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M E M O

To: Mike Zimmerman, Everglades National Park

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Subject: C111 - GRR Supplement

The meeting on November 29 was informative and productive. My comments are summarized below.

In modifying the project to address the perceived water quality problems, it is important not to compromise its basic hydrologic objectives. The initial objective of creating a hydrologic barrier to reduce leakage from the Park seems paramount. Additional objectives, such as increasing water deliveries to Taylor Slough and providing additional flood control for surrounding urban and agricultural areas, potentially increase the effective watershed area and risk of water quality problems. Until the hydrologic objectives and operating policies are clearly defined, it will be difficult to evaluate potential water quality problems and to engineer appropriate solutions.

In defining hydrologic objectives, there is some risk that the existence of treatment cells will be used as a basis to justify diversion of urban and/or agricultural runoff into the project (i.e. providing additional flood protection). This direction is not recommended, given the existing uncertainties in forecasting contaminant loads and treatment area performance.

The draft plan calls for scraping soil from buffer cells and attempting to operate some of them at shallow water depths. These concepts seem to be contrary to the hydrologic objective of maintaining a seepage barrier. They are also based upon untested hypotheses that the overall performance of a treatment area is enhanced by soil removal and/or shallow depths. Anecdotal evidence that scraping did not increase hydraulic conductivity in one area was discussed at the meeting, but does justify scraping the entire buffer and risking a serious compromise in performance as a hydrologic barrier. Even if conductivity were controlled by the limerock substrate, scraping operations would involve some risk of fracturing the substrate. Although scraping may promote desirable vegetation communities, low hydraulic residence times resulting from high seepage recycling rates could hinder treatment performance. The benefits and impacts of scraping should be evaluated with a carefully-planned experiment and extensive hydrologic/water quality modeling before broad implementation.

Evaluation of potential water quality problems is hindered by discrepancies in the phosphorus data. These discrepancies are obvious in the attached graphs of data from S331, S332D, and S332. Processes to resolve these problems are reportedly underway. Despite considerable efforts under the Everglades Round Robin program, data incompatibility across labs continues to be a significant problem in attempting to integrate monitoring and research results, particularly in these low concentration ranges. To minimize these problems in the future, I recommend that all monitoring be conducted by SFWMD under an appropriate cost-sharing agreement. Since buffer cell sizes are determined by land constraints (vs. an engineering calculation based upon loads), data uncertainties do not seem to be on the critical path of this project at this point. Resolution of these matters should be a TOC priority.

Nutrient and contaminant loads to the buffer would depend upon the sources of water being pumped into it. Qualitatively, these would include deliveries from the North, runoff and induced groundwater inputs from local watersheds, and recycled seepage from the buffer and/or Park. Quantitative breakdowns should be obtainable from hydrologic modeling results. To date, only snipits of these results have appeared. The hydrologic models should be used more effectively to help quantify inflow sources, contaminant loading potential, and depth/flow regimes within the buffer cells, as they may influence treatment performance.

Based upon the draft report, the 31-year average inflow to the project would be ~500 cfs and the total treatment area would be 8,511 acres. These figures translate to an average hydraulic load of 19 meters/year, as compared with a design range of 6 to 12 m/yr for the ECP Stormwater Treatment Areas. The average inflow is somewhat larger than the average historical flow for the entire basin (445 cfs, S332+S175+S18C, Water Years 1983-1999). Presumably, a significant portion of the 500 cfs inflow will consist of recycled seepage from the buffer itself (vs. external inflows).

Historically, phosphorus concentrations in L31N have ranged from ~25-30 ppb during periods with low stage differential (when seepage from the Park into L31N is minimal) to ~6 ppb during periods with high stage differential (when seepage from the Park is dominant) (Walker, W.W., "Analysis of Water Quality & hydrologic data from the C-111 Basin, prepared for U.S. Department of the Interior, October 1997). If an average buffer inflow concentration of 25 ppb and a settling rate of 16 m/yr (similar to ENR project) are assumed, the steady-state STA design model predicts an average outflow concentration less than 10 ppb. While this is a considerable extrapolation of the design model, it suggests that the overall scale of the treatment areas is not unreasonable. Given that existing concentrations in the L31N canal are usually less than 10 ppb (based upon SFWMD data) and given that recycled seepage will account for a portion of the buffer inflow, it seems likely that actual project inflow concentrations will average less than 25 ppb, assuming that project operation does not induce/create new sources (flood control) to a significant degree.

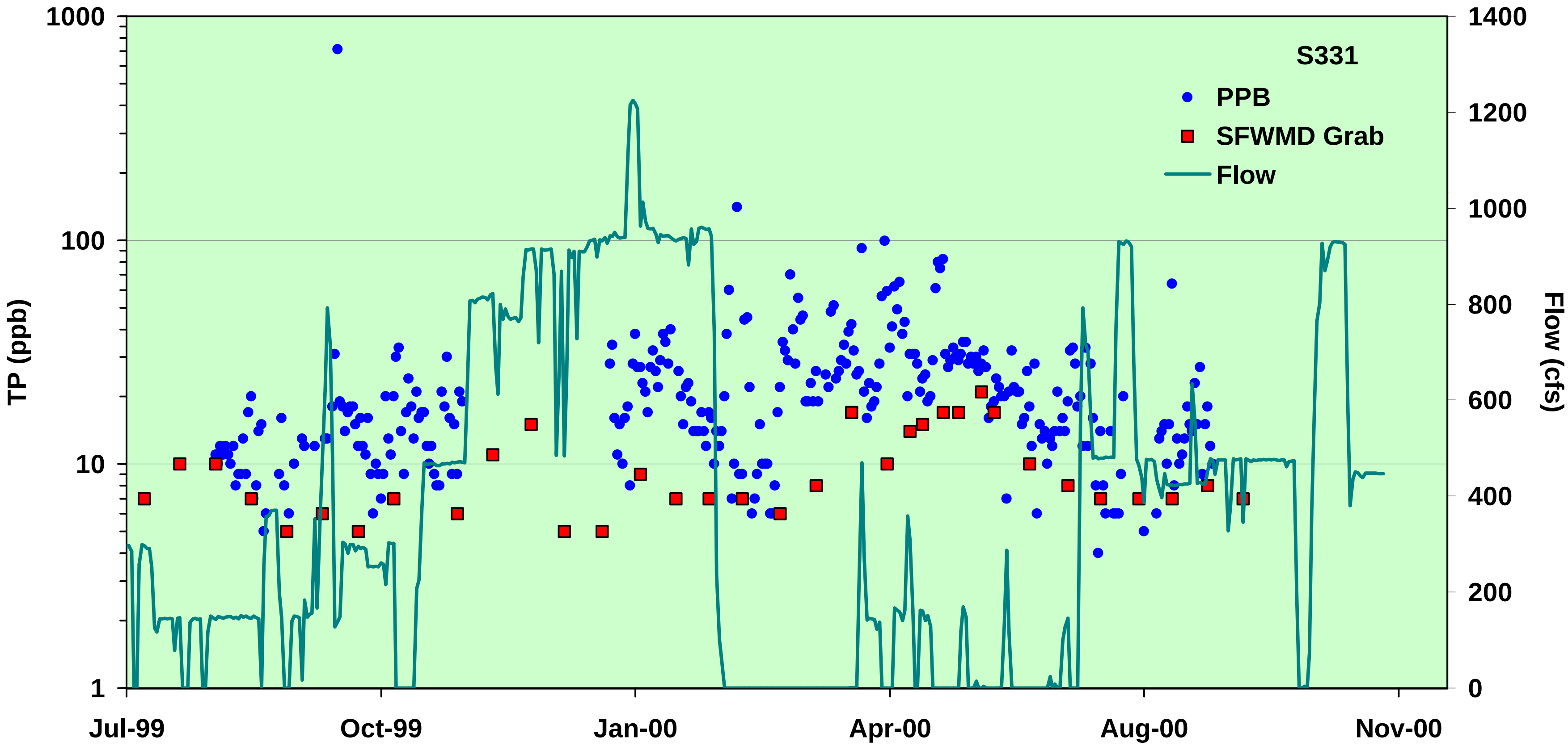
Within a few months, DMSTA (Dynamic Model for Stormwater Treatment Areas) should be sufficiently developed and calibrated to permit application to the project. The will provide performance projections that consider fluctuating inflows and water levels, as well as integration of ongoing green-technology research results. Hydrologic modeling results and data collected in C111 spoil mounds area over the past few years may also be useful for calibration purposes.

Given the constraints imposed by the inflow volumes, cell areas, leaky substrates, project hydrologic objectives, and the array of unknowns associated with green technologies, the idea of designing and operating the buffer to select for the "ideal" plant communities may be naï ve. An adaptive management path seems imminent if not unavoidable at this point. This will require monitoring to characterize internal mechanisms and functions, as well as project inputs and outputs. Model(s) will also be required for data interpretation and translation into management recommendations.

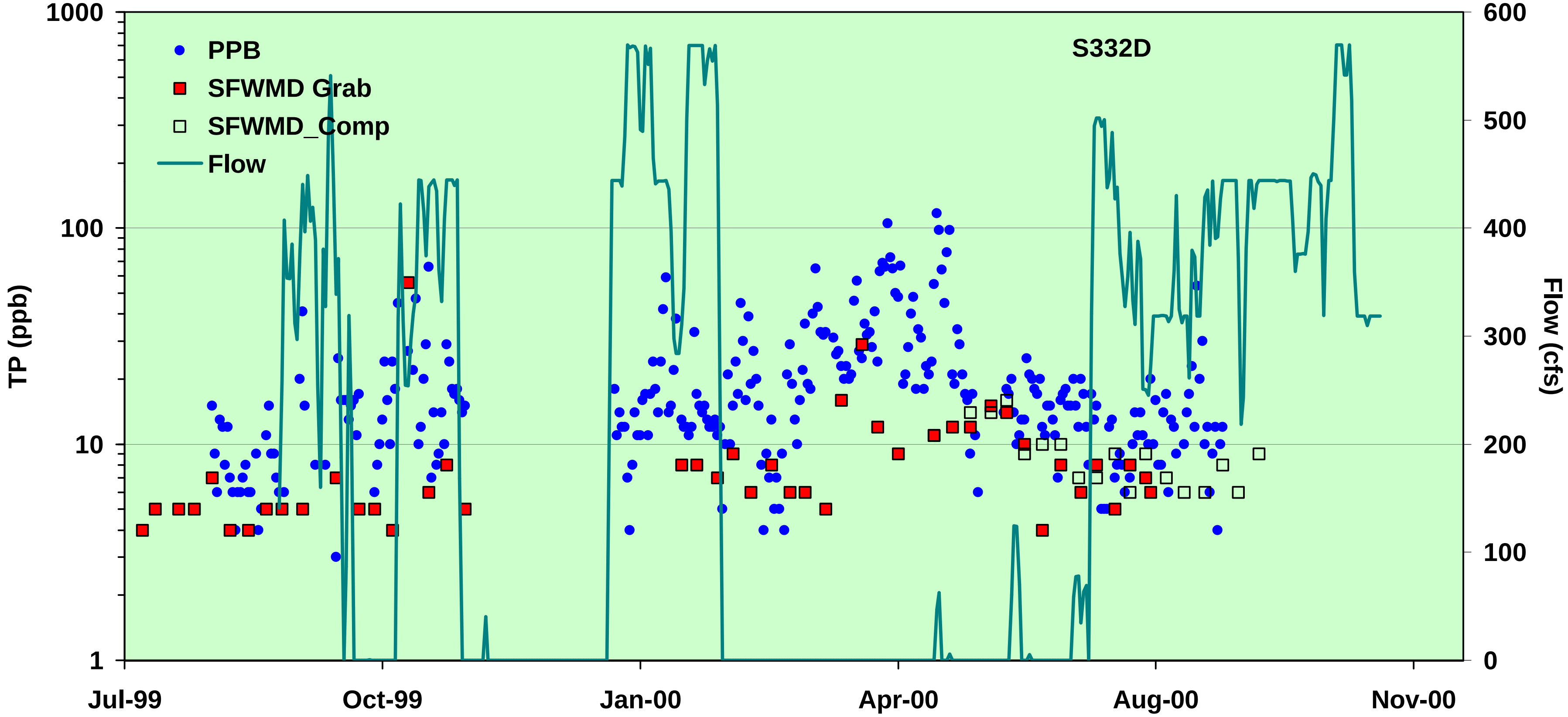
To some extent, portions of the existing project (e.g., downstream of spoil mounds & S332B detention area), can serve as experimental protypes for the full-scale design. These areas should be monitored and modeled to extract design information. New small-scale experiments may be useful to address some questions, but would be limited by problems related to scaling artifacts, long experimental durations, lingering effects of antecedent soil conditions, and lack of a consistent source of water with elevated P concentrations.

Attachments– Graphs of Phosphorus Data from S331, S332D, & S332

S331 Phosphorus Data



S332D Phosphorus Data



S332 Phosphorus Data