

Review of the *St. Johns River Water Supply Impact Study: Final Report*

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Introduction

St. Johns Riverkeeper (SJRK) is a citizens group based in Jacksonville Florida whose focus is the protection and restoration of the St. Johns River. In 2005, the SJRK attended a water withdrawal public meeting in Sanford, Florida where the subject of removing water from the St. Johns River was discussed. Since that time, SJRK has been involved with the subject of potential water withdrawals from the St. Johns and Ocklawaha Rivers.

In the St. Johns River basin, a 2005-2006 water supply planning study conducted by the St. Johns River Water Management District (SJRWMD) showed that increasing water withdrawals from the Upper Floridan Aquifer—the principal groundwater supply of the basin and most of peninsular Florida—beyond those projected to occur by 2013 would lead to undesirable declines in the aquifer's piezometric surface, and damages to lakes and wetlands. As a consequence, the District began to consider alternative sources of supply for the population growth that was expected in the region. These sources included recycling and reuse of wastewater and a variety of water conservation measures, but the District concluded that these would not be sufficient and thus began to consider surface water withdrawals from the St. Johns River and its major tributary, the Ocklawaha River.

SJRK has been the most vocal opponent of water withdrawals (WW) to meet future water demand in the watershed. SJRK has challenged the need for these projects and the societal costs and benefits. SJRK has championed the use of water conservation as an alternative to WW and finally, warned of the potential ecological impacts of WW on the St. Johns and Ocklawaha Rivers.

SJRK, St. Johns County, and Jacksonville challenged Seminole County's Yankee Lake WW project, the first, of potentially many, water withdrawal projects that will remove hundreds of millions of gallons of water from the St. Johns and Ocklawaha Rivers. Almost 400 citizens tried to attend the Yankee Lake CUP hearing in Palatka. SJRK's administrative challenge was ultimately unsuccessful in the legal arena. Seminole County was granted a Consumptive Use Permit (CUP) to allow them to remove 5.5 million gallons of water per day (MGD) from the St. Johns. The plant design will ultimately allow 55 MGD to be removed from the river.

The SJRK used the opposition to the Yankee Lake project to raise public awareness about other proposed WW projects. SJRK, and the public, believed no additional WW projects should be permitted until all remaining questions about the ecological impacts of these projects could be answered. Due to public concerns voiced during the Yankee Lake hearing, and at subsequent meetings and forums, the SJRWMD Board members directed the staff to undertake a comprehensive analysis of the potential ecological impacts of WW projects on the health of the St. Johns and Ocklawaha Rivers.

In 2008, the SJRWMD began a large scientific study on the potential hydrologic and ecological effects of withdrawing water from the St. Johns River and its major tributary, the Ocklawaha River. The District requested that their study, called the Water Supply Impact Study (WSIS), be reviewed as it progressed by a committee of the National Research Council (NRC).

In late 2008, the Water Science and Technology Board (WSTB) of the National Academies was asked to review the progress of the WSIS, including such scientific aspects as hydrologic and water quality modeling and how river withdrawals will affect wetlands, biogeochemical processes, plankton, benthos, the littoral zone, fish, and wetlands wildlife in the basin.

The NRC issued their draft final report in December, 2011. SJRK has reviewed the NRC's report, based upon the work of eight SJRWMD work groups. What follows is our analysis of that work and the draft report. SJRK attended the majority of the NRC's meeting, and made comments to the SJRWMD and the NRC during public comment periods. SJRK attended the field trip to the middle and lower basins, including the field visit to the Ocklawaha River.

SJRK's comments represent our opinion(s), and they are based solely on the NRC report. In some cases, the comments echo the report verbatim. In some cases, the review draws its own conclusions based upon our review of the NRC work and our attendance at NRC meetings in Florida.

Our purpose in this review is to provide feedback to the SJRWMD as well as publish an overview of the process to our membership and the general public.

The WSIS was a complex, timely, and in some ways, an historic undertaking that required great time and resources from both the SJRWMD and NRC committee members. On behalf of SJRK, thanks to both groups for their efforts and the commitment.

Much was learned, but many questions about the ecological impacts of water withdrawals on the St. Johns and Ocklawaha Rivers remain. One conclusion is clear; the WSIS does not provide carte blanche to remove water from the St. Johns River.

Simply put, the WSIS is another tool that will help all of us to better understand and protect our great river, the St. Johns.

**St. Johns Riverkeeper comments on the
*Review of the St. Johns River Water Supply Impact Study: Final Report***

General Comments

1. The work/involvement of the National Resource Council (NRC), who authored *Review of the St. Johns River Water Supply Impact Study: Final Report*, was directly due to the public's concerns and/or involvement with the proposed water withdrawals from the St. Johns and Ocklawaha Rivers.

2. The St. Johns River Water Management District (SJRWMD) responded to the public's concerns and contracted and funded the NRC study. While St. Johns Riverkeeper (SJRK) has reservations about the study, we commended the SJRWMD for acting upon the public's apprehension.
3. The SJRWMD's scientists gained knowledge about the system that the District manages--the St. Johns River Watershed. In addition, SJRWMD gained useful experience in conducting large-scale environmental impact studies, and hopefully, their involvement will result in improvements in their analyses. Although this process will serve the District well in the future, limitations and questions remain about the impacts of water withdrawals on the St. Johns River.
4. The NRC lays out a variety of additional, specific, analyses that must be completed before any additional water withdrawals from the St. Johns River are considered.

Study Limitations

- 1) The St. Johns Riverkeeper (SJRK) agreed the Water Supply Impact Study (WSIS) was warranted and welcome, but public input to the process was limited. In general, the SJRWMD, and consequently the NRC, generally ignored suggestions and recommendations from the public, especially in the early stages of the project.
- 2) In 2008, St. Johns Riverkeeper Neil Armingeon, and Putnam County Environmental Council (PCEC) members Karen Ahlers and Robin Lewis argued early in the process that the original review should be a so-called "Cumulative Impact Study of Water Withdrawals from the St. Johns River." This suggestion was not acceptable to SJRWMD. It was clear that SJRWMD had no intention to actually look at cumulative impacts from many decades of modifications to the river and its flows, and place the most recent proposed withdrawals in a true ecosystem impact context.
- 3) A decision was made to artificially establish the year 1995 as the baseline (pristine) year and assume no impact from anything prior to that date, and to totally ignore any historical impacts to the Ocklawaha River (OR), such as the Kirkpatrick Dam, or the 30% reduction in flows from Silver Springs in the last decade, that has contributed to stress/decrease freshwater flow to the St. Johns River (SJR).
- 4) The SJRWMD chose to rename the study and chose to isolate the proposed "new" withdrawals from any previous impacts. In effect, this approach limited any meaningful ecological conclusions about how the SJR might change in the future with, or without, proposed water withdrawals. Other process decisions exacerbate the shortcomings of this approach.
- 5) The Ocklawaha River (OR), the largest tributary of the St. Johns River, was not included in the WSIS—despite the fact that the Ocklawaha contributes one-third of the total flow of the SJR. The NRC expressed concern from the outset of this study about the exclusion of potential effects of withdrawals on the Ocklawaha River from the WSIS (NRC, 2009). The SJRWMD made the decision to omit the OR from the study.
- 6) The District gave two primary reasons for excluding the Ocklawaha River from the WSIS. First, a Minimum Flows and Levels study (MFL) had not yet been conducted for the Ocklawaha, but one was planned for the near future. The District thought it would be premature to include the Ocklawaha in the current WSIS without the existence of an MFL. As of this date, there is still not an MFL for the Ocklawaha River.

- 7) District scientists and administrators felt that a focus on the potential effects of water withdrawals on the main channel of the St. Johns River was a sufficiently complicated (and costly) undertaking of its own, and they did not wish to dilute that effort by including the Ocklawaha in the present study.
- 8) Concerning the Ocklawaha MFL, the NRC noted, “The Committee wishes again to emphasize the importance of doing this analysis in a thoughtful and comprehensive way that is informed by lessons learned from the current study.” The NRC recommended the SJRWMD should develop an MFL for the OR that is similar in detail and scope to the WSIS rather than the “cursory approach” used by the SJRWMD in the St. Johns River-Deland MFL study.
- 9) To its credit, SJRWMD indicated that it realizes the potential withdrawal effects on the Ocklawaha do need to be addressed. Unfortunately, the SJRWMD now has less staff and far less financial resources that it had when this study was started. The OR study is being cut back in scope and detail every day. For example, the essential soils study for the OR has been canceled. Again, the omission of the OR from this analysis prevents, or severely limits, the opportunity to draw meaningful ecological conclusions from the WSIS.
- 10) While decisions and omissions have reduced the comprehensive nature of the WSIS, the study still has merit. We support this use of the WSIS as a tool for the SJRWMD and the citizens of the Sr. Johns Watershed.

Hydrology and Hydrodynamics

1. The NRC believes the hydrology and hydrodynamic (H&H) work group’s analysis is state-of-the art science, including the hydrologic and hydrodynamic models. However, additional work is needed.
2. The H&H group should continue to fine tune the model to consider the impacts of sea level rise and land use changes on the outputs.
3. The model provides limited analysis on the ecological impacts of water withdrawals on surrounding wetlands. SJRWMD should continue developing the Hydroperiod Tool and analyzing water level data from transects used to develop regulations MFLs to determine the correspondence between river stage and wetland hydroperiod and thus the potential responses of different wetland types to water withdrawals.
4. The model does not fully address the relationship between groundwater and the river. The SJRWMD should develop a groundwater model that simulates the full interaction of the river with the surficial aquifer system and the Upper Floridan aquifer under both steady state and transient conditions. The NRC believes the additional analyses are needed including an uncertainty analysis for groundwater discharge to the river based on hydraulic conductivity, which may have uncertainties of an order of magnitude or more for basins the size of the St. Johns.

Environmental Workgroups

Wetlands

1. The wetlands work group produced an analysis process that can be used to predict potential impacts from water withdrawals to the St. Johns River. NRC

recommends using these methods--based on the Ortega River-- and adapting them to other river segments as more data and resources become available.

2. The wetland group focused on river segment 8—Chain of Lakes-- in the upper basin, where impacts to river stage were predicted to be greatest, and segment 2,-- Doctors Lake Segment-- where changes in the salinity regime were predicted to be highest.
3. The wetlands workgroup found “moderate” impacts to wetlands in segments 2 and 8 under the most extreme future withdrawal scenarios.

Biogeochemistry

1. The workgroup concluded that two effects of water withdrawal had potentially high significance: reduced nutrient sequestration and increased release of colored dissolved organic matter.
2. Due to experimental failure, only segment 8 received the full analysis, and the workgroup found that the impacts of an extreme withdrawal scenario would be negligible.

Plankton

1. The plankton workgroup was charged with determining the possible environmental impacts of water withdrawals on plankton communities in the St. Johns River, most of which were consequences of enhanced growth of phytoplankton. This group’s work is particularly significant because the St. Johns River suffers from toxic blue green algae blooms on a regular basis.
2. The workgroup concluded that the range of withdrawal scenarios likely would have little impact in excess of pre-existing algal bloom conditions in segments 2, 3—Deep Creek--, 4—Lake George--, and 6—Central Lakes--of the St. Johns River. Keep in mind, however, currently, the Florida Department of Environmental Protection lists segments 2 and 3 impaired for nutrient pollution.
3. The WSIS noted water withdrawals may not worsen conditions, but clearly they will not improve conditions in the river.

Littoral Zone: Submersed Aquatic Vegetation (SAV)

1. The littoral zone work group focused their analysis in the middle and lower basin *Vallisneria americana*, which has been identified in 92 percent of the MFL, transects in the basin.
2. The assessments appear to be “state of the art” and robust with regard to salinity and water levels.
3. The WSIS advised the District of two management issues related to SAVs. The first is that future water withdrawals will be necessitated by increased population density, which will lead to higher nutrient loadings from the watershed and thus increase the duration and intensity of phytoplankton blooms in the St. Johns River unless strong management efforts are undertaken to control nutrient export. This secondary effect of the proposed water withdrawals could be as much a problem as salinity and water levels in determining the fate of SAV in the St. Johns.
4. Salinity will increase in the estuarine portion of the St. Johns River as downstream dredging projects, e.g., JAXPORT channel deepening, and sea-level rise progress.

Benthos –Freshwater

1. The workgroup based its analysis on the hypothesis that changes in stage prompted by water withdrawals would have a direct impact on the density and distribution of target taxa, as well as on community and population metrics such as diversity, density, and biomass.
2. The workgroup's final predictions for the extreme withdrawal scenarios ranged from negligible to moderate.
3. Limited data and lack of a hydro ecological model limited the NRC's ability to test the hypothesis.

Benthos--Estuarine

1. The estuarine benthic community was hypothesized to be susceptible to changes in flow and salinity that might accompany water withdrawal. The estuarine benthos analyses were more sophisticated than the freshwater benthos analyses, but the analysis was still limited.
2. The NRC noted there were no direct statistical models for abundance and inflow such that quantitative predictions could be made (as in other ecological parts of the WSIS). The interpretations appear to have been derived from how salinity changes with withdrawal scenarios and how abundance relates to salinity.
3. NRC suggested more work on the direct effects of salinity on epifauna needs to be completed before epifaunal impacts can be dismissed.
4. Additional study is required to better understand impacts to benthic organisms from salinity increases, combined with low DO levels, which could occur periodically in the lower river.

Fish--Freshwater

1. The processes of concern to the freshwater fish workgroup included how changes in water levels, flow, floodplain inundation and frequency, and entrainment/impingement, may lead to changes in vital fish metrics at different levels of organization.
2. The workgroup's predictions regarding impacts ranged from minor to major (for entrainment/impingement) under extreme withdrawal scenarios, but there are limitations to the analysis.
3. The NRC notes the approach focuses mainly on mean water level with a few comparisons of extreme levels (low and high); it does not capture cumulative effects of water withdrawals on fishes, such as concentration of fishes into reduced water volumes and loss of prey for wading and fish-eating birds, snakes, and mammals.
4. Consecutive drought years, which likely would have considerably more negative impacts on fishes, were not examined.
5. NRC notes the workgroup report was written as if the entire assemblage of fishes within each habitat-guild had been examined when, in fact, only common representatives of each assemblage were examined.
6. Lastly, the discussion of entrainment and impingement of fish species by withdrawal focused on various shad species and did not fully consider all species collected.

Fish-- Estuarine

1. The effects of water withdrawals on estuarine fish assemblages (open water small estuarine fishes, estuarine marsh fishes, estuarine benthic fishes, sciaenid fishes, and marine fishes) relate to changes in water levels, flow, and changes in spatial distribution of salinity.
2. The analyses were conducted for “pseudo species” only, defined as gear-, size class-, month-, and zone-specific designations for each species. For all groups, the workgroup predicted moderate impacts under the worst case withdrawal scenario in river segment 1--Mill Cove and segment 3--Deep Creek.
3. The fish workgroup predicted a “major” response to water withdrawal, but this was for an extreme scenario that is not plausible.
4. The NRC suggested precautions be when designing intake structures to avoid impacts of the potential entrainment or impingement of larval organisms at intake sites.
5. NRC also noted SJRWMD should consider when entrainment/impingement is temporally important (such as during seasonal spawning peaks), permit conditions be written that require reduction of withdrawals during peak recruitment periods.

Wetlands Wildlife

1. The wetlands wildlife workgroup assessed the potential effects of surface water withdrawals on 320 species of vertebrate wildlife that depend on the St. John’s River floodplain habitat.
2. The wetlands wildlife analysis was limited by the lack of quantitative, species specific information on the response of wildlife to altered hydrology and salinity.
3. Under the extreme withdrawal scenario, major impacts were predicted for estuarine wildlife in segment 1--Mill Cove, moderate impacts were predicted for estuarine wildlife in segment 2--Doctors Lake, and moderate impacts were predicted to freshwater wildlife in segments 2--Doctors Lake, 7--State Road 50, and 8--Chain of Lakes.
4. The findings of the wildlife workgroup were obscured by the diverse ways in which species were classified according to their hydrologic attributes. Establishing wildlife hydrologic types is a sound way to deal with the diversity of habitat requirements for the species included in the analysis, but the terms used to describe them are not fully appropriate. This methodology may not be appropriate for all species, for example, amphibians.

General Conclusions about the WSIS

1. The SJRWMD welcomed the Committee’s recommendations and implemented them when feasible, thus overcoming many of the limitations noted by the Committee early in the project.
2. The WSIS was not designed to address all the outstanding issues related to water withdrawals. There are critical issues beyond the District’s control or statutory responsibility. These issues include future sea level rises and increased stormwater runoff and water quality degradation of surface runoff engendered by future population growth and increases in impervious area and pollutant generation associated with urban development. As noted earlier, these issues singularly, or in

combination, could result in greater negative impacts to the river than would be experienced from water withdrawals.

3. Workgroups did not appear to consider the possibility of “back-to-back” extreme events (e.g., several extreme droughts separated by only a short period of normal rainfall) in their impact analyses.
4. Many of the workgroup’s driver variable were computed using mean values. Although mean values are the most likely responses from a statistical perspective, ranges (or variances) of responses also should be considered in analyzing potential environmental impacts of changes in driver variables. The WSIS also tended to present mean responses to changes in driver variables with little or no consideration of the variance in response.
5. The use of mean values tends to overlook the potential impacts from responses that while less likely than mean values with negligible probabilities, could be more detrimental than the mean responses.
6. The District’s MFL program/regulations limit the withdrawal volume allowable during low flow periods. The NRC raised concerns whether MFLs will be rigidly enforced in the future. If there is an extended drought in the future, water suppliers might not be able to withdraw water from the river for months or even years on end. The NRC questioned if this delay would be socially acceptable. We would add politically acceptable to the NRC’s concerns.
7. Then NRC recommends the results of the WSIS be combined with previous water supply studies which focused on the potential impacts to natural vegetation from groundwater withdrawals.