Attachment II

March 15, 2012

Walter:

Would that it were true.

DMSTA cannot model any pollutant other than phosphorus, but, as noted by John Arthur Marshall, reservoirs have water quality problems other than nutrients, including those associated with turbidity, dissolved oxygen, and mercury. The P and N cycles influence the manifestations of these other water quality problems and vice versa. Hence the need to use an agency-approved model of the appropriate complexity to accurately simulate these influences and effects, both within the reservoirs and downstream in the STAs and the Everglades flow-way.

The mercury problem in reservoirs is so widespread that is often referred to as the reservoir effect.
http://www.deq.state.va.us/air/vamercury/gen_rpt_and_state/Fink_Florida_Everglades_Hg.pdf The effect appears to be exacerbated when wetlands are inundated to create the reservoir.
http://ecologia.icb.ufmg.br/~rpcoelho/Congressos/DGL2008/Reservoirs%20GHG%20emiissions/Environm%20Sci%20Technol_1997.pdf

Unfortunately, neither WRDA 1996 nor EFA 1994 relieves the South Florida Water Management District of water quality constraints other than nutrients. Nor is mercury an exception to the rule because the problem is caused by atmospheric deposition. To the contrary, where sulfate is below the CERP RECOVER performance objective of 1 mg/L because the water body water chemistry is solely under the influence of rainfall, there is no mercury impairment. Conversely, where high-sulfate waters originating with EAA runoff and Lake Okeechobee releases were rerouted from WCA-3A to ENP via the L-67 Canal, the methylmercry bioaccumulation hot spot in largemouth bass moved in tandem, impairing the ENP waters in the vicinity of the US 41 Culvert.
http://iaspub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=FL3289J&p_cycle=2010&p_state=FL&p_report_type=T

DMSTA was used by William W, Walker, Jr., Ph.D., under contract to USEPA Region 4 to develop and evaluate compliance with total phosphorus water quality-based effluent limits for the STAs per Appendix H of the Amended Determination (attached). DMSTA cannot model any of the other water quality standards as constraints on CEPP infrastructure design, operation, maintenance, impact assessment, permit application, or compliance monitoring, including

turbidity, dissolved oxygen, and mercury. This is also true of ELM as regards mercury.

As an expedient to keep the CEPP planning process moving briskly, it should be possible to adapt the Lake Okeechobee water quality model from the USEPA WASP modeling series for use in a shallow reservoir that will be filled not infrequently with Lake Okeechobee releases. SFWMD's Tom James should be consulted in that regard. WASP now also includes a mercury module. The most recent version of TetraTech's Dynamic Mercury Cycling Model can also be used for mercury modeling in subtropical lakes and reservoirs. SFWMD's Mercury Program Manager, Ben Gu should be consulted in that regard.

I will address the deficiencies of DMSTA with respect to P modeling in a separate communication.

Thanks.

Larry E. Fink, M.S.
Waterwise Consulting, LLC

From: "Wilcox, Walter" <wwilcox@sfwmd.gov>
To: 'Larry E. Fink' <larryfink@waterwiseconsulting.com>
Cc: "Estenoz, Shannon" <shannon_estenoz@ios.doi.gov>; "'Murika.Davis@usace.army.mil'" <Murika.Davis@usace.army.mil>; "'Daniel.E.Crawford@saj02.usace.army.mil'" <Daniel.E.Crawford@saj02.usace.army.mil>
Sent: Monday, March 12, 2012 6:01 PM
Subject: RE: Modeling Water Quality Impacts

To the contrary – DMSTA has been specifically developed and applied to deal with some of the unique challenges of south Florida hydrology / water quality and due to its ability to handle the subtleties of the most critical element of STA design in the EAA (Phosphorus) is ideally suited to answer the questions of CEPP in an expedited schedule. We have frequently found that so called "off the shelf" models, while nationally approved (and very good at what they do), have some limitations when applied to the extremely flat topography and low nutrient south Florida system and frequently require significant effort to create reasonable outputs. A similar line of thinking is evident in the recent application of DMSTA by USEPA in developing the Amended Determination rather than using one of their "approved" tools.

Walter M. Wilcox

Hydrologic and Environmental Systems Modeling
South Florida Water Management District
Work: (561) 682-2527
Cell: (561) 718-4039

From: Larry E. Fink [mailto:larryfink@waterwiseconsulting.com]
Sent: Monday, March 12, 2012 5:41 PM
To: Wilcox, Walter
Cc: Estenoz, Shannon; 'Murika.Davis@usace.army.mil'; 'Daniel.E.Crawford@saj02.usace.army.mil'
Subject: Modeling Water Quality Impacts

March 12, 2012

Walter:

This is a follow up question to one posed by John Arthur Marshall of the Arthur R. Marshall Foundation at the SFERTF-sponsored public workshop on restoration alternatives. His question regarded the impact of deep reservoirs on downstream water quality. In response you noted that DMSTA had been applied to STA design and was being applied by CEPP for the assessment of combined reservoir-STA water quality impacts. This prompts the question: How does the District decide whether to make or buy a water quantity or quality model? When the District makes a new model, is it's substantial equivalence demonstrated to an agency-approved model with recognized scientific, regulatory, and judicial pedigree?

So, for example, there are many USEPA-, USGS-, and USACE-approved water quantity and quality models available in the public domain that model reservoir hydrodynamics and water quality, including phosphorus (P), dissolved oxygen, mercury, and sedimentation, but the District decided instead to pay a contractor to adapt the DMSTA model to reservoirs, despite DMSTA being limited to the modeling of P removal by abiotic and biotic particle sedimentation and dissolved P sediment sequestration. http://www.docstoc.com/docs/81113869/Design-Models-for-Treatment-Wetland-Systems-at-Low-Phosphorus-

One might naively conclude that an inferior version of the wheel was being reinvented in this example, with unnecessary delay and expense, neither of which CEPP cannot afford.

Thanks.

Larry E. Fink, M.S.
Waterwise Consulting, LLC

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To: 'Larry E. Fink' <larryfink@waterwiseconsulting.com>
Cc: "Estenoz, Shannon" <shannon_estenoz@ios.doi.gov>; "'Murika.Davis@usace.army.mil'" <Murika.Davis@usace.army.mil>; "'Daniel.E.Crawford@saj02.usace.army.mil'" <Daniel.E.Crawford@saj02.usace.army.mil>
Sent: Monday, March 12, 2012 1:37 PM

Subject: RE: Implications of the Sensitivity of Restoration Decision-Making to Canal Groundwater Capture Efficiency Assumptions

Larry,

Thanks for the feedback. At this time for CEPP, we are not envisioning any further model refinements due to the pace of the effort. We have done a comprehensive review of the project intent and associated model capabilities (this is what led to the L31N update that I presented at the 3/9 PDT) and at least I personally feel that we are in good shape. As I have previously mentioned, robust quantifications of model uncertainty are not yet readily available, although efforts on development of this set of tools continue within HESM as resources are available.

Related to the idea to utilize ionic strength as a means of determining groundwater/surface water interaction, I think that has some merit and you are hitting close to my personal areas of interest. I actually performed a stable isotope study in the vicinity of L31N as part of my Master's work at University of Miami. Since standing water is more subject to evaporative processes which tend to enrich water with higher ratios of deuterium, tritium and oxygen-18, Everglades water that has been subject to these processes is readily distinguishable from the local rapid infiltration water observed in the eastern developed areas. As such, it is possible to trace the flow of water and relative contributions of various sources to canal flow, wellfield intakes, etc…

This type of validation with field experimentation is known in my field as "model benchmarking". While we always strive to get data from all available sources, in some cases controlled experimentation is needed to truly understand the physics of the processes that we are trying to model. To that end, we have actually be able to acquire some monitoring equipment this fiscal year specifically for this purpose. They are portable water level data loggers that we can take around the south Florida system and coordinate with operations to create specific hydraulic conditions that tell us extensive information about the physical parameters of the surrounding area. The great thing is that since these loggers are portable and do not require remote telemetry, we can perform this work at minimal cost to the taxpayers and simultaneously target specific areas to help increase the certainty of our predictions. Lots of thing to keep on the radar, but we keep making forward progress…

I will forward your e-mail to some of the hydraulic experts on my team so that they can begin to ponder how this idea may fit into future model refinement beyond CEPP. Thanks again for your continued engagement.

Walter M. Wilcox
Hydrologic and Environmental Systems Modeling
South Florida Water Management District
Work: (561) 682-2527
Cell: (561) 718-4039

From: Larry E. Fink [mailto:larryfink@waterwiseconsulting.com]
Sent: Monday, March 12, 2012 1:01 PM
To: Wilcox, Walter
Cc: Estenoz, Shannon; 'Murika.Davis@usace.army.mil'; 'Daniel.E.Crawford@saj02.usace.army.mil'
Subject: Implications of the Sensitivity of Restoration Decision-Making to Canal Groundwater Capture Efficiency Assumptions

March 12, 2012

Walter:

I enjoyed your modeling presentations at the public meeting on design alternatives for Everglades and Florida Bay restoration sponsored by the South Florida Ecosystem Restoration Task Force on Friday, March 9, 2012. I greatly appreciate the clarity and candor with which you are able and willing to communicate what the models are designed to do, what the models assume, how the models work, what the models tell us, and where the modeling results get soft.

I was especially interested in your finding that the design and operation of Everglades and Florida Bay restoration infrastructure is sensitive to the uncertainty in the percentage of groundwater captured by the canals that interdict the surficial aquifer. Regarding the Miami Canal segment, the original assumption was that it captured 90%, but subsequent studies determined that it was closer to 70%, so there was less water gained while that segment was in operation and less water lost when it is backfilled and taken out of operation. It is also not clear whether this correction should apply to other segments of the canal system or whether it is limited only to the segment studied. Please correct any misunderstandings of your findings or their implications in this regard.

This finding underscores the importance of identifying the uncertainties in the modeling assumptions, approximations, interpolations, and extrapolations to which restoration decision-making is most sensitive and using those findings to guide adaptive monitoring, special studies, and research to reduce the compounded uncertainty to an acceptable level within the decision-making timeframe. It also underscores why we need greater margins of safety in the capacities and flexibilities of design, operation, and maintenance of restoration infrastructure when the decision-making process is accelerated and the period of adaptive feedback between modeling and measurement is greatly foreshortened.

With that in mind, it would appear necessary to measure the rate of influx of groundwater into the canal system as a function of water table depth and canal stage. It occurs to me that this could be effected most efficiently by taking advantage of the difference in the ionic strength of groundwater and surface water to infer the seepage rate by the magnetic field generated by that ionic flux. The method with which I am familiar obtained the measurements by recording the induced current in a conductive cable dragged along the lake shoreline. It also occurs to me that the cost of obtaining these data could be greatly reduced by taking advantage of automated monitoring systems based on RoboBoat, the patent for which is held by the District. The chief developer of RoboBoat, Anier Sosa, may be available to assist in its adaptation to groundwater ion flux monitoring in the District's canal system. This approach could/should be supplemented with surficial groundwater monitoring using ground-penetrating radar. To calibrate and validate these alternative methods, both would be used in representative segments in combination with more traditional methods, e.g., seepage meters, including the design innovated by the

District's Steve Krupa, all within a water budget mass balance framework.
http://www.hydrol-earth-syst-sci.net/10/873/2006/hess-10-873-2006.pdf

Good luck and keep up the great work.

Sincerely,

Larry E. Fink, M.S.
Owner and Principal
Waterwise Consulting, LLC

We value your opinion. Please take a few minutes to share your comments on the service you received from the District by clicking on this link.

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