HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
10002 Princess Palm Avenue
Registry One Building, Suite 200
Tampa, Florida 33619
(813) 630-4498
Fax: (813) 630-1967

M E M O R A N D U M **DATE:** September 22, 2010

FOR: Eberhard Roeder, Ph.D., Florida Department of Health

FROM: Damann Anderson, P.E., Hazen and Sawyer, P.C.

SUBJECT: Task D QAPP

Please find attached the revised Task D QAPP. The revised QAPP incorporates the response to comments as discussed on July 13, 2010 and summarized in the Task D Recommendation for Process Forward meeting minutes.

In addition to specific comments received, the general approach for providing simple tools and a groundwater model were discussed in the July 13th conference call. One issue discussed was related to accelerating the complex soils model deliverable to enable estimates of a "load per system" approach that could be used as an input to a large scale / watershed scale model. It was discussed that the simple soil tool would enable estimates of inputs to groundwater such that exceedance from a development (or some other land application) could be backed out and/or a maximum allowable mass per system could be estimated based on various land use scenarios. The need for a simple soil approach (such as a table or graphical illustration) is still warranted. However, such simple tool development still requires multiple simulations and therefore, a range of conditions must be defined (i.e., can not represent/illustrate all potential Florida OSTDS conditions). Accelerating the simple soil model is certainly reasonable, but will result in delaying the combined groundwater model. This should not be a problem based on our discussions in Tallahassee on September 8th.

The technical capabilities of the groundwater model were also discussed. The first issue was how a low redox condition affects plume development. The model will require simplifying assumptions including carbon interactions and parameters that drive redox conditions. Both of these cases are very complex and preclude incorporation into a simple model that would be developed as part of the FOSNR work. At some level of sophistication the model is no longer a "site-general user-friendly" tool, and a consultant with expertise in using existing numerical models with the desired complexity must be employed. Task D will utilize the best available data to allow the best available model development and evaluation. The second issue was how to incorporate the effect of a variable water table and nitrogen inputs. These cases can likely be incorporated into the groundwater model, but further thought and consideration are needed. Finally, the third technical issue was related to conducting a sensitivity analysis for the groundwater model. The sensitivity analysis for the HPS model previously conducted (Heatwole, 2005

and Heatwole and McCray, 2007) was conducted for a limited range of model-input parameters relevant to a specific aquifer in Colorado. The same process will be critical for application to Florida which may or may not match the previous results (e.g., groundwater velocity is a sensitive parameter, but rarely collected).

The subtasks initially outlined in the Task D QAPP were consistent with the subtasks as currently described in the contract. These subtasks were developed as the approach in response to the broad request for proposal. As additional discussions have been held including those described herein, and the target goals refined (i.e., accelerate complex soil tool), the approach, and corresponding subtasks, should be modified. The following is the recommended Task D Path Forward incorporating these modifications:

1. **Simple tools**. The simple tools will be a series of tables or matrices that provide an estimation of expected nitrogen reduction for general conditions common throughout Florida. A groundwater tool that incorporates a simple soil component (such as presented by Otis, 2007) will not be developed.
    a. Tool Development. The simple soil tool will consist of a series of tables or matrices that provide at a glance estimation of expected nitrogen removal. The tables will be populated with values obtained using complex model runs for general conditions common through out Florida. The table values can be used for input into a groundwater model or watershed model during land use evaluation and planning.
    b. Performance Evaluation. The tabular values will be corroborated using the best available data. No calibration or validation will be conducted due to the simplicity of the tool developed.
    c. Decision Support. The methods used to populate the tables will be documented for incorporation into the final project decision support framework.
2. **Complex tools**. The complex tools developed will include a soil component and a groundwater transport model. Development will be an iterative process with modifications to tool development based on performance evaluation and as data is available from Task C (or other) activities.
    a. Tool Development. Three complex tools will be developed:
        1. *Complex soil tool*. The complex soil tool will be based on a STUMOD approach, but incorporate conditions specific to Florida (e.g., soil texture, averaged ET rates, temperature, etc.). The output from the complex soil tool will serve as a spatially averaged input to a subsequent groundwater model.
        2. *Groundwater transport model*. The groundwater transport model will be an analytical modeling tool based on the HPS approach to predict temporal and spatial concentrations and fluxes of nitrate in the down gradient groundwater plume. The output from the model will be the groundwater plume from a spatially averaged OSTDS input.
        3. *Complex soil module combined with groundwater transport model*. This complex tool will link the complex soil tool with the groundwater transport model described above. The output will be the nitrogen groundwater plume based on an expected OSTDS input to the soil.
    b. Performance Evaluation. During development of each tool, the performance will be evaluated through code evaluation, corroboration/calibration of the output to the best available data, uncertainty analyses, and validation of the model parameters as data from Task C become available.

c. Decision Support. The methods used to develop and evaluate the complex tools will be documented for incorporation into the final project decision support framework.
d. Tool Refinement. Based on the outcomes of tool development and performance evaluation, the tools (complex soil tool and groundwater transport model) will be refined to incorporate complexities such as temporal variable inputs (e.g., water table elevations, ET rates, rain events, nitrogen concentrations, etc.). The "refined" tools will undergo the same performance evaluation and decision support documentation as described in b and c above.

3. **Development-scale tools**. The development-scale tools will incorporate spatial input variations to the groundwater. Development of this model will enable simulation of nitrogen concentrations and mass flux in space and time from several OSTDS in a development-scale area.
    a. Tool Development. The combined soil and groundwater complex tools will be adapted or a new model developed that will allow multiple inputs for transport of nitrogen to either deeper aquifer zones or to surface water.
    b. Performance Evaluation. The development-scale tools will be evaluated through code evaluation and corroboration of the output to the best available data. No calibration, uncertainty evaluation or validation is planned due to the expected the lack of appropriate data sets. Should such data sets be identified, calibration, uncertainty evaluation, and validation will be conducted.
    c. Decision Support. The methods used to develop and evaluate the development-scale tools will be documented for incorporation into the final project decision support framework.
4. **Multi-development scale tools**. A multi-development scale model may be developed based on available funding to incorporate spatially averaged OSTDS inputs over a sub-basin area. The model performance will be evaluated through code evaluation and corroboration of the output to the best available data. The methods used to develop and evaluate the model will be documented for incorporation into the final project decision support framework.
5. **Decision support framework**. The culmination of Task D activities will be a final report in the format of a decision support framework providing guidance on selection of appropriate input parameters while following a risk-based approach for model selection.

The Path Forward described above is similar to the existing contract in regards to scope, but the approach and schedule has been revised. The only scope change is that the groundwater model combined with the simple soil tool has been omitted.

As discussed in our meeting in Tallahassee September 8th, the complex soil model development will remain in the Phase 2 budget, but the remaining modeling tasks will be pushed into Phase 3 pending further discussions and funding allocations.

Please give me a call if you have any questions on the Task D QAPP or proposed path forward.

c: E. Ursin
J. McCray
K. Lowe
J. Hirst

File 44237-001