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February 25, 2016

Mr. Doug Leeper
MFLs Program Lead
Natural Systems & Restoration Bureau
Southwest Florida Water Management District
2379 Broad Street
Brooksville, Florida 34604

Subject: Additional Comments Concerning Establishment of Minimum Flows and Levels (MFLs) for the Gum Slough Spring Run in Sumter and Marion Counties, Florida

Dear Mr. Leeper:

The Howard T. Odum Florida Springs Institute (FSI) thanks you and Kym Holzwart for coming to our office in High Springs and describing the revisions to the proposed MFLs for Gum Slough Spring Run (Gum Slough) to me and to Dr. Todd Kincaid, recognized expert in hydrogeology/groundwater flow modeling and member of FSI's advisory panel.

In addition to the concerns previously described in my letter to Dr. Gary Williams dated April 16, 2012 (see attached), the FSI offers the following observations and recommendations to the Governing Board as they decide on adoption of a protective set of MFLs for the Gum Slough Springs System.

FSI generally supports the establishment of MFLs that are cognizant of the unique qualities and values of Florida springs and especially those springs that are designated as Outstanding Florida Waters. In that regard the ideal MFL is one that mandates that historic flows be maintained in perpetuity and allows no significant human-induced change in spring flows. FSI recognizes that such an MFL would allow no net extraction of groundwater and is not realistic given the current extent of urban and agricultural development in Florida. However, based on best available scientific data FSI has concluded that spring flow is the most influential forcing function affecting springs health. For this reason, state policy should be to maintain ample spring flows to minimize ecological harm to these precious resources.

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*The Howard T. Odum Florida Springs Institute is a 501(c)3 non-profit organization.
FEIN: 46-1663401*

For this reason, FSI recommends that the Governing Board establish the allowable level of Gum Slough flow reduction at 3 percent rather than the 6 percent recommended by District staff. This level of allowable harm has considerable precedence based on the Governing Board’s prior establishment of MFLs at Homosassa and Chassahowitzka Springs.

When establishing protective MFLs it is essential to compare existing flow conditions to historic baseline flows that are representative of predevelopment conditions that were minimally altered due to anthropogenic factors. This has been the state-of-the-art since the District established the first lake MFLs in the early 1990s.

In the case of the proposed Gum Slough Springs MFLs, your staff did task their consultant, INTERA, to establish a true baseline for Gum Slough spring flows. INTERA’s analysis found that a long period-of-record flow database from a nearby spring (Rainbow) allowed accurate estimates of historic flows at Gum Slough back to 1965, a time of significantly lower groundwater extractions. The result of INTERA’s work was the determination that median flows at Gum Slough declined from more than 180 cfs during the 1960s decade to less than 90 cfs during the most recent decade, an observed flow decline of more than 50 percent (Figure 1). Unfortunately, your staff chose to ignore this result because their Northern District Groundwater Flow Model (NDM v. 4.0) estimated Gum Slough flow declines of only 3.4 percent due to groundwater pumping.

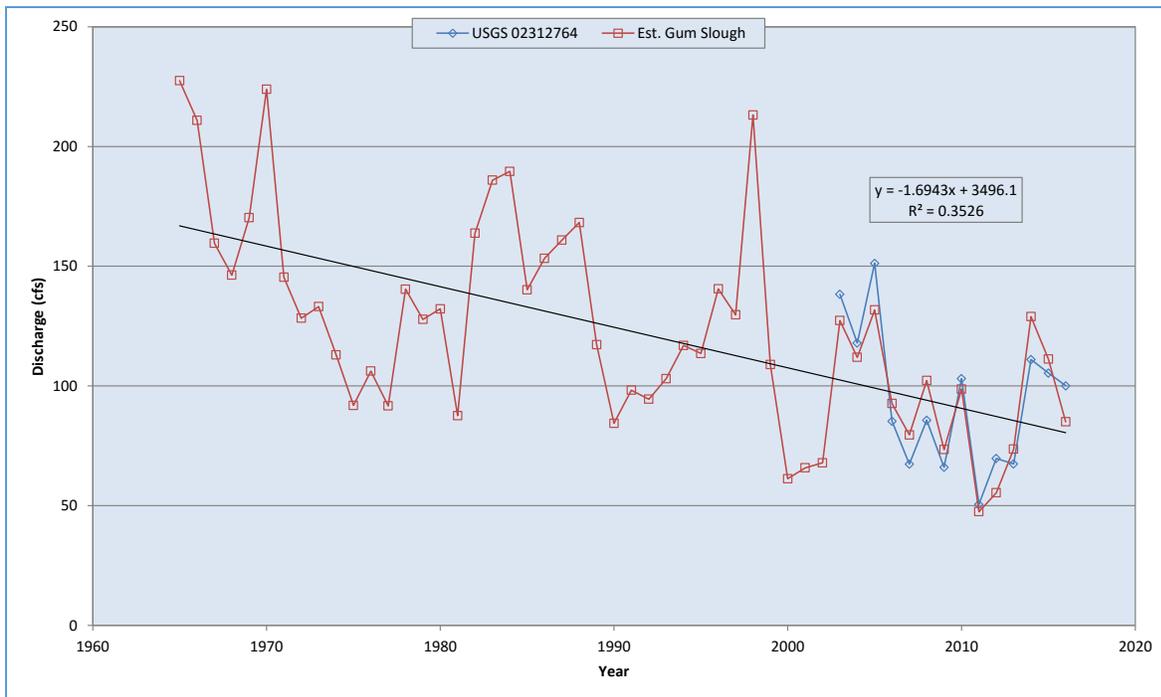


Figure 1. Gum Slough long-term annual average flow record. Flow data prior to 2003 are estimated based on the correlation between annual flows at Rainbow Springs and Gum Slough ($y=0.4403x-173.54$, $R^2=0.83$).

Groundwater flow modeling by District staff using the NDM indicates that the effect of existing groundwater pumping is an average 3.4 percent flow reduction in Gum Slough. This model estimate is not credible given INTERA's analysis presented above that indicates actual average flow declines at Gum Slough are closer to 50 percent. The obvious discrepancy between these two estimates of average flow decline begs resolution based on an independent data/model review.

The staff's February 9, 2016 Gum Slough MFL PowerPoint presentation provides a data summary that allows a ready comparison between NDM predictions and actual groundwater pumping data. District records indicate that an average of 461 MGD of groundwater was pumped in the 10,000 square mile NDM domain in 2010. However, NDM estimates provided by the District indicate that resulting springflow reductions for all of the major spring groups in the model domain (Silver, Rainbow, Gum, Kings Bay, Homosassa, Chassahowitzka, and Weeki Wachee) were only 41 MGD for the same time period.

It is a basic scientific fact that mass is conserved, including the amount of water entering and exiting the Floridan Aquifer. Over annual periods of minor net fluctuations in aquifer levels, recharge from rainfall and from human activities must be equal to discharge, including pumping and spring flow. In other words, a gallon of groundwater that is extracted and consumed, for example by evaporation during lawn watering, is one less gallon that will emerge from the aquifer as spring flow. While a relatively small portion of the 461 MGD pumped does return to the aquifer as recharge, the NDM model estimates of reduced spring flows are an order-of-magnitude low. This result indicates that the NDM groundwater flow estimates are greatly underestimating reality.

In summary, we renew our previous recommendations concerning the Gum Slough MFLs in the attached letter and offer the following additional recommendations to the District's Governing Board for consideration:

- Reduce the level of allowable harm in the Gum Slough Spring Run MFL to no more than a 3 percent flow reduction;
- Direct District staff to include the INTERA estimate of the actual predevelopment flow baseline for Gum Slough to at least the 1960s conditions;
- Direct District staff to describe in detail the limitations of the Northern District Groundwater Flow Model version 4.0 as a regulatory tool for establishing estimates of the effects of groundwater pumping on spring flows and provide the Governing Board with a statistically-based estimate of the uncertainty around the model-predicted spring flow reductions for the District's springs;
- Conduct an independent review of the suitability of the NFM as compared to empirical data and re-evaluate the model's suitability for estimating the effects of groundwater pumping on individual spring flows and MFLs;
- Establish a recovery plan for Gum Slough that restores average spring flows to at least 97 percent of true 1960 baseline conditions; and

- Implement a comprehensive on-going monitoring program at Gum Slough to document springs ecological health as average flows are restored.

FSI and the citizens of Florida thank the Governing Board for their consideration of the information presented in this letter and for implementing recommendations that will favor recovery of Gum Slough to at least 97 percent of its historic health and vigor.

If you have any questions or comments about these concerns and recommendations, please feel free to call me to discuss.

Sincerely,

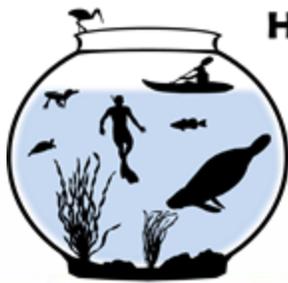


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Enclosure



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Gary Williams, Ph.D.
Southwest Florida Water Management District
2379 Broad Street
Brooksville, Florida 34604

April 16, 2012

Dear Mr. Williams:

Subject: Recommendations for Establishing Minimum Flows and Levels (MFLs) for the Gum Slough Spring Run in Sumter and Marion Counties, Florida

The Howard T. Odum Florida Springs Institute (FSI) is a private, non-profit organization dedicated to restoration and protection of Florida's springs through the development of sound science and effective management. As Director of the FSI and a professional springs ecologist, I am providing these comments and recommendations concerning establishment of technically sound and protective MFLs for the important first-magnitude Gum Slough Spring Run (Gum Slough) spring system.

The FSI has a number of concerns about the draft MFLs developed by the District for Gum Slough. General concerns include the following:

- The Northern District Water Resource Assessment Project (NDWRAP) groundwater flow and transport model is not a suitable tool for assessing the effects of groundwater pumping at Gum Slough. The scale of the NDWRAP model is regional (more than 10,000 square miles) and is not appropriate for making accurate water level and flow estimates at the local scale represented by Gum Slough (one model cell out of more than 40,000 grid cells). For example, in the HydroGeologic report the model developers state with reference to the model's limitations: "A 6-percent error resulted between the steady-state observed and simulated spring discharges and a 15-percent error resulted between observed and simulated base flow." The observed error in the model overwhelms the level of model precision assumed in

this draft MFL that assumes a flow reduction of 9 percent or less will not cause significant harm at Gum Slough.

- Standard engineering practice and available tools/analytical methods were not fully used to estimate existing anthropogenic impacts at Gum Slough.
- The District has not responded to critical comments from the peer review panel, or comments previously provided by the Florida Geological Survey and the FSI.
- Anecdotal evidence of worsening ecological conditions provided by adjacent landowners and professional guides/naturalists who have a long familiarity with Gum Slough has not been adequately considered to assess the effects of the increasing local development/groundwater uses in the springshed.
- The District's MFL procedure assumes that a 15-percent habitat change constitutes significant harm. By the District's own admission, this value is arbitrary and needs to be confirmed through an ongoing District-financed study. This unscientific approach is biased towards allowing significant harm to occur in fragile aquatic ecosystems such as Gum Slough.
- The District's MFL methodology does not acknowledge or account for the imprecise nature of the model predictions (PHABSIM and NDWRAP models) that form its foundation, and does not incorporate any assumed statistical error or margin of safety to protect the public's interest in maintaining healthy aquatic resources.

To rectify these deficiencies in this draft MFL, the FSI respectfully requests that the District incorporate the following additional analyses/ revisions before finalizing the Gum Slough MFL report and presenting it for Governing Board approval:

1. Prepare an empirical water balance for the Gum Slough springshed, independent of the NDWRAP model that provides individual estimates of historic and current recharge, groundwater pumping, and resulting spring flow.
2. Redefine "significant harm" for the Gum Slough ecosystem more conservatively by utilizing existing data and consideration of all ten human use and water resource values required by Section 62-40.473, Florida Administrative Code. Two examples include data recently published in the Gum Slough reported funded by the Florida Fish and Wildlife Conservation Commission (FWC), *An Ecosystem-Level Study of Florida Springs - Part II: Gum Slough Springs Ecosystem Characterization* (WSI 2011), that documents the relationship between spring flow and photosynthetic efficiency; the observed inverse statistical relationship between spring flow and spring nitrate concentrations illustrated by the District at the public meeting on April 4, 2012; and a longer modeled flow regime based on standard regression analysis

between rainfall, well levels, and Gum Slough flows as recommended at the April 4 meeting.

3. Estimate the likely margin-of-error in the NDWRAP model estimates of existing Gum Slough flow reduction impacts and incorporate those into the allowable flow changes incorporated in the Gum Slough MFL.
4. Incorporate an appropriate margin of error to account for uncertainty in this and all future District MFLs.

The District should let the public and the Governing Board know that existing flows in Gum Slough are 18 cfs, the lowest flow on record. If the recommended draft MFL is approved by the District, this MFL authorizes a cumulative 50% reduction in flows at a time of crisis when the upper half of the spring run and at least three named springs have zero flow. This situation surely cannot be conceived to be in the public's or the environment's best interest. Recent record low flows at Gum Slough illustrate the fact that this spring run has highly variable flows and that the short period-of-record available at the USGS station is insufficient to develop a protective MFL at Gum Slough without incorporation of a safety factor. Additionally, existing permitted human groundwater withdrawals in the Gum Slough springshed may already be exceeding the capacity of rainfall and recharge to provide adequate water to protect this natural system.

In summary, the FSI offers the following specific recommendations to the District concerning finalization of the Gum Slough MFL:

- The Gum Slough MFL should be set at “no additional harm” until additional relevant hydrologic and ecological data can be collected and analyzed.
- A recovery or provisional MFL should be adopted by the Governing Board as soon as possible to protect this important resource from additional significant harm.
- No additional consumptive use permits should be issued within the historic Gum Slough springshed and existing permits should be reviewed to evaluate their effects on the aquatic/wetland ecosystem.
- The District should commit to continuing ecological studies of Gum Slough with an updated assessment of existing harm within the next ten years.

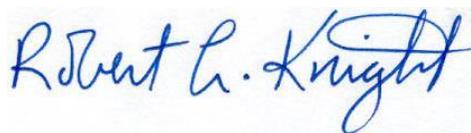
On behalf of the FSI, I would like to thank the District for considering these and other informed comments concerning this MFL decision. The FSI recognizes that sound MFLs provide an important balance between water for our ecological resources and water that can be safely withdrawn for essential and efficient human uses. The best available science is needed to accurately and clearly identify the appropriate balance between these two competing water needs.

This letter offers recommendations that are intended to help the District Governing Board make a sound and defensible MFL decision at Gum Slough.

We urge the District to “Do No Harm” when establishing this MFL. If the District errs on the side of the spring, they will have helped preserve one of Florida’s irreplaceable natural wonders; if, on the other hand, the District errs on the side of greater water withdrawals, future generations will have lost one more precious natural resource.

If you have any questions or comments about these recommendations, please feel free to call me to discuss.

Sincerely,

A handwritten signature in blue ink that reads "Robert L. Knight". The signature is written in a cursive style with a blue highlight behind it.

Robert L. Knight, Ph.D.,

Director Howard T. Odum Florida Springs Institute