reviewers ask.

p 109, fourth paragraph - The 2014 report provided more explanation of how the 60 cfs high flow threshold for shifting the allowable withdrawal limit was determined. The text in the 2016 report is sufficient and no revision is requested, but the 60 cfs threshold was not arbitrarily determined.

P 113 (Chapter 6 in general) In using the output from INTB model for determining minimum flows, District staff concluded that model predicted flow values less than 5 cfs should not be used directly for determining if the Pithlachascotee River is meeting its minimum flows. This was due to the relatively large magnitude of possible model error at low flows. Values below 5 cfs could be used if they were included in an overall statistical distribution, such as the calculation of an overall median. The 2014 discussed the reasons for not directly using values less than 5 cfs. I don't know that such a discussion needs to be included in the 2016 report. However, the potential impact of groundwater withdrawals on low flows in the river could use some qualitative discussion in the report, which I discuss in a later section of my comments.

p 118 first paragraph, last sentence - reverse the 0.8 and 0.2 values to correctly correspond to mean and median impact values previously referenced in the sentence.

**<u>Content and interpretation of Figures 6-4 and 6-5</u>**

p 118 and 119. Figures 6-4 and 6-5 are hard to understand and could use more explanation in the text. First, the text says that results for both the 74.3 mgd and 90 mgd scenarios are plotted in Figure 6-4, but the figure caption and the plotted values indicate that results for only the 74.3 mgd scenario are shown.

Assuming that one scenario is graphed, what exactly is plotted? The text says daily flow impacts predicted by the model. I assume these are daily predictions taken from the 1996-2006 modeling period. If so, does the solid line represent the median value of daily flow reductions for each rate of baseline flow, with the dotted lines being the 5th and 95th percentile values of the predicted daily flow reductions for each rate of daily baseline flow? If so, how many impacted daily flow values are there for each rate of baseline flow? In general, a more clear description of the content of Figures 6-4 and 6-5 is needed.

In both Figures 6.4 and 6.5, the 1.4 cfs allowable reduction in median flows is plotted at 8.5 cfs on the x axis, which corresponds to the median flow for the baseline scenario. If so, in Figure 6-4 does this mean that at the median baseline flow, 90 percent of the predicted values for daily flow impact for the 74.3 mgd scenario were between about 1.2 and 3.0 cfs. Therefore, the 1.4 cfs allowable impact is within the range of 90 percent of the predicted impact values.

Similarly, in Figure 6-5, 90 percent of the values of daily flow impact at the median baseline flow for the 150 mgd scenario are between 3.2 and 6.6 cfs. If this interpretation is right, at least 90 percent of the predicted impact values for the 150 mgd scenario are greater than the allowable impact.

The paragraph says "This suggests that impacts associated to the median flow in the river associated with withdrawals of up to 90 mgd from the Central System Facility wellfields under the modeled withdrawal distribution would not be expected to exceed the allowable flow reductions associated with the proposed minimum flow criteria for the upper, freshwater river segment." This conclusion needs more explanation. The predicted impact in median flows (2.2 cfs) is still greater than the allowable impact (1.4 cfs), but is within the range of 90 percent of the predicted impact values at the median flow for the baseline scenario. It may be, but I am not sure that this 90 percent range of values is exactly the same as a 90% confidence interval that would be expressed for a statistical value or model prediction.

Finally, where are the graphical results for the 90 mgd scenario?

If my interpretation of Figures 6-4 and 6-5 is not correct, please let me know.

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p 120, fourth paragraph, line 3. 0.8 cfs is 3.9 percent of what flow value - the mean flow or some other value at the gage? Or, is the 3.9 percent the average of daily percent values. Same question on the next sentence for the 1999 - 2006 period. Clarification would be helpful.

The next sentence that starts with "These model error statistics exceed......" is grammatically odd and might imply the reverse of what it intends. I think it intends to mean that pumping scenario results examine a relative change in stress, but the wording indicates the opposite.

P 125 and 126 - The captions for Figure 6-11 and Table 6-5 need to specify these are percent exceedance values as described in the text, not straight percentiles.

p 125, last sentence - This statement seems correct enough, but the implied interpretation might be off. Median water levels for 2010 to 2015 for the control wells corresponded to long-term percent exceedance values from 31 to 33 percent. However, the long-term data were measured over a population of values that were presumably not impacted, so they would have an overall higher distribution of values. Conversely, the water levels in the Starkey wellfield represent a period of time in which groundwater impacts varied, thus the overall distribution of values over the period of analysis might be lower. Hypothetically, if you could compare water levels for a given site for impacted and unimpacted decades, the values corresponding to the same percent exceedance limit would differ between decades. Thus, comparison of a recent median to a long-term 33 percent exceedance value from a previously impacted site may not be equivalent to comparing a median to a 33 percent exceedance value from an unimpacted site for purposes of assessing recovery to pre-impacted background conditions.

p 126, last sentence. If this sentence pertains to the analysis of percentile values presented on page 125, I question the validity of the statement.

p 128 - 129. Among the most convincing evidence for the recovery of flow in the Pithachascotee River is the time series graph of yearly mean streamflow values (Figure 6-14) and corresponding rainfall hydrograph (Figure 6-15). The six-year period from 2010 to 2015 had yearly mean flow values that ranged from medium to high. I also accessed flow data for 2016, and if the river stops flowing in November and December, the average flow for 2016 would be 31 cfs, which is above the long-term mean flow for the river. As described in my earlier comments, these hydrographs could be moved up to Chapter 2 and then later discussed in Chapter 6.

**<u>Simulated effects of groundwater withdrawals on low flows in the Pithlachascotee</u>**

The Pithlachascotee River, which is really a creek, poses a challenge for determining minimum flow compliance because of its frequency of very low rates of flow. Baseflow in the river is often less than 2 cfs. Application of the percent of flow method for surface water withdrawals is straightforward, and in water use permits the District is effectively regulating actual surface water withdrawals from rivers. Similarly, the percent of flow method can be effectively applied to the regulation of groundwater withdrawals for rivers with high baseflow, such as the Weeki Wachee. Optimally, the implementation minimum flows should protect all components of a river's flow regime, but accurately assessing and managing the effects of groundwater withdrawals on small streams with low baseflow like the Pithlachascotee can be challenging.

The assessment of whether the Pithachascotee River is meeting its minimum flows was dependent on the use of integrated surface water / groundwater modeling. Fortunately, the well developed INTB model was available for this use. However, as mentioned in my comment for page 113, the relative magnitude of potential model errors inhibited the model's use for directly evaluating the effects of groundwater withdrawals on low flows (< 5 cfs) in the river.

Having said that, a comparison of flow duration characteristics of the impacted conditions scenario (actual groundwater withdrawals) with the gaged flow record for the 1989 to 2000 modeling period showed the INTB model did a very good job of estimating the flow duration characteristics of the river. As shown in Table 4-1 on page 64 in the 2016 report, the predicted percentile flow values for the median flow and below for the impacted scenario were within 0.1 cfs of the corresponding percentiles for the gaged flow record.

Furthermore, comparison of the modeled baseline flow percentiles to the modeled impacted flows in Table 4-1 indicates the relative reductions in low flows in the river are relatively large. For example, the 25th percentile flow dropped from 2.9 to 0.4 cfs. As previously discussed, potential model errors inhibit the precise examination of reductions of very low flows. Also, this comparison is for the impacted flow scenario, and flow reductions resulting from the recent cutbacks in groundwater use would be less. However, the modeling results and logical hydrological reasoning would indicate that groundwater withdrawals have a strong, and possibly their greatest relative effect, on low flows in the river.

**Summary - Is the river meeting its minimum flows, the need for a minimum flows recovery strategy, and the periodic reexamination of minimum flow compliance**

Although it is likely that groundwater withdrawals strongly affect low flows in the Pithlachascotee, it was agreed by District staff that a comparison of median and mean flow values could be examined to indicate minimum flow compliance. I suggest that for this river the comparison if medians is the most direct and applicable indicator if the river is meeting its minimum flows. These modeling presented in the report indicate there are 0.7 and 0.8 cfs deficits in allowable reductions in median flows the 74.3 mgd and 90 mgd withdrawal scenarios, respectively. It is good that these deficits in median flow values are mentioned in the Executive Summary of the report.

I believe that these modeling results indicate, but don't prove, the river is not meeting its minimum flows based on median values. The 2016 report suggests that the deficits in flow median flow values must be outside the two-tailed 90 percent confidence interval before it can be concluded that the median flows have been significantly affected. I understand the role of modeling error in the analysis and the need for statistical confidence, but the best analytical tool we have indicates there are deficits in the median flow values.

The report utilizes other methods of analysis to evaluate if the river is meeting its minimum flows. I support that approach and concur there has been a good recovery in flows in the river, due in part to large reductions in groundwater use.

Even those supplementary analyses are supportive, I believe is more appropriate to say the analyses provide mixed results regarding if the river is meeting its minimum flows, due to the deficits in the modeled median flow values. Also, although modeled low flow results were not used in the final minimum flows determination, I think a statement should be included that says that caution should be applied because the integrated modeling indicates that groundwater withdrawals also affect the low flow characteristics of the river below the median.

In consideration of all factors, I agree that a minimum flows recovery strategy for the Pithachascotee River is not necessary at this time, beyond the measures that are incorporated in the recovery strategy and comprehensive plan for the Northern Tampa Bay Water Use Caution Area. However, pending the findings of future monitoring of flows in the river and other hydrologic variables in the watershed, I suggest that the question of whether the Pithlachascotee River is meeting its minimum flows should be periodically reexamined. Such periodic assessments should also be considered if withdrawals from the regional wellfields significantly exceed the 74.3 mgd average rate that was emphasized in the 2016 report. This does not mean that a new minimum flows study be conducted, but that new empirical and modeling analyses be conducted to determine if the river is meeting its adopted minimum flows.

Finally, during the public comment period of the peer review meeting on November 1, 2016, it was suggested by a non-panel participant that lakes or wetlands might be more sensitive indicators of the effects of groundwater withdrawals due to their close hydrologic connection with the surficial aquifer. I believe that conclusion may be off base, for baseflow in the Pithlachascotee is dominated by contributions from the surfical aquifer and the model results indicate that low flows in the river can be strongly affected by groundwater withdrawals. Small rivers and streams may be every bit as sensitive to impacts from groundwater withdrawals as are lakes and wetlands in the Northern Tampa Bay Water Use Caution Area.

# APPENDIX 1G

Southwest Florida Water Management District. 2018. District response to comments on proposed minimum flows for the Pithlachascotee River submitted to the peer review panel by Sid Flannery. Brooksville, Florida..

# District Response to Comments on Proposed Minimum Flows for the Pithlachascotee River Submitted to the Peer Review Panel by Sid Flannery

February 6, 2018

Doug Leeper, Gabriel Herrick, Ph.D., Ron Basso, P.G.,
and Yonas Ghile, Ph.D.
Southwest Florida Water Management District
Brooksville, Florida

The Southwest Florida Water Management District (District) does not discriminate on the basis of disability. This nondiscrimination policy involves every aspect of the District's functions, including access to and participation in the District's programs and activities. Anyone requiring reasonable accommodation as provided for in the Americans with Disabilities Act should contact the District's Human Resources Bureau Chief, 2379 Broad St., Brooksville, FL 34604-6899; telephone (352) 796-7211 or 1-800-423-1476 (FL only), ext. 4703; or email ADACoordinator@WaterMatters.org. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1-800-955-8771 (TDD) or 1-800-955-8770 (Voice).

## Introduction

In October and November 2016, the Southwest Florida Water Management District convened a panel for the independent, scientific peer review of minimum flows proposed for the upper and lower segments of the Pithlachascotee River. The Panel consisted of a Chairperson, Bill Dunn with Dunn Salsano & Vergara Consulting, LLC as a sub-contractor to Barnes, Ferland and Associates, Inc., Panelist Sam Upchurch, with Sdii Global Corporation as a sub-contractor to Interflow Engineering, Inc., and Panelist Ray Walton with West Consultants, Inc., as a sub-contractor to HSW Engineering, Inc.

On November 10, 2016, Mr. Sid Flannery submitted written comments on the District's draft report on proposed minimum flows for the river that the Panel was reviewing. Mr. Flannery is a former District employee and one of the co-authors of the District's draft minimum flows report. He asked that the panel and District staff consider his comments as part of the review process.

The Panel's final report titled, "Pithlachascotee River MFLs Peer Review", was submitted to the District on November 30, 2016. Within the report, one of the panelist noted that: he agreed with many of Mr. Flannery's comments, he chose not to reproduce Mr. Flannery's comments in the Panel's report, and that the comments should be addressed by District staff.

To further support the review process and the Governing Board's consideration of peer-review findings, staff has reproduced Mr. Flannery's written comments in this document and included staff comments and responses, which are identified using blue highlighting.

The Panel's final report has been posted on the District web site, made available upon request to interested parties, and will be provided to members of the District Governing Board. This is also the case for staff's response to the Panel's final report and for this response to Mr. Flannery's written comments. As directed by Section 373.042 of the Florida Statutes, the Governing Board is to give significant weight to the peer review Panel's final report when establishing minimum flows for the river system.

**November 10, 2016**

**To:** Doug Leeper, Minimum Flows and Levels Program Lead

**From:** Sid Flannery, retired Chief Environmental Scientist, SWFWMD

**Subject**: Technical comments on the report - *Proposed Minimum Flows for the Pithlachascotee River - Revised Draft Report for Peer Review, August 29, 2016*

**<u>Overview</u>**

These comments are being submitted to the District as public comment as part of the peer review process for the report titled *Proposed Minimum Flows for the Pithlachascotee River - Revised Draft Report for Peer Review*, dated August 29, 2016. I am requesting that my comments be submitted to scientific peer review panel for their consideration.

In August 2014, I retired from a position as a Chief Environmental Scientist at the Southwest Florida Water Management District, where I worked on minimum flows projects for over twenty-nine years. I was one of the principal staff working on the minimum flows project for the Pithlachascotee River and was the senior author of the draft minimum flows report for the river that was dated August 26, 2014.

Before listing my specific comments on the report, I want to commend the District for its minimum flows work on the Pithlachascotee and its revision of the 2014 draft report to produce a succinct and informative report. The District has been a leader in the field of minimum flows and the Pithlachascotee presented a new, challenging river for minimum flows analysis because the effects of human water use on flows in the river have changed over time.

I also want to commend Tampa Bay Water for the timely implementation of the recovery strategy and comprehensive plan for the Northern Tampa Bay Water Use Caution Area. The dramatic reduction in groundwater withdrawals associated with the recovery strategy and comprehensive plan is unprecedented in the state and has significantly reduced withdrawal related impacts to the Pithlachascotee River and other wetland and aquatic resources in the region.

I agree with the conclusion of the report that a minimum flows recovery strategy for Pithlachascotee that goes beyond the requirements of the existing recovery strategy and comprehensive plan for the Northern Tampa Bay Water Use Caution Area is not needed at this time. However, I think the conclusion that the river is meeting its minimum flows needs to be more carefully stated with some qualification. I believe the findings regarding minimum flow compliance are mixed and there should be careful monitoring of hydrologic variables associated with the river and its drainage basin. Pending the findings of such monitoring, the question of whether the Pithlachascotee River is meeting its adopted minimum flows could be reexamined sometime during the 20-year planning horizon.

My comments on the report listed by page number (p) below. In addition, comments for four general topics are grouped under sub-headings with corresponding discussions. For brevity, I have omitted the mention of a number of grammatical edits I expect District staff have noticed and will address.

p 16 - Last sentence under section 1.4.4. Additional references are needed for the statement supporting the seasonal component of the building block approach. Based on estuarine resources, the cited article by Flannery et al. (2002) mentions that withdrawals should be most restrictive in the springtime, but it was written before the District had formalized its approach using three seasonal blocks. There are several other District minimum flows reports that can be cited that clearly describe the seasonal block approach.

**Staff response:** We deleted the reference to Flannery et al. (2002) in the identified paragraph within the revised version of the minimum flows report.

**Watershed and streamflow characteristics of the Pithlachascotee River**

Compared to the 2014 draft report, the 2016 report downsized the description of the watershed characteristics of the Pithlachascotee River and deleted a number of long-term hydrographs and the findings of streamflow trend analyses. The District states this was done to streamline the report, and after reviewing the 2016 draft report, I believe [the] approach may be suitable. However, a couple of other options might be feasible to enhance the presentation of the streamflow characteristics of the river, considering the factors below.

In addition to the long-term gage on the river near New Port Richey, the 2014 draft report presented hydrographs and flow statistics for the upstream gage on the river at Fivay Junction and Fivemile Creek, the latter a tributary to the upper river. A hydrograph and discussion of water levels in Crews Lake, which periodically contributes flow to the upper reaches of the river, were also presented along with a hydrograph of flows in Jumping Gully, a tributary to Crews Lake.

The presentation of data from these other water courses is not critical to the determination of minimum flows for the designated reach of the river between the gages at Fivay Junction and near New Port Richey. However, the data from these water courses are informative for describing the overall hydrologic setting of the Pithlachascotee River, and with relevance to minimum flows, how high flows in the river and the inundation of floodplain habitats may be influenced by water levels in the upper regions of the watershed and outflows from Crews Lake. Similarly, as described in the 2014 report, Fivemile Creek sometimes contributes more flow to the upper river than is measured at the gage on the river at Fivay Junction.

These upstream water courses are shown in a map of the Pithlachascotee River basin in the 2016 report (Figure 2-2). On page 29, the 2016 report includes a very brief discussion of these water courses. This discussion of these upstream watercourses could be adequate, but at its meeting on November 1, 2016, the review panel suggested that some additional discussion of the upstream areas of the watershed could be included and mention that minimum levels are being determined for Crews Lake.

For any river where minimum flows are being determined, I think it is valuable to discuss the long-term streamflow characteristics and any flow trends for that river early in the report. This is especially important where there have been known anthropogenic effects to streamflow. The District has taken this approach in other minimum flows reports to describe trends where human factors have caused flows to increase (Myakka and Little Manatee), decline (Upper Peace), or rise and then later decline due to changes in point source discharges (Alafia). Hydrographs and trend analyses of various flow components (seasonal flows, yearly percentile flows) can be presented to show how the flow regime of the river may have changed over time.

One problem with presenting hydrographs and trend analyses is that the results can change with the collection of more recent data. The 2014 draft report for the Pithlachascotee presented analyses of flow data collected through water year 2013, which ended September 30, 2013. Since that time, data from 2014 and 2015 have become available which show a strong rebound in flows in the Pithlachascotee, due to two years of above average rainfall and cutbacks in groundwater use.

The 2016 report presents a hydrograph of yearly mean flows from 1964 to 2015 in Chapter 6 to make the point that flows are rebounding in the river and a minimum flows recovery strategy is not needed. As described below, I think these results should be moved up to Chapter 2.

A couple of options could be available for presenting updated hydrologic data in the 2016 report. Optimally, the hydrographs and trend analyses presented in the 2014 report could be revisited to include the more recent data, along with a discussion of the role of climate and the effects of changes in groundwater use on long-term changes in flows. This should be presented in Chapter 2 in the characterization of flow regime of the river. However, such an update this would require additional work by the District. Having said that, the inclusion of several hydrographs (yearly mean flows, dry and wet season flows, five or so yearly percentile flows) with corresponding trend analyses might be a reasonable task.

Another option would be to separately provide the 2014 analyses to the review panel for their consideration. Or, the 2014 analyses could be included as an Appendix to the report. However, I do not suggest that, as publishing the results of outdated trend analyses would be misleading, especially given the high flows that have occurred since 2014.

The final option would be some modest expansion of the streamflow characterization discussion in the 2016 report. I think some long-term hydrographs should be included in Chapter 2 of the report. At a minimum, the hydrograph of mean yearly flows for 1964 to 2015 that is now presented in Chapter 6, plus the corresponding rainfall graph and discussion, should be moved up to the discussion of flow characteristics in Chapter 2. Those results could then be later referenced in Chapter 6 in the discussion of the minimum flows status assessment. Again, I think that hydrographs of several yearly flow parameters would also be valuable.

As previously discussed, the current report could also include more discussion of the upstream tributaries, including an updated hydrograph of water levels in Crews Lake and a plot of water levels in Crews Lake vs. flow in the river at the Fivay Junction gage, similar to what was included in the 2014 report.

**Staff response:** We acknowledge that much of the descriptive watershed information included in the draft 2014 minimum flows report was not included in the 2016 version of the report. These omissions were made to streamline presentation of relevant information in the more recent document. Our goal was to include the necessary, primary data that directly supports minimum flow development, and to also include selected ancillary data that provides context for interpretation of the primary data and minimum flow analyses. We believe we have included the data that are sufficient for the hypothesis-testing framework used to evaluate percentage-of-flow reductions that may result in more than a 15% change in evaluated resources of concern.

We agree with the assertion made in the comment above that presentation of much of the information included in the previous draft minimum flows report is not critical to the determination of minimum flows for the river. We note, however, that we have made modest revisions throughout the revised report (e.g., Sections 2.3, 2.4, 2.5, 4.1 and 6.3.5) to include additional information on rainfall, physiographic regions, hydrogeology, and Crews Lake and other water bodies in the upper portion of the watershed.

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p 30, last two paragraphs. This discussion of low runoff in the Pithlachascotee drainage basin was taken from the 2014 report. However, that report also mentioned that part of the reported low runoff value calculated for the Pithlachascotee basin is simply due to the large watershed size reported by the USGS, which includes the drainage basin to Crews Lake. That point should be repeated. That upstream area frequently does not contribute flow to the river at Fivay Junction, so the 2014 report examined runoff for the drainage area between the Fivay Junction and New Port Richey gages and found the runoff (7.6 inches) was more comparable, but still somewhat lower, than runoff in the

Anclote River (10.6 inches) for the same period. The District should consider incorporating that discussion in the 2016 report.

**Staff response:** A sentence from the original 2014 minimum flows report addressing the effect of the size of the upper watershed on runoff in the Pithlachascotee basin has been included in the referenced paragraph of the revised version of the report.

Because watershed area is used to calculate area based runoff, the low runoff rates reported for the Pithlachascotee River basin are related to the relatively large watershed area reported for the river above the Fivay Junction gage (150 $mi^2$), which includes the drainage basin for Crews Lake (see Figure 2-2).

p 36, last paragraph before Section 2.10 - Accounting for the typo, this paragraph discusses results from 2008 to 2014. Where these results taken from Appendix 2B, or instead from the analyses performed for the minimum flows assessment that are described in Chapter 6? It seems those analyses used a different method for calculating wellfield impacts than the method presented in Appendix 2B. The method that was used to determine the values presented in this paragraph should be clarified.

**Staff response:** Appendix 2B includes a summary of model runs completed in 2014 using the INTB model. It was primarily focused on determining historic groundwater impact and individual wellfield pumping impacts during the period 1989-2000 using the 1997 distribution of TBW pumping. The main focus of the memorandum was determining the streamflow impact by mgd of withdrawals by wellfield. That ratio was then applied to the actual record of pumping back to the 1960s in an attempt to determine annual historic impact to flows for the Pithlachascotee River. It did also reference streamflow impacts from the 90 mgd run of the INTB model back in 2014, but these results have been superseded by more recent results of the INTB model using a revised model code and through removal of agricultural return water during the "pumps off" run. These more recent results have been presented in Chapters 2 and 6 of the revised minimum flows report. The text was also revised in the last paragraph prior to Section 2.10 to make it clearer.

p 43, last paragraph. The 2016 report says the dissolved oxygen (DO) concentrations in the uppermost zone of the lower river were weakly correlated with flow and reported an $r^2$ value of 0.25; p,.0001). The 2014 report reported a correlation coefficient value (r) of 0.53 for this zone, but also showed the results of a regression that had an $r^2$ value of 0.28. The 2014 report showed a scatter plot for this regression, discussed its large confidence interval, and then applied the regression to predict that a reduction in flow of one cfs would result in a reduction in DO of only 0.024 mg/l. With less explanation, the 2016 report makes this same point.

I suggest the 2016 report be slightly revised to report the r value (0.53) and say a regression was fitted to the data, report the $r^2$ and significance value for the regression, then make the statement about a one cfs flow reduction resulting in a 0.024 mg/l reduction in DO. Given the small reductions in flow represented by the minimum flows at low flows (when occasional hypoxia in the upper zone was observed), it is not expected that there will be ecologically significant effect of minimum flows implementation on DO in the lower river.

**Staff response:** Text and Figure 2-17 that concern DO relationships with flow in the lower river have been made to Section 2.10.3 in the revised minimum flows report. These changes address comments made above as well as those made by the Peer Review Panel.

p 50, first paragraph. An introductory sentence would be helpful to tell the readers that Water & Air Research conducted a study of benthic sediment composition and macroinvertebrate populations in the lower river before jumping into the results. As now written, the transition from the first to the second paragraph is too abrupt and the reader (me) wondered if the District was talking about the same study. The section heading says benthic substrates and organisms, but an introductory sentence would help.

**Staff response:** The introductory paragraph in Section 3.4 of the revised minimum flows report has been updated to address this comment.

p 65, last paragraph - change "Table 4-1" to "Table 4-2"

**Staff response:** The reference to Table 4-2 in Section 4.3 of the revised minimum flows report has been corrected.

p 83, second paragraph from bottom. The isohaline regressions were developed by HDR Engineering Inc. under contract to the District, not by District staff.

**Staff response:** The error has been corrected in Section 4.5.2.1 of the revised minimum flows report.

p 107, first paragraph, first sentence. Water column isohalines, not surface water isohalines, were used to calculate reductions in salinity based water volumes. This is stated in the methods (p 86) and also mentioned in the next sentence on page 107.

**Staff response:** The error has been corrected in Section 5.5.1.3 of the revised minimum flows report.

p 109, third paragraph, last sentence. The 2014 report included graphics that indicated the linear interpolation of the results for mean reductions in habitat was a valid approach. This does not need to be included in the 2016 report, but can be provided if reviewers ask.

**Staff response:** The error has been corrected in Section 5.5.1.3 of the revised minimum flows report.

p 109, fourth paragraph - The 2014 report provided more explanation of how the 60 cfs high flow threshold for shifting the allowable withdrawal limit was determined. The text in the 2016 report is sufficient and no revision is requested, but the 60 cfs threshold was not arbitrarily determined.

**Staff response:** An additional sentence has been added to the paragraph addressing development of the 60 cfs flow threshold in Section 5.5.2 of the revised minimum flows report.

P 113 (Chapter 6 in general) In using the output from INTB model for determining minimum flows, District staff concluded that model predicted flow values less than 5 cfs should not be used directly for determining if the Pithlachascotee River is meeting its minimum flows. This was due to the relatively large magnitude of possible model error at low flows. Values below 5 cfs could be used if they were included in an overall statistical distribution, such as the calculation of an overall median. The 2014 discussed the reasons for not directly using values less than 5 cfs. I don't know that such a discussion needs to be included in the 2016 report. However, the potential impact of groundwater withdrawals on low flows in the river could use some qualitative discussion in the report, which I discuss in a later section of my comments.

**Staff response:** Use of INTB model results for minimum flow status assessments is discussed in Chapter 6 of the minimum flows report. Section 6.2.2 specifically addresses use of river flows predicted with the model, and focuses on mean and median responses. We do not see the need to discuss model limitations for flow predictions in that section of the report. Uncertainty associated with INTB model output for the river is, however, discussed in Section 6.2.3.

INTB model flows of less than 5 cfs were not used in the calibration of the model. Simulated low flows are therefore uncalibrated. Staff do not believe the model tool can be used as an effective predictive tool under low flow conditions.

p 118 first paragraph, last sentence - reverse the 0.8 and 0.2 values to correctly correspond to mean and median impact values previously referenced in the sentence.

**Staff response:** These values were placed in the correct order and revised to 0.6 and 0.1 in Section 6.2.2 of the revised minimum flows report, based on updated model results.

**<u>Content and interpretation of Figures 6-4 and 6-5</u>**

p 118 and 119. Figures 6-4 and 6-5 are hard to understand and could use more explanation in the text. First, the text says that results for both the 74.3 mgd and 90 mgd scenarios are plotted in Figure 6-4, but the figure caption and the plotted values indicate that results for only the 74.3 mgd scenario are shown.

**Staff response:** Results from the 90 mgd have been included in a revised version of the figure.

Assuming that one scenario is graphed, what exactly is plotted? The text says daily flow impacts predicted by the model. I assume these are daily predictions taken from the 1996- 2006 modeling period. If so, does the solid line represent the median value of daily flow reductions for each rate of baseline flow, with the dotted lines being the 5th and 95th percentile values of the predicted daily flow reductions for each rate of daily baseline flow? If so, how many impacted daily flow values are there for each rate of baseline flow? In general, a more clear description of the content of Figures 6-4 and 6-5 is needed.

**Staff response:** The figures include daily flow impacts for the entire 11-year simulation period (total of 4,015 data points). Daily flow impact due to groundwater withdrawals (y-axis) is plotted against the simulated “pumps off” flow (x-axis) at the Pithlachascotee River gage near New Port Richey. The solid black line represents the median of daily flow impact with “pumps off” flow. The other lines include the $5^{th}$ and $95^{th}$ percentile of daily flow impact. This was done for the 90 mgd permitted run and the current Tampa Bay Water pumping in 2014. The plus sign is simply the allowable median flow impact superimposed on the results.

In both Figures 6.4 and 6.5, the 1.4 cfs allowable reduction in median flows is plotted at 8.5 cfs on the x axis, which corresponds to the median flow for the baseline scenario. If so, in Figure 6-4 does this mean that at the median baseline flow, 90 percent of the predicted values for daily flow impact for the 74.3 mgd scenario were between about 1.2 and 3.0 cfs. Therefore, the 1.4 cfs allowable impact is within the range of 90 percent of the predicted impact values.

**Staff response:** This assessment of information presented in Figures 6-4 and 6-5 is correct. Note, however, that we have removed Figure 6-5 from the revised version of the report.

Similarly, in Figure 6-5, 90 percent of the values of daily flow impact at the median baseline flow for the 150 mgd scenario are between 3.2 and 6.6 cfs. If this interpretation is right, at least 90 percent of the predicted impact values for the 150 mgd scenario are greater than the allowable impact.

**Staff response:** The assessment above is correct. Note, however, that we have determined Figure 6-5 is not necessary and removed it from the revised version of the report.

The paragraph says "This suggests that impacts associated to the median flow in the river associated with withdrawals of up to 90 mgd from the Central System Facility wellfields under the modeled withdrawal distribution would not be expected to exceed the allowable flow reductions associated with the proposed minimum flow criteria for the upper, freshwater river segment." This conclusion needs more explanation. The predicted impact in median flows (2.2 cfs) is still greater than the allowable impact (1.4 cfs), but is within the range of 90 percent of the predicted impact values at the median flow for the baseline scenario. It may be, but I am not sure that this 90 percent range of values is exactly the same as a 90% confidence interval that would be expressed for a statistical value or model prediction.

**Staff response:** The paragraph containing the sentence referenced in the comment above has been revised to note the allowable impact is the lower portion of the 90th percentile envelop of predicted impacts, indicating that current and predicted flows are close to the allowable minimum flow requirements.

Finally, where are the graphical results for the 90 mgd scenario?

**Staff response:** Results from the 90 mgd have been included in a revised version of Figure 6-4.

If my interpretation of Figures 6-4 and 6-5 is not correct, please let me know.

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p 120, fourth paragraph, line 3. 0.8 cfs is 3.9 percent of what flow value - the mean flow or some other value at the gage? Or, is the 3.9 percent the average of daily percent values. Same question on the next sentence for the 1999 - 2006 period. Clarification would be helpful.

**Staff response:** The difference between mean simulated and observed flow at the New Port Richey gage was 0.8 cfs or 3.9% (10-year period from 1989-1998). We have modified the referenced sentence in the revised minimum flows report as follows: “The mean error in simulated versus observed flow from the INTB model for the calibration period from 1989-1998 was 0.8 cfs or 3.9 percent at the Pithlachascotee River near New Port Richey gage.”

The next sentence that starts with "These model error statistics exceed......" is grammatically odd and might imply the reverse of what it intends. I think it intends to mean that pumping scenario results examine a relative change in stress, but the wording indicates the opposite.

**Staff response:** These model error statistics likely are larger than error associated with the pumping scenario results because we are matching particular flow rates during calibration rather than a relative change in flows due to pumping stress.

P 125 and 126 - The captions for Figure 6-11 and Table 6-5 need to specify these are percent exceedance values as described in the text, not straight percentiles.

**Staff response**: Captions for Figure 6-10 (formerly Figure 6-11) and Table 6-5 have been updated in the revised minimum flows report to indicate the median 2010-2015 water levels are expressed as exceedance percentiles for the 1999 through 2015 period.

p 125, last sentence - This statement seems correct enough, but the implied interpretation might be off. Median water levels for 2010 to 2015 for the control wells corresponded to long-term percent exceedance values from 31 to 33 percent. However, the long-term data were measured over a population of values that were presumably not impacted, so they would have an overall higher distribution of values. Conversely, the water levels in the Starkey wellfield represent a period of time in which groundwater impacts varied, thus the overall distribution of values over the period of analysis might be lower. Hypothetically, if you could compare water levels for a given site for impacted and unimpacted decades, the values corresponding to the same percent exceedance limit would differ between decades. Thus, comparison of a recent median to a long-term 33 percent exceedance value from a previously impacted site may not be equivalent to comparing a median to a 33 percent exceedance value from an unimpacted site for purposes of assessing recovery to pre-impacted background conditions.

**Staff response**: We do not agree with the assertions in this comment. The presented information is a comparative analysis that is supported by the hydrograph separation analysis included in the four figures (Figures 6-7 through 6-10) preceding the referenced text. If water levels were unusually low on the wellfield due to withdrawals from 2010-2015, this would be reflected in differing percentiles than those of background wells. The fact that they mimic the background well water levels (as expressed as a similar percentile) seems to point to the water levels are close to background conditions. We further note that the presented well information is a supplemental analysis that supports other parts of the evaluation and is not meant to be definitive.

p 126, last sentence. If this sentence pertains to the analysis of percentile values presented on page 125, I question the validity of the statement.

**Staff response:** Comment noted.

p 128 - 129. Among the most convincing evidence for the recovery of flow in the Pithlachascotee River is the time series graph of yearly mean streamflow values (Figure 6-14) and corresponding rainfall hydrograph (Figure 6-15). The six-year period from 2010 to 2015 had yearly mean flow values that ranged from medium to high. I also accessed flow data for 2016, and if the river stops flowing in November and December, the average flow for 2016 would be 31 cfs, which is above the long-term mean flow for the river. As described in my earlier comments, these hydrographs could be moved up to Chapter 2 and then later discussed in Chapter 6.

**Staff response:** We see merit in the suggested changes, but think it is most useful to leave the referenced figures in the status assessment chapter. That section of the report can then continue to serve as sort of a stand-alone reference for those interested in how the proposed minimum flows were assessed and will presumably be assessed in the future.

**Simulated effects of groundwater withdrawals on low flows in the Pithlachascotee**

The Pithlachascotee River, which is really a creek, poses a challenge for determining minimum flow compliance because of its frequency of very low rates of flow. Baseflow in the river is often less than 2 cfs. Application of the percent of flow method for surface water withdrawals is straightforward, and in water use permits the District is effectively regulating actual surface water withdrawals from rivers. Similarly, the percent of flow method can be effectively applied to the regulation of groundwater withdrawals for rivers with high baseflow, such as the Weeki Wachee. Optimally, the implementation minimum flows should protect all components of a river's flow regime, but accurately assessing and managing the effects of groundwater withdrawals on small streams with low baseflow like the Pithlachascotee can be challenging.

The assessment of whether the Pithlachascotee River is meeting its minimum flows was dependent on the use of integrated surface water / groundwater modeling. Fortunately, the well developed INTB model was available for this use. However, as mentioned in my comment for page 113, the relative magnitude of potential model errors inhibited the model's use for directly evaluating the effects of groundwater withdrawals on low flows (< 5 cfs) in the river.

Having said that, a comparison of flow duration characteristics of the impacted conditions scenario (actual groundwater withdrawals) with the gaged flow record for the 1989 to 2000 modeling period showed the INTB model did a very good job of estimating the flow duration characteristics of the river. As shown in Table 4-1 on page 64 in the 2016 report, the predicted percentile flow values for the median flow and below for the impacted scenario were within 0.1 cfs of the corresponding percentiles for the gaged flow record.

Furthermore, comparison of the modeled baseline flow percentiles to the modeled impacted flows in Table 4-1 indicates the relative reductions in low flows in the river are relatively large. For example, the 25th percentile flow dropped from 2.9 to 0.4 cfs. As previously discussed, potential model errors inhibit the precise examination of reductions of very low flows. Also, this comparison is for the impacted flow scenario, and flow reductions resulting from the recent cutbacks in groundwater use would be less. However, the modeling results and logical hydrological reasoning would indicate that groundwater withdrawals have a strong, and possibly their greatest relative effect, on low flows in the river.

**Summary - Is the river meeting its minimum flows, the need for a minimum flows recovery strategy, and the periodic reexamination of minimum flow compliance**

Although it is likely that groundwater withdrawals strongly affect low flows in the Pithlachascotee, it was agreed by District staff that a comparison of median and mean flow values could be examined to indicate minimum flow compliance. I suggest that for this river the comparison if medians is the most direct and applicable indicator if the river is meeting its minimum flows. These modeling presented in the report indicate there are 0.7 and 0.8 cfs deficits in allowable reductions in median flows the 74.3 mgd and 90 mgd withdrawal scenarios, respectively. It is good that these deficits in median flow values are mentioned in the Executive Summary of the report.

I believe that these modeling results indicate, but don't prove, the river is not meeting its minimum flows based on median values. The 2016 report suggests that the deficits in flow median flow values must be outside the two-tailed 90 percent confidence interval before it can be concluded that the median flows have been significantly affected. I understand the role of modeling error in the analysis and the need for statistical confidence, but the best analytical tool we have indicates there are deficits in the median flow values.

The report utilizes other methods of analysis to evaluate if the river is meeting its minimum flows. I support that approach and concur there has been a good recovery in flows in the river, due in part to large reductions in groundwater use.

Even those supplementary analyses are supportive, I believe is more appropriate to say the analyses provide mixed results regarding if the river is meeting its minimum flows, due to the deficits in the modeled median flow values. Also, although modeled low flow results were not used in the final minimum flows determination, I think a statement should be included that says that caution should be applied because the integrated modeling indicates that groundwater withdrawals also affect the low flow characteristics of the river below the median.

**Staff response:** We agree that current and projected 20-yr flows in the Pithlachascotee River are close to the minimum flow requirements proposed for the river. Language addressing this perspective has been included in Section 6.4 within the revised minimum flows report.

In consideration of all factors, I agree that a minimum flows recovery strategy for the Pithlachascotee River is not necessary at this time, beyond the measures that are incorporated in the recovery strategy and comprehensive plan for the Northern Tampa Bay Water Use Caution Area. However, pending the findings of future monitoring of flows in the river and other hydrologic variables in the watershed, I suggest that the question of whether the Pithlachascotee River is meeting its minimum flows should be periodically reexamined. Such periodic assessments should also be considered if withdrawals from the regional wellfields significantly exceed the 74.3 mgd average rate that was emphasized in the 2016 report. This does not mean that a new minimum flows study be conducted, but that new empirical and modeling analyses be conducted to determine if the river is meeting its adopted minimum flows.

**Staff response:** We continue to support the ongoing monitoring and minimum flows status assessment processes identified for the river in the minimum flows report.

Finally, during the public comment period of the peer review meeting on November 1, 2016, it was suggested by a non-panel participant that lakes or wetlands might be more sensitive indicators of the effects of groundwater withdrawals due to their close hydrologic connection with the surficial aquifer. I believe that conclusion may be off base, for baseflow in the Pithlachascotee is dominated by contributions from the surficial aquifer and the model results indicate that low flows in the river can be strongly affected by groundwater withdrawals. Small rivers and streams may be every bit as sensitive to impacts from groundwater withdrawals as are lakes and wetlands in the Northern Tampa Bay Water Use Caution Area.

**Staff response:** We agree with this characterization of groundwater withdrawal effects on low-flow systems.

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# APPENDIX 1H

Upchurch, S.B. 2018. Memorandum to Doug Leeper, MFLs Program Lead, dated January 17, 2018. Subj: Critique of the District's Responses to Peer Reviewer Comments Pithlachascotee River Minimum Flows Basis Document Purchase Order No. 18P000003 16. Prepared for the Southwest Florida Water Management District. Brooksville, Florida.

**Memorandum**

**TO:** Doug Leeper, MFLs Program Lead
Southwest Florida Water Management District
Springs and Environmental Flows Section
2379 Broad Street
Brooksville, FL 34604

**FROM:** Sam B. Upchurch, Ph.D., P.G.
Florida License No. PG004

SAM B. UPCHURCH, Ph.D., P.G. LICENSE NO. PG 4 STATE OF FLORIDA PROFESSIONAL GEOLOGIST

**DATE:** January 17, 2018

**SUBJ:** Critique of the District's Responses to Peer Reviewer Comments
Pithlachascotee River Minimum Flows Basis Document
Purchase Order No. 18P00000316

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In October and November 2016, the District convened a panel of three experts, including me, to evaluate the scientific basis and technical validity of the draft document proposing minimum flows for the Pithlachascotee River downstream from the Fivay Junction gage. The peer reviewers submitted their responses verbally and in the form of tables that included general and line-by-line comments and corrections, comment relevance, and importance.

This Memorandum constitutes my responses to the District's efforts to adjust the MFL basis report to the peer reviewers' comments. In order to develop this response, the following documents were reviewed:

- "Recommended Minimum Flows for the Pithlachascotee River", dated January 5, 2018, with changes to the report indicated in MS Word's Track Changes option [NB, this report is termed the "basis document" for the MFLs pertinent to the Pithlachascotee River in this memorandum];
- "District Response to the Pithlachascotee River MFLs Peer Review", dated January 5, 2018, by Doug Leeper, Gabriel Herrick, et al.; and
- "District Response to Comments on Proposed Minimum Flows for the Pithlachascotee River Submitted to the Peer Review Panel by Sid Flannery", dated January 5, 2018.

This memorandum represents my findings and opinions only. The District's responses and manuscript alterations in reaction to the findings of the other peer reviewers were reviewed but this memorandum deals largely with my concerns.

First of all, it is important to state that the basis report is excellent and reads well, for which the authors and District are to be complimented. The revised basis document is easily understood and the peer reviewers' comments and concerns have been appropriately addressed in my opinion.

I had several general concerns about the basis document. These are indicated below with comments.

- Data and model uncertainties and reliability – All of the peer reviewers expressed concerns about aspects of the data quality used to identify the minimum flows and the models used to evaluate wellfield effects and baseline conditions. The additions to the text address these issues. I am especially pleased to note that an alternative evaluation tool other that HES-RAS was added.
- The document should "stand alone" – I realize that scientific reports can seldom include development of all concepts and tools used in the report. To this end, references and appendices are used to direct the reader to pertinent supporting information. In spite of this practice, I believe that each report should be written to stand alone as much as possible as a convenience to the reader, especially one who is inexperienced with the subject matter. Several of my comments suggested areas where background information should be added to strengthen the report. For the most part, these suggestions were followed by the District and I am satisfied that the basis report can serve as a "stand alone" report, especially with the appendices that have been added.
- Relationship of the upper Pithlachascotee watershed to the MFL water body – The early part of the initial draft report dealt with the entire basin, including Crews Lake and its drainages. Then there was a rather abrupt transition to the river below the Fivay Junction stream gage. I felt that this transition needed explanation, especially why the Crews Lake portion of the river basin was not considered. This transition has been correctly and clearly explained. This explanation, especially the information that the Crews Lake Basin was internally drained and had a separate MFL, is important to the following concern.
- Regulatory issues for the Pithlachascotee River – I think it is important the note that the river is one of the most highly regulated water bodies in the District. With the MFL for Crews Lake and its drainage, the wellfield permits and agreements with Tampa Bay Water, flows in the Pithlachascotee are highly constrained. This is important as assurance to the public and stakeholders.
- Concern for how the MFLs were to be implemented – Finally, implementation of the MFL is complex because of the evident temporal lags between wellfield withdrawals and river flow responses. This time lag complicates management of flows in the river. The District has added a final section on MFL implementation that addresses these issues.

In summary, the revised MFL basis report is greatly improved. In my opinion, the proposed minimum flows are appropriately stated and should protect the river system from significant harm as required by Ch. 373 F.S.

In reading the basis document, I found a few minor editorial suggestions. These are included as a table attached as an appendix to this report.

APPENDIX – Editorial comments. [NB: page numbers refer to text showing track changes including deletions]

1. Page 13, 1st paragraph – staff is a singular noun. Sentence should read "District staff thinks…." This mistake is repeated elsewhere in text.
2. Use of surficial aquifer terminology. Recommend the nomenclature use in Florida Geological Survey SP 28. Throughout the report the surficial aquifer is termed surficial aquifer system, surficial aquifer, surficial sand aquifer, etc. Please be consistent. In the Pithlachascotee Basin it is appropriate to call it the surficial aquifer since the aquifers that make it a system are sand and gravel, Biscayne, etc. None of which are in the basin.
3. Page 26, 1st para – Insert "undifferentiated" before Hawthorn since that is the way it is mapped in the area.
4. Page 26, 1st para – Suggest changing thickness of the Hawthorn to 0 to 25 ft. since you state that it is breached.
5. Throughout report it is not necessary to say "___ age" before listing the series/epoch during which sediments were deposited. The meaning is clear without stating age, especially since the report is describing the series, not the actual age. You also do not need to say "Upper" for Eocene Ocala Limestone.
6. Page 26, 3rd para – Is there a conflict between stating that the water table is deep in the upper basin and then talking about shallow limestone. I'm not sure about how much vadose limestone there is. The deep water table is below thick aeolian and terrace sands and karst is developed where limestone is near land surface in most cases. These are two different scenarios.
7. Page 26, last para – " Wide-scale fluctuation in sea-level stands during the Miocene age and throughout recent geologic time has led to multiple-horizons of concentrated karst features (Knochenmus and Yobbi, 2001)." This sentence, as written, leaves out the Pliocene and Pleistocene epochs, during which most of the karst formed. The word "recent" is not precise. If the word had been capitalized, it would refer to the Recent Epoch or Stage. As written, it refers to events that are not too ancient.
8. Page 36, 1st para – Sentence states that the Fivay Junction gage is 150 $mi^2$ in area. Just omit the parenthetic statement since the area of the basin above the gage have been stated previously in the paragraph.
9. Page 79 – Delete one phrase in "as well as as well as".
10. Page 80 – Please use the peer reviewers as a group or by name. Do not use our company affiliations as we are the peer reviewers, not our companies.

# APPENDIX 1I

Southwest Florida Water Management District. 2018. District Response to Sam B. Upchurch's January 17, 2018 Memorandum: Critique of the District's Responses to Peer Reviewer Comments Pithlachascotee River Minimum Flows Basis Document Purchase Order No. 18P000003 16. Brooksville, Florida.

# District Response to Sam B. Upchurch's January 17, 2018 Memorandum: Critique of the District's Responses to Peer Reviewer Comments Pithlachascotee River Minimum Flows Basis Document Purchase Order No. 18P000003 16

January 23, 2018

Southwest Florida
Water Management District

Doug Leeper, Gabriel Herrick, Ph.D., Ron Basso, P.G.,
and Yonas Ghile, Ph.D
Southwest Florida Water Management District
Brooksville, Florida

## Introduction

In January 2018, the Southwest Florida Water Management District contracted with Dr. Sam Upchurch, a member of the panel that completed an independent, scientific peer review of minimum flows proposed for the upper and lower segments of the Pithlachascotee River in 2016, to assess the District staff response to the panel's findings and comments. Dr. Upchurch completed this peer review follow-up effort in January 2018 and summarized his findings in a memorandum submitted to the District on January 17, 2018.

To further support the review process and the Governing Board's consideration of peer-review findings for the proposed minimum flows for the river, staff has reproduced within this document the appendix Dr. Upchurch included in his January 17th memorandum in which he summarized minor editorial comments for the revised minimum flows report. Also included are staff responses that indicate how Dr. Upchurch's editorial comments were addressed.

Dr. Upchurch's January 17th memorandum and this District staff response document will be made available upon request to interested parties, and will be provided to members of the District Governing Board for their consideration when establishing minimum flows for the Pithlachascotee River.

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Appendix from Dr. Sam Upchurch's January 17, 2018 memorandum,
with added District staff responses

APPENDIX - Editorial comments. [NB: page numbers refer to text showing track changes including deletions]

1. Page 13, Ist paragraph - staff is a singular noun. Sentence should read "District staff thinks. ..." This mistake is repeated elsewhere in text.

   **Staff response**: Comment addressed by making corrections in Sections 1.3 and 1.4.1 of the minimum flows report.

2. Use of surficial aquifer terminology. Recommend the nomenclature use in Florida Geological Survey SP 28. Throughout the report the surficial aquifer is termed surficial aquifer system, surficial aquifer, surficial sand aquifer, etc. Please be consistent. In the Pithlachascotee Basin it is appropriate to call it the surficial aquifer since the aquifers that make it a system are sand and gravel, Biscayne, etc. None of which are in the basin.

   **Staff response**: Comment addressed by using "surficial aquifer" throughout the report.

3. Page 26, Ist para - Insert "undifferentiated" before Hawthorn since that is the way it is mapped in the area.

   **Staff response**: Comment addressed by making this edit to Section 2.5 of the report.

4. Page 26, Ist para - Suggest changing thickness of the Hawthorn to 0 to 25 ft. since you state that it is breached.

   **Staff response**: Comment addressed by making this edit to Section 2.5 of the report.

5. Throughout report it is not necessary to say "_ age" before listing the series/epoch during which sediments were deposited. The meaning is clear without stating age, especially since the report is describing the series, not the actual age. You also do not need to say "Upper" for Eocene Ocala Limestone.

   **Staff response**: Comments addressed by revising text as suggested, within Section 2.5 of the report.

6. Page 26,3rd para - Is there a conflict between stating that the water table is deep in the upper basin and then talking about shallow limestone. I'm not sure about how much vadose limestone there is. The deep water table is below thick aeolian and terrace sands and karst is developed where limestone is near land surface in most cases. These are two different scenarios.

   **Staff response**: Comment addressed by adding a parenthetic descriptor to the referenced text in Section 2.5 to indicate what is meant by a "deep water table". For the most part, staff agrees that the basal portion of the surficial sands tend to remain saturated under regionally unconfined conditions in the UFA. There are, however, some locations based on monitor well data, where the water table drops below the top of limestone at least seasonally or during dry years.

7. Page 26, last para - " Wide-scale fluctuation in sea-level stands during the Miocene age and throughout recent geologic time has led to multiple-horizons of concentrated karst features (Knochenmus and Yobbi, 2001)." This sentence, as written, leaves out the Pliocene and Pleistocene epochs, during which most of the karst formed. The word "recent" is not precise. If the word had been capitalized, it would refer to the Recent Epoch or Stage. As written, it refers to events that are not too ancient.

   **Staff response**: Comment addressed by changing the phrase, "recent geologic time" to "the Pliocene and Pleistocene epochs" in the referenced text within Section 2.5 of the report.

8. Page 36, Ist para - Sentence states that the Fivay Junction gage is 150 $mi^2$ in area. Just omit the parenthetic statement since the area of the basin above the gage have been stated previously in the paragraph.

   **Staff response:** Comment addressed by deleing the parenthetic reference to the upstream basin size in Section 2.8.1 of the report.

9. Page 79 - Delete one phrase in "as well as well as".

   **Staff response:** Comment addressed by deleting the duplicate phrase from Section 4.4.2.2 of the report.

10. Page 80 Please use the peer reviewers as a group or by name. Do not use our company affiliations as we are the peer reviewers, not our companies.

   **Staff response**: The peer review report cover indicates the document was prepared by Dunn, Salsano & Vergara, Consulting, LLC, Barnes, Ferland and Associates, Inc., SDII Global, and West Consultants, Inc., so staff is inclined to continue to reference, cite and attribute the report to the listed companies. We note, however, that the three reviewers are identified by name within the peer review report and in acknowledgments section of the minimum flows report. To further differentiate the individual reviewers from their companies, text identifying the reviewers by name has been included in Sections 1.1, 1.4.6 and 4.4.2.2.3 of the minimum flows report.

# APPENDIX 1J

Dunn, W.J. 2018. Memorandum to Mr. Doug Leeper, dated January 29, 2018. RE: Task Work Assignment No. 18T0001118. Dunn, Salsano & Vergera Consulting, LLC. Longwood, Florida. Prepared for the Southwest Florida Water Management District. Brooksville, Florida.

DSV
DUNN, SALSANO & VERGARA
CONSULTING, LLC
HELPING CLIENTS MEET THEIR WATER RESOURCE NEEDS

P.O. BOX 916295
LONGWOOD, FL 32791-6295
MAIN OFFICE (407) 884-8800
FAX (407) 884-7195

January 29, 2018

Mr. Doug Leeper
Southwest Water Management District
2379 Broad Street
Brooksville, FL 34604 **(VIA EMAIL ONLY)**

RE: Task Work Assignment No. 18T0001118

Dear Mr. Leeper:

Dunn, Salsano & Vergara Consulting, LLC (DSV) appreciates the opportunity to provide peer review services to the Southwest Florida Water Management District (SWFMD) for recommended minimum flows and levels (MFLs) for the Pithalchascotee River MFLS Peer Review Panel. I served as DSV's review manager, and coordinated closely with SWFWMD's project manager, Doug Leeper, throughout the course of this effort. This letter report is the final memo report for this effort based on Task No. 3 of the current task work assignment TWA 18T0001118. DSV has performed this peer review as a sub-contractor to Barnes, Ferland and Associates, Inc (BFA).

For the peer review process, DSV served as panel chair and in that capacity, we submitted a combined peer review report to the District in November 2016. During the calendar year 2017 District staff have judiciously addressed the panel's comments, questions, recommendations, and requested revisions. In January 2018 the District authorized TWA 18T0001118 with BFA for follow up services by DSV. This new TWA covers five tasks. This letter report fulfills Task No. 3 of the referenced TWA. Under Task 1 of the TWA we completed a review of the District staff's response to the peer review panel's November 2016 report. The documents reviewed for Task 1 include:

1. the District's January 5, 2018 document giving specific written responses to the comments and recommendation in the panel's November 2016 peer review report, and
2. the District's revised minimum flows report dated January 5, 2018, and other supporting documents.

Under Task 2 of the TWA we participated in a teleconference with you, the District's project manager and MFLs staff to discuss the findings of our review of the key documents provided under Task 1. This teleconference occurred on Friday January 26, 2018. This discussion with you and the MFLs team was very helpful in clarifying some final points.

Based on the review of the key documents provided by staff for Task 1, and the discussion with staff during the teleconference we conclude that District staff have adequately addressed the questions, recommendations, and revisions that we enumerated in the November 2016 peer review report.

We note that District has addressed in detail our comments and recommendations regarding the adaptive management of uncertainty. In my specific peer review comments, we advocated for and recommended applying an adaptive management approach to the recommended MFLs, specifically to manage the sources of uncertainty. In their peer review responses, and the revisions to the MFLs report we found that

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GAINESVILLE, FLORIDA
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EAST PALATKA, FLORIDA
**Barbara A. Vergara, P.G**
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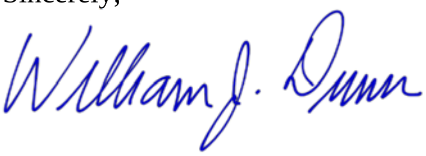
District staff has addressed adaptively managing uncertainty in text revisions to the MFLs report. We conclude that District staff have adequately addressed the questions, recommendations, and revisions that we enumerated in the November 2016 peer review report.

The text of this letter report has been shared with and approved by Barnes, Ferland and Associates, Inc.

Sincerely,



William J. Dunn, Ph.D., Partner
Dunn, Salsano & Vergara Consulting, LLC

Cc: **(ALL VIA EMAIL ONLY)**
Jerry Salsano, DSV
Patrick Barnes, P.G., BFA
John Watson, P.G., BFA

# APPENDIX 1K

Walton, R. 2018. Technical memorandum to Doug Leeper, Southwest Florida Water Management District, dated January 29, 2018. RE: Pithlachascotee River Minimum Flows Peer Review Panelist Follow-up. WEST Consultants, Inc. Bellevue, Washington. Prepared for the Southwest Florida Water Management District. Brooksville, Florida.

# Technical Memorandum

**WEST Consultants, Inc.**
12509 Bel-Red Road, Suite 100
Bellevue, WA 98005-2535
(425) 646-8806 (425) 646-0570 Fax
www.westconsultants.com

**To:** Doug Leeper, Southwest Florida Water Management District

**Date:** 29 January, 2018

**From:** Raymond Walton

**RE:** Pithlachascotee River Minimum Flows Peer Review Panelist Follow-up

## Introduction

In 2016, the Southwest Florida Water Management District (District) engaged the services of three independent experts in the fields of hydrology, hydrogeology, limnology, biology or other relevant scientific disciplines to, as a Peer Review Panel, evaluate and review information used for development of recommended minimum flows for the Pithlachascotee River, and summarize Panel findings in a peer review report. Each panelist was then asked to review the District's responses to their individual comments, and to changes made to the modified report ("Recommended Minimum Flows for the Pithlachascotee River"), to determine if all comments had been appropriately addressed.

I, Dr. Raymond Walton, a Peer Review Panel member, was asked to comment on the minimum flows document in the areas of hydrology, hydraulics, and modeling. This memo presents my review of the District's responses to my original comments, and to changes made to the document.

## Summary of Major Points

In my original review, incorporated into the Peer Review Panel's report, I focused on four major areas:

1. The regression analysis used to determine potential changes to downstream salinities in the Pithlachascotee River due to reduced river flows;
2. The establishment of minimum flows in the upper river, using an HEC-RAS hydraulic model to determine the minimum flow needed to maintain at least 0.6 feet of water depth for fish passage;

3. The establishment of intermediate flows for overall fish habitat using the PHABSIM model; and
4. The establishment of flows for floodplain connectivity.

Of these areas, I was most concerned about the first two.

***Salinity Regression***

I had made several comments that the salinity regression could perhaps be improved using additional data and incorporating storm surges into the synthetic tidal record. I reviewed the District's responses, and found them acceptable. In general, while the analysis could be expanded, I believe that it would be a large effort that would not change the outcome of the analysis in any significant way. In addition, the flow limits in the lower (estuarine) river are small compared to the minimum flows in the upper river.

I had made a comment that it was not proved that a lag time of 45 minutes gave the "best" regression results. In fact, District responses generally concurred with my comment. While I do not believe that a detailed sensitivity of the lag time would yield significantly better results, it would be nice if the comment where addressed in the text, as the text does not support the use of "best".

***Minimum River Flows***

In the initial analysis, the District used an HEC-RAS hydraulic model to estimate a minimum low flow threshold of 25 cfs for fish passage. In the revised minimum flows report, the District replaced this approach with an analysis based in the Tennant (or Montana) method. This resulted in a much lower minimum low flow threshold of 11 cfs.

During a phone conversation with District staff on 26 January, 2018, I noted that as a hydrology expert, I was not familiar with the Tennant method, as it is a biology-based technique. I was told that it is a technique commonly used in many regions to estimate minimum flows for biological reasons, and that the resulting minimum flow of 11 cfs is very similar to the minimum low flow threshold of 12 cfs established for the nearby Anclote River.

I concluded that if this method was acceptable to other panel members with biological expertise, and that the final report included wording to fully justify this approach, then I had no reason to dispute this. In this case, all my comments about the accuracy and validity of the HEC-RAS hydraulic model, while still valid in my view, are mute because HEC-RAS would not be used to establish the minimum low flow threshold.

### *Habitat and Floodplain Flows*

Habitat flows were established using PHABSIM. And floodplain flows were established using the HEC-RAS hydraulic model. The sensitivity analysis of floodplain flows demonstrated, in my view, that these flows are well established and generally insensitive to hydraulic model uncertainty. Consequently, I accept District responses about the establishment of these flows.

### *Flannery Comments*

In my initial review, I had noted that I agreed with some of the comments made by Flannery, and would not repeat them. After reviewing the comments to Flannery's comments, I concur with those that covered my subject matter expertise.

### *Summary*

Accepting, with the concurrence of biology experts, that the Tennant method is appropriate to establish minimum flows in the upper river, I accept the District's responses to my comments regarding the salinity regression analysis in the lower (estuarine) river, and the establish of Block flows in the upper river. I feel no need for additional study in this subject area. I would make several general recommendations:

1. If the Tennant method is used for minimum upper river flows, the final minimum flows report needs to remove or modify the discussion of the 0.6 feet of water depth for fish passage, as the Tennant method is not tied to achieving a specific water depth (see Sections 4.4.2.2.1, and 5.2.1, and Table 5-5). Section 5.2.2.1 still mentions 25 cfs, and continued discussion of using HEC-RAS for $Q_{min}$=25 cfs, which is later not recommended, may serve only to confuse the reader. It might be better to state that the HEC-RAS model is not reliable for low flows, and that you therefore turned to the Tennant method, and drop further discussion of HEC-RAS for fish passage.
2. I would suggest that the entire minimum flows report be reviewed by an editor for grammar, especially the sections "Executive Summary" and "Purpose". There are a number of grammatical issues, especially adding commas.
3. The text should be modified to either remove or justify the use of a 45-minute lag as the "best" fit for the salinity regression analysis.

## Additional Minor Comments

1. On page 8, paragraph 2, there should be a comma in "…status of the river, District staff…", to add clarity. The next paragraph should start with "Because **of** climate change…".
2. Throughout the report the "west" in WEST Consultants should be capitalized. It is an acronym.
3. In the paragraph following Figure 2-11, remove "is" in third sentence.
4. On page 29, second paragraph, the "R" in rivers should be capitalized.
5. In the comparison of the Pithlachascotee River and Anclote River's rainfall depth per area, it might be useful to also present the Pithlachascotee River's depth per area that does not include the watershed area above Crews Lake.
6. On page 37, second paragraph, I would delete "coefficient" in "…through a leakage coefficient term."
7. In the report (Executive Summary and Section 6.2.3) you should note that rainfall uncertainty is "spatial", so why not say "….associated with **spatial** rainfall variation due to the localized convective nature of summer thunderstorm events."
8. In Section 5.5.2, there is a grammatical error in this paragraph "salinities up 2 to psu was more sensitive".
9. From Flannery's comments, the original text has 0.8 and 0.2. I am not sure where the "0.7 and 0.1" values are in the text/table based on the District's response.

# APPENDIX 1L

Southwest Florida Water Management District. 2018. District response to Raymond Walton's technical memorandum regarding Pithlachascotee River Minimum Flows Peer Review Panelist Follow-up. Brooksville, Florida.

# District Response to Raymond Walton's January 29, 2018 Technical Memorandum: Regarding Pithlachascotee River Minimum Flows Peer Review Panelist Follow-up

February 6, 2018

Doug Leeper, Gabriel Herrick, Ph.D., Ron Basso, P.G., and Yonas Ghile, Ph.D
Southwest Florida Water Management District
Brooksville, Florida

## Introduction

In January 2018, the Southwest Florida Water Management District contracted with Dr. Ray Walton, a member of the panel that completed an independent, scientific peer review of minimum flows proposed for the upper and lower segments of the Pithlachascotee River in 2016, to assess the District staff response to the panel's findings and comments. Dr. Walton completed this peer review follow-up effort and summarized his findings in a technical memorandum submitted to the District on January 29, 2018.

To further support the review process and the Governing Board's consideration of peer-review findings for the proposed minimum flows for the river, staff has reproduced Dr. Walton's technical memorandum as an appendix to this document and imbedded staff responses in the appendix to indicate how Dr. Walton's comments were addressed.

Dr. Walton's January 29th technical memorandum and this District staff response document will be made available upon request to interested parties, and will be provided to members of the District Governing Board for their consideration when establishing minimum flows for the Pithlachascotee River.

Appendix: Staff response to Ray Walton’s January 29, 2018 technical memorandum.

# Technical Memorandum

**WEST Consultants, Inc.**
12509 Bel-Red Road, Suite 100
Bellevue, WA 98005-2535
(425) 646-8806 (425) 646-0570 Fax
www.westconsultants.com

**To:** Doug Leeper, Southwest Florida Water Management District

**Date:** 29 January, 2018

**From:** Raymond Walton

**RE:** Pithlachascotee River Minimum Flows Peer Review Panelist Follow-up

## Introduction

In 2016, the Southwest Florida Water Management District (District) engaged the services of three independent experts in the fields of hydrology, hydrogeology, limnology, biology or other relevant scientific disciplines to, as a Peer Review Panel, evaluate and review information used for development of recommended minimum flows for the Pithlachascotee River, and summarize Panel findings in a peer review report. Each panelist was then asked to review the District's responses to their individual comments, and to changes made to the modified report ("Recommended Minimum Flows for the Pithlachascotee River"), to determine if all comments had been appropriately addressed.

I, Dr. Raymond Walton, a Peer Review Panel member, was asked to comment on the minimum flows document in the areas of hydrology, hydraulics, and modeling. This memo presents my review of the District's responses to my original comments, and to changes made to the document.

## Summary of Major Points

In my original review, incorporated into the Peer Review Panel's report, I focused on four major areas:

1. The regression analysis used to determine potential changes to downstream salinities in the Pithlachascotee River due to reduced river flows;
2. The establishment of minimum flows in the upper river, using an HEC-RAS hydraulic model to determine the minimum flow needed to maintain at least 0.6 feet of water depth for fish passage;

3. The establishment of intermediate flows for overall fish habitat using the PHABSIM model; and
4. The establishment of flows for floodplain connectivity.

Of these areas, I was most concerned about the first two.

### *Salinity Regression*

I had made several comments that the salinity regression could perhaps be improved using additional data and incorporating storm surges into the synthetic tidal record. I reviewed the District's responses, and found them acceptable. In general, while the analysis could be expanded, I believe that it would be a large effort that would not change the outcome of the analysis in any significant way. In addition, the flow limits in the lower (estuarine) river are small compared to the minimum flows in the upper river.

I had made a comment that it was not proved that a lag time of 45 minutes gave the "best" regression results. In fact, District responses generally concurred with my comment. While I do not believe that a detailed sensitivity of the lag time would yield significantly better results, it would be nice if the comment where addressed in the text, as the text does not support the use of "best".

### *Minimum River Flows*

In the initial analysis, the District used an HEC-RAS hydraulic model to estimate a minimum low flow threshold of 25 cfs for fish passage. In the revised minimum flows report, the District replaced this approach with an analysis based in the Tennant (or Montana) method. This resulted in a much lower minimum low flow threshold of 11 cfs.

During a phone conversation with District staff on 26 January, 2018, I noted that as a hydrology expert, I was not familiar with the Tennant method, as it is a biology-based technique. I was told that it is a technique commonly used in many regions to estimate minimum flows for biological reasons, and that the resulting minimum flow of 11 cfs is very similar to the minimum low flow threshold of 12 cfs established for the nearby Anclote River.

I concluded that if this method was acceptable to other panel members with biological expertise, and that the final report included wording to fully justify this approach, then I had no reason to dispute this. In this case, all my comments about the accuracy and validity of the HEC-RAS hydraulic model, while still valid in my view, are mute because HEC-RAS would not be used to establish the minimum low flow threshold.

### *Habitat and Floodplain Flows*

Habitat flows were established using PHABSIM. And floodplain flows were established using the HEC-RAS hydraulic model. The sensitivity analysis of floodplain flows demonstrated, in my view, that these flows are well established and generally insensitive to hydraulic model uncertainty. Consequently, I accept District responses about the establishment of these flows.

### *Flannery Comments*

In my initial review, I had noted that I agreed with some of the comments made by Flannery, and would not repeat them. After reviewing the comments to Flannery's comments, I concur with those that covered my subject matter expertise.

### *Summary*

Accepting, with the concurrence of biology experts, that the Tennant method is appropriate to establish minimum flows in the upper river, I accept the District's responses to my comments regarding the salinity regression analysis in the lower (estuarine) river, and the establish of Block flows in the upper river. I feel no need for additional study in this subject area. I would make several general recommendations:

1. If the Tennant method is used for minimum upper river flows, the final minimum flows report needs to remove or modify the discussion of the 0.6 feet of water depth for fish passage, as the Tennant method is not tied to achieving a specific water depth (see Sections 4.4.2.2.1, and 5.2.1, and Table 5-5). Section 5.2.2.1 still mentions 25 cfs, and continued discussion of using HEC-RAS for $Q_{min}$=25 cfs, which is later not recommended, may serve only to confuse the reader. It might be better to state that the HEC-RAS model is not reliable for low flows, and that you therefore turned to the Tennant method, and drop further discussion of HEC-RAS for fish passage.

   **Staff response:** We acknowledge the potential for confusion regarding which criterion was ultimately used to develop the recommended minimum low flow threshold, and think the suggested revisions have merit. However, we chose to continue to include/present information on the HEC-RAS based fish passage and wetted perimeter analyses along with information on the Tennant method. This decision was based on the desire to ensure that readers understand that staff investigated all reasonable approaches for establishing the recommended threshold.

2. I would suggest that the entire minimum flows report be reviewed by an editor for grammar, especially the sections "Executive Summary" and "Purpose". There are a number of grammatical issues, especially adding commas.

   **Staff response:** Staff have reviewed/revised the report to address grammatical and other minor errors.

3. The text should be modified to either remove or justify the use of a 45-minute lag as the "best" fit for the salinity regression analysis.

Staff response: This recommendation was addressed by removing the phrase "best-fit" from the sentence within the paragraph from Section 4.5.2.1 that precedes presentation of Equation 3 in the minimum flows report. However, as indicated in the staff response to the Peer Review Panel's report, we believe the regression model (Equation 3) used to predict water levels at the Main Street gage for use in development of regressions for predicting isohaline locations was based on best available information.

## Additional Minor Comments

1. On page 8, paragraph 2, there should be a comma in "…status of the river, District staff…", to add clarity. The next paragraph should start with "Because **of** climate change…".

   **Staff response:** Both suggested changes were made to the executive summary section of the revised report.

2. Throughout the report the "west" in WEST Consultants should be capitalized. It is an acronym.

   **Staff response:** Suggested change were made throughout the revised report.

3. In the paragraph following Figure 2-11, remove "is" in third sentence.
   Staff response: Suggested change were made the paragraph in the revised report.

4. On page 29, second paragraph, the "R" in rivers should be capitalized.

   **Staff response:** Staff chose not to make this suggested change in the revised report, based on review of information on capitalization from various style manuals.

5. In the comparison of the Pithlachascotee River and Anclote River's rainfall depth per area, it might be useful to also present the Pithlachascotee River's depth per area that does not include the watershed area above Crews Lake.

   **Staff response:** We determined that for the Pithlachascotee River between the near New Port Richey and near Fivay gages, mean flow is 20.4 cfs which is equivalent to an average runoff rate of 9.2 inches of water over the 30 $mi^2$ section of the drainage basin. This is comparable to the Anclote River at the gage near Elfers, where average runoff was 10.8 in/yr. This information to Section 2.8.1 of the revised report.

6. On page 37, second paragraph, I would delete “coefficient” in “…through a leakage coefficient term.”

   **Staff response:** The term “coefficient” was deleted from the last sentence of the paragraph following Figure 2-19 within the revised report.

7. In the report (Executive Summary and Section 6.2.3) you should note that rainfall uncertainty is “spatial”, so why not say “….associated with **spatial** rainfall variation due to the localized convective nature of summer thunderstorm events.”

   **Staff response**: The term “spatial” was added to the topic sentence of the first paragraph in Section 6.2.3 of the revised report.

8. In Section 5.5.2, there is a grammatical error in this paragraph “salinities up 2 to psu was more sensitive”.

   **Staff response**: The phrase “salinities up to 2 psu” was changed to ”salinity up to 2 psu” in the revised report.

9. From Flannery’s comments, the original text has 0.8 and 0.2. I am not sure where the “0.7 and 0.1” values are in the text/table based on the District’s response.

   **Staff response:** The “0.8” and “0,2” values identified in Sid Flannery’s comments were revised to 0.6 and 0.1 in Section 6.2.2 of the revised minimum flows report, based on updated model results. The comment included in the District staff response to Sid Flannery’s comment incorrectly identified a value of “0.7” rather than “0.6.” This error has been corrected in an updated version of the staff response document.