

THIS AMENDMENT, entered into between the State of Florida, Department of Health, hereinafter referred to as the "department" and Hazen and Sawyer, P.C., hereinafter referred to as the "provider", amends contract # CORCL.

1. Attachment I of Contract is hereby amended to read:

Section B. and Section C. shall be amended to read:

B. MANNER OF SERVICE PROVISION

1. Service Tasks

a) Task List

This section describes the tasks, subtasks and deliverables associated with the Florida Onsite Sewage Nitrogen Reduction Strategies project. Following the task and deliverable descriptions is a table (Table I) summarizing the estimated cost components by deliverable and phase.

Task A: Technology Evaluation for Field Testing: Review, Prioritization, and Development

The provider will:

- Perform literature review to evaluate nitrogen reduction technologies
- Develop technology classification scheme
- Formulate criteria for ranking of nitrogen reducing technologies
- Rank and prioritize nitrogen reduction technologies for field testing
- Conduct technology ranking workshop with RRAC
- Prepare innovative systems application
- Conduct Technology Development in Passive Nitrogen Removal Study II

Sub-tasks and Deliverables

1. Literature Review (draft)

The literature review of nitrogen reducing technologies completed as part of the Passive Nitrogen Removal Study commissioned by FDOH in 2007 will be updated with information which has emerged since the original study. The scope of the review will be expanded from the Passive Nitrogen Removal Study to include source separation, active systems, modifications to conventional onsite treatment systems, including modified soil treatment units, in addition to passive systems. The provider shall produce a searchable literature reference database, compatible with Endnote X or other department approved software format. The literature reference database shall not infringe on any copyrights. The provider shall also produce a technology database, in tabular or other department approved format, that will facilitate establishment of categories for summary and comparison, assessment of individual citations within the context of organizational categories, and analysis of trends and differences among systems. The categories shall include items such as treatment classification, media type, wastewater source, treatment configuration, documented effectiveness, documented and theoretical longevity, cost, nutrient recovery, and effect of water chemistry. The provider shall summarize the updated literature review in a report.

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Some tasks are identified to occur in years after the first year. Funding for these tasks is not available at the time of execution of this document and is uncertain. Details of the tasks identified for subsequent years, including deliverables and prices, will be determined in an amendment to this contract before work on these tasks begins.

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Deliverables: Draft updated literature reference database; draft updated technology database; draft updated literature review report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

2. Literature Review (final)

The department will gather comments on the draft documents of sub-task A1 from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables for the literature review within one month of receiving comments.

Deliverables: Updated literature reference database; updated technology database; updated literature review report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

3. Classification of Technologies (draft)

The provider will develop a scheme to classify and group identified nitrogen reduction technologies and practices to summarize the literature and facilitate comparisons between similar technologies. Four classifications are envisioned: waste stream alteration (such as blackwater systems, and urine separation); conventional OSTDS alteration (such as dosed vs. gravity systems, operational strategies, installation depth); passive nitrogen removal (OSTDS systems using no more than one pump and excluding aerators); active nitrogen removal (mechanical systems utilizing more than one pump or aerators). The preliminary classification scheme will be presented to the RRAC at a workshop, which will provide a forum for full vetting and discussion.

Deliverable: Draft classification scheme of technologies report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

4. Technology Ranking Criteria (draft)

The provider will develop evaluation criteria to rank technologies and practices to determine which best meet the goals of the project and shall have priority for further development or field evaluation. Criteria will build on and may lead to revisions to the categories developed in the literature review and include characterizations of nitrogen removal effectiveness, maturity of technology including status in Florida, costs (energy, maintenance, monitoring, replacement of parts and media), critical knowledge gaps, likelihood of success, need to field test, and the feasibility of obtaining data from existing installations in Florida. The provider will evaluate the technologies classified in sub-task A3 relative to each criterion. The provider will propose draft sets of weights to characterize the relative importance of each criterion for a) work during the initial funding period; b) work during future funding periods. The provider will prepare a working document, such as a calculation table, that shows the ranking of technologies given the evaluations relative to the criteria and the relative weights of each criterion. The provider will summarize criteria and weights in a report.

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Deliverables: Draft summary of criteria and proposed weights for short-term and long-term testing, working document for obtaining technology ranks from evaluations to

criteria and criteria weights. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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5. **Priority List for Testing (draft)**

The provider will propose additional criteria to consider in establishing priorities for testing from the top ranked technologies and practices. Such criteria may address representation of several technology classifications (sub-task A3), similarity of technologies or several maturity levels in the study. The purpose of prioritization is to select the more promising technologies that may not have sufficient prior testing or that may be differently configured to improve performance, and to avoid duplicating testing where substantial experience already exists. The provider will also list technologies to be considered for sub task A10 and A11 (innovative system application assistance).

Deliverable: Draft summary of additional criteria; Draft priority list for testing. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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6. **Technology Classification, Ranking and Prioritization Workshop**

The provider will present the preliminary technology classification, rankings and priority lists developed in sub-task A3, A4 and A5 to the RRAC at a public workshop, which will provide a forum for full vetting and discussion of evaluation criteria and their assigned weights. This one day roundtable workshop with the Research Review and Advisory Committee (RRAC) will present the results and recommendations contained in the draft reports of technology classification, ranking and prioritization. The provider will facilitate RRAC's development of guidance on modifications to the draft classification, ranking and prioritization. Unless this guidance results in a need for further information collection by the provider, RRAC will provide comments on the priority lists for the initial and future funding periods. The comments and concerns of the RRAC will be documented and incorporated into the three final reports.

Deliverable: Public RRAC-Workshop, Summary of the workshop. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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7. **Classification of Technologies (final)**

The provider will incorporate RRAC comments and concerns and comments provided by the department within two weeks of the workshop into the final classification scheme.

Deliverable: Final report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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8. **Technology Ranking Criteria (final)**

The provider will incorporate RRAC comments and concerns and comments provided by the department within two weeks of the workshop into the final technology ranking scheme.

Deliverable: Final report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

9. **Priority List for Testing (final)**

The provider will incorporate RRAC comments and concerns and comments provided by the department within two weeks of the workshop into the draft priority list.

Deliverable: Final report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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10. **Innovative Systems Application Report (draft)**

Based on the technology evaluation in sub-task A5, the provider will identify emerging and innovative technologies that have not matured or are not currently permitted by FDOH but rank high for consideration for testing. For up to five technologies, the provider will complete or assist the manufacturer if appropriate, in completing an innovative system application for acceptance by FDOH, for which field testing of Task B will be part of the proposed innovative system monitoring protocol.

Deliverable: Innovative system application (per technology).

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11. **Innovative Systems Application Report (final)**

The provider will respond or assist the manufacturer in responding to any requests for additional information by the department in regard to the innovative system applications.

Deliverable: Additional information resulting in an innovative permit by the department (per technology if additional information is requested by the department).

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12. **Identification of Test Facility Sites (per site agreement)**

The provider will identify and evaluate potential sites for their suitability for establishing test centers. Among these potential sites will be the Gulf Coast Research and Education Center and the University of South Florida (USF) Lysimeter Station. Test facility site evaluations will include the feasibility of multiple treatment technology testing as well as the ability to monitor non-comingled subsurface plumes and the assessment of subsurface nitrogen fate and transport. Salient issues include space availability, site access, wastewater source of sufficient quantity and availability, subsurface hydrology, power supply, and security. The provider will obtain a letter of authorization from the respective property owners for establishing and operating test centers on their property and for ownership and continued use after project is completed. If a potential site is deemed unsuitable for use in this project, a brief evaluation memo shall be prepared documenting the evaluation of the site and reasons for not recommending the site as a test facility location.

Deliverables: Site evaluation memo, or letter of authorization **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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13. **Passive Nitrogen Removal Study II Quality Assurance Project Plan (draft)**

The provider will develop a draft QAPP that documents the objectives, experimental design, system operation, analytical methods, and sampling frequencies to be used in PNRS II. The objectives are to 1) directly address denitrification, which the provider proposes as the highest priority onsite nitrogen removal knowledge gap; 2) expand the performance envelope for the innovative unsaturated filter media filters demonstrated in

the PNRS I; 3) delineate TN removal capability of PNRS I media using pre-denitrification; 4) establish test systems that are close to full scale; 5) enable critical testing of a large number of systems to be completed within the first project year; 5) produce key data which can then be used directly for design of denitrification filters for subsequent full scale testing at home sites; 6) develop data for preliminary life cycle cost analysis and resource needs.

The experimental design is expected to consist of a battery of passive nitrogen removal treatment systems fabricated to evaluate salient design features of passive nitrogen removal systems including filter media, media stratification, surface loading rates, filter length, geometry, and aspect ratios, and unsaturated filter recycle for pre-denitrification and alkalinity recovery. The test configuration is anticipated to consist of a common wastewater feed stream, a suite of vertical unsaturated filters supplied by a common septic tank effluent (STE) feed stream, mixing of the unsaturated filter effluents to provide a common influent to the denitrification filters, a suite of horizontal saturated filters using lignocellulosic and sulfur reactive media and liquid carbon dosing as well as other system designs, and a means of final effluent disposal. The draft QAPP will address additives issues per Florida Administrative Code (FAC) Chapter 64E-6. The draft QAPP will propose where the test facility will be located and operated to determine nitrogen removal performance and optimize design variables.

Deliverable: Draft QAPP. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

14. **Recommendation for Process Forward**

Based on the details agreed upon in the draft QAPP, the provider will develop a recommendation whether or not to proceed with the remainder of Task A as outlined below, or recommend an amendment to this contract, and present a revised cost estimate. This will include a recommendation on whether the USF Lysimeter Station should be renovated and utilized as a test facility for this project. Both the provider and FDOH shall reach a written agreement prior to moving forward with the remaining parts of Task A.

Deliverable: Meeting summary and recommended scope and budget revisions. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

15. **PNRS II Quality Assurance Project Plan (final)**

The department will gather comments on the draft QAPP from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments. If the provider subsequently recommends modifying or adding procedures to address conditions encountered in the field, the QAPP may be revised or appended upon mutual agreement between provider and the department.

Deliverable: Final QAPP to be approved by FDOH. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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16. Materials Testing for FDOH Additives Rule

The engineered media for the biofilters proposed in the PNRSII QAPP will be tested as required to meet 64E-6.0151 F.A.C. for additives. Effluent from the tank based pilot systems will be used as the effluent source for this testing. A brief technical memo describing the results of this testing will be prepared and presented to FDOH prior to constructing biofilter systems at the GREC test facility or elsewhere in the field. The department may authorize the provider in writing to perform such testing for additional materials.

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Deliverable: Technical memo describing the results of additives rule testing per 64E-6.0151, per additive tested. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

17. PNRS II Specification Reports

The provider will specify, order and purchase specialty materials for test facility construction and experimental monitoring. The provider will oversee preparation of materials to meet specifications, and prepare procurement and assembly reports that document design and fabrication of the test systems, procurement of treatment system construction materials as well as the media for the filters, site preparation, monitoring instrumentation and equipment, and start-up testing of the PNRS II systems. Actual cost for materials and supplies will be documented as part of this subtask and be included in the construction budget for PNRSII construction.

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Deliverables: Specification reports, materials list and cost and as-built diagrams of the treatment systems to be tested as part of PNRS II. **Two specification reports will be provided, one for the in-tank PNRS II testing and one for the in-situ testing.**

18. PNRS II Test Facility Design (50%)

The provider will design the test facility. Since the GREC was chosen as the only test facility, the design will include both PNRSII pilot testing facilities and Task C groundwater fate and transport monitoring facilities. However these components will be separated into two construction phases on the design drawings to the extent possible. The PNRSII test facility 50% design submittal under this subtask will include preliminary layout sketches and design concepts and criteria. Provisions for supporting the installation and operation of in-tank treatment systems and in-situ biofilters monitoring systems, including supply of power, , a common wastewater source at controllable flowrates, provision for wastewater source routing to pilot facilities and effluent routing to soil treatment units, sampling collection and monitoring appurtenances, and a preliminary flow diagram will be included. The 50% design documents will be submitted to FDOH for review and comment. The department will provide comments within two weeks of receipt.

Deliverable: 50% design documents. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

19. PNRS II Test Facility Design (100%)

The provider and the department will agree on the design concepts based on review of the 50% design submittal. The provider will prepare a test facility 100% design submittal

based on these concepts. The 100% design submittal will include the design details and technical specifications for the ~~work plan~~ described in the PNRS II QAPP, and include the stage 1 unsaturated biofilters, stage 2 denitrification filters, and in-situ engineered media biofilter systems. These documents will provide the level of detail necessary to estimate construction cost. These documents will be submitted to FDOH for review and comment. The department will provide comments within two weeks of receipt.

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Deliverable: 100% design documents. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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20. PNRS II Test Facility Construction Support and Administration

The provider will work with a construction contractor for facility construction using a design-build methodology within the amount budgeted for construction in this attachment or its amendments. Construction will be completed in two phases, with Phase 1 relating mostly to PNRSII pilot test facilities while Phase 2 will primarily involve construction of facilities related to Task C fate and transport studies. This subtask will cover the Phase 1 construction. There will be some overlap between PNRSII and Task C facilities, for example power supply for the test facility will be constructed in this task but will also serve the Task C facilities. The in-situ biofilter systems for PNRSII will be constructed in Phase II along with the mini-mounds for Task C.

Provider will be onsite during construction to review materials and equipment being used to determine if work is conducted in accordance with the construction plans and will assist with installation of monitoring equipment. Construction will be reviewed for completeness by the provider and for conformance with the design intent. As necessary, the provider will propose a contract amendment to increase funds or test facility design changes to decrease costs as feasible.

Deliverable: Compensation for this subtask will be in two phases: 50% upon start of facility construction and the remaining 50% at construction completion. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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21. PNRS II Test Facility Construction (50%)

The provider will monitor facility construction as needed to monitor progress and conformance with design documents. For budgeting purposes, the provider and the department have assumed a construction cost value in this scope and budget. At the time the contractor is onsite and construction is started, invoices for materials and mobilization will be submitted to the Department by the Provider for payment. When the provider determines that approximately 50% of the facility construction is complete, a construction progress report will be provided for documentation and this subtask will be deemed complete, and the remaining amount in the Section C. cost schedule for this subtask will be paid to provider.

Deliverable: Construction Progress Report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

22. PNRS II Test Facility Construction (100 % construction)

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Provider will monitor facility construction as needed to monitor progress and conformance with design documents. This task will include the construction cost of the facility based on the construction estimate and any approved additional costs. For budgeting purpose the provider and the department have assumed a construction cost value in this scope and budget. This subtask will be based on this amount as a cost reimbursable item not to exceed the estimated total construction cost value, and will be documented by contractor invoices, material and equipment bills, and other provider incurred expenses. The amount paid will be the total documented construction cost less the amount paid to provider in subtask A-21 above.

Deliverable: Construction Progress Report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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23. Test Facility Construction (substantial completion)

Provider will conduct a site inspection to determine if the project is substantially complete. The inspection will result in the preparation of a punch list to be delivered to the contractor in writing for final completion.

Deliverable: Construction punch list. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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24. Test Facility Construction (accept construction)

The provider will conduct one final inspection for the project to determine if the work has been completed in accordance with the contract documents and the punch list. Subsequent to this final inspection, the provider will make final payment to the subcontractor. The provider shall give written notice to FDOH that the work is complete. As-built drawings will then be developed by the provider for the facility.

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Deliverable: As-built drawings of the test facility. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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25. Sample Event Reports

After each sampling event, the provider will provide sample event reports verifying operation of the test systems, flowrate monitoring, field parameter results, and chain of custody forms that document sample collection and delivery to the analytical laboratory. The number of events and the parameters to be analyzed shall be as provided in the PNRSII QAPP at a minimum. Sampling events subsequent to the number in the budget for this task are subject to available funding and the department shall authorize the provider in writing to perform each additional sampling event.

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Deliverables: Sampling event report (per sampling event).

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26. Data Summary Reports

The provider will provide data reports that verify completion of analyses by an analytical laboratory and that include compiled data from field and analytical laboratory analyses in electronic and paper form. This task is contingent on the previous task.

Deliverables: Data Summary Reports (per sampling event).

27. PNRS II Report (draft)

The provider will prepare a PNRS II report that includes PNRS II objectives, experimental methods, results, discussion, conclusions and recommendations. For each nitrogen reduction technology tested at the GCREC pilot facility a technical description will be prepared that includes name, supplier, operating principles, salient physical description, flow sequence, pertinent design details, manufacturer or designer claims of treatment goals, and operating recommendations. The draft report will be provided to the department for comments from the department and the RRAC prior to submitting a final report.

Deliverable: Draft report.

28. PNRS II Report (final)

The department will gather comments on the draft report from RRAC and FDOH review and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

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Deliverable: Final report.

29. Task A Final Report (draft)

The provider will submit a draft final report summarizing the results of the technology classification, ranking and prioritization efforts in Task A and the conclusions from PNRSII and provide recommendations for onsite nitrogen reduction technologies for Florida.

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Deliverable: Draft report.

30. Task A Final Report (final)

The department will gather comments on the draft report from RRAC and FDOH review and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

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Deliverable: Final report.

31. Change-order Allowance

From time to time the Department may find it necessary to make minor changes or adjustments to activities under this task based on results that indicate a potential improvement to the project by making a change. Examples of such changes include additional or revised sample locations and parameters, minor modifications to test systems or field activities based on problems encountered, or conditions that develop requiring expedient actions to correct a potentially serious problem. Up to \$ 40,000 will be allocated from the contract budget for such minor changes to research activities under this task. Upon determination by the Department that changes should be made, all or a portion of these funds may be authorized by written notification from the

Department to the Provider directing specific changes to research activities be made, and the amount budgeted for the changes specified.

Deliverable: As specified in the authorization.

Task B Field Testing of Technologies and Cost Documentation

The objectives of Task B are:

- Identify home sites and establish use agreements
- Establish vendor agreements
- Quality Assurance Project Plan
- Design and construct test facilities
- Install field systems at test facilities and home sites
- Operate and monitor field systems
- Compile results in report format
- Provide technical description of nitrogen removal technologies
- Acceptance of systems by homeowners
- Conduct Life Cycle Cost Analyses
- Final Report for Task B

Sub-tasks and Deliverables

1. Identification of Home Sites (per homeowner agreement)

The provider will identify individual homeowner sites for their suitability for establishing technologies for field evaluation. Criteria considered in the suitability will include homeowner willingness, site access, number of residents and continuousness of occupancy, power supply, security, location, adequate space, access for monitoring and maintenance, participation in previous or concurrent studies, and pre-existing treatment technologies. The provider will survey the homeowners and/or system users on use characteristics. Agreements will be established between homeowners and the provider for establishing and monitoring treatment systems. Written homeowner agreements will specify the arrangements in regards to responsibility for application for permits, modifications, operation, maintenance, monitoring, inspections, removal or leaving the system in place at study termination. If a homeowner site will also be used for fate and transport studies (Task C), then access will be needed for monitoring equipment in the downgradient direction and lack of interference with other systems must be ascertained. Up to ten (10) home sites at various locations in Florida (e.g. Wekiva Study Area, Wakulla and south Florida) will be indentified for **potential** testing under this task.

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Deliverable: Written agreements between homeowner and provider, completed homeowner survey.

2. Vendor Agreement Report (per vendor agreement)

The provider will contact technology vendors to explain the testing project, to identify specifics of the technology offering and special considerations, to delineate to the vendor the arrangements by which testing will be conducted, to identify specific models to be tested, and to obtain a price quotation for purchase or ascertain vendor interest in donating a system. Vendors will agree to specifications that vendors will not be allowed

to physically modify or manipulate equipment once installed. Any exceptions to this default policy will be fully documented. Up to 2 vendors will be identified for testing under this task.

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Deliverable: Written agreements between vendor and provider.

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3. Quality Assurance Project Plan for Field Testing (draft)

A QAPP will be developed to document the objectives, specific systems for testing, and technology configurations that will be tested, operation of the systems, sampling and monitoring methodology and frequency, analytical parameters and methods, and data and document management. The monitoring program will develop performance data sets for total treatment systems and also for intermediate points such as aerobic treatment unit effluent or mixed aerobic effluent with STE and pre-denitrification. Monitoring of intermediate locations will provide data sets for separate evaluation of loading and performance for individual treatment components. The anticipated monitoring program will begin six weeks after startup and approximately 8 sample events per system will be conducted. Monitoring points will include septic tank effluent (STE), aerobic effluent (if applicable), and denitrification filter effluent (if applicable). Anticipated parameters for influent STE include TSS, cBOD5, TKN, NH4+, and NOx, as well as temperature, pH, alkalinity, dissolved oxygen and oxidation reduction potential. Stage 1 and Stage 2 effluents will be monitored for the same parameters, with less frequent analyses for TSS and cBOD5. Lower frequency monitoring will be conducted as necessary for a number of parameters: total phosphorus, PO4, and fecal coliform in STE, aerobic and denitrification effluents, SO4 and H2S in sulfur denitrification filter influent and effluent, and cBOD5 in lignocellulosic filter effluents.

The provider will develop a data management and storage template for cataloging and assessing performance data from disparate treatment systems and technology combinations and influent wastewater characteristics.

The selection of systems for testing will follow the recommendations developed in Task A. The provider will consider the use of and the addition of components to existing systems.

The exact sequencing of installations over the multi-year project will be established in the QAPP based on the priority list developed in Task A and refinements through the study.

Deliverable: A draft QAPP will be provided to the Department. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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4. Recommendation for Process Forward (per meeting)

Based on the details agreed upon in the final QAPP, the provider will develop a revised cost estimate and recommendation as to the number of systems included in the initial and future funding phases and whether or not to proceed with the remainder of Task B as outlined below, or recommend an amendment to this contract. Both the provider and FDOH shall reach a written agreement prior to moving forward with Task B.

Deliverable: Meeting summary and recommended scope and budget revisions. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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5. Quality Assurance Project Plan (final)

The department will gather comments on the draft QAPP from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final QAPP accepted by FDOH. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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6. Field Systems Installation Report (per system)

The provider will submit existing system evaluations performed by individuals authorized by the department to perform such work, modifications, or new system permits as appropriate for the respective home sites and shall ensure proper permitting through the department for such permits. The provider will be, or will hire, an engineer of record for innovative or performance-based treatment system applications and identify the maintenance entity for each system. The provider will be responsible for individual field test systems to be purchased or fabricated and installed at individual homeowner sites. Field system installation will include providing all materials and assembly needed to produce a fully functional and working treatment system, including initial test evaluation and installation report. If necessary an existing system evaluation will be conducted per FAC Chapter 64E-6. The provider will ensure that operating permits and maintenance entity contracts for the system exist, as required by FDOH. The provider will address the event if one or several of the homeowners seek to withdraw from the program by assisting with installing a replacement onsite wastewater system or fund system repair or maintenance.

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Deliverable: Copy of final system permit including operating permit if necessary; detailed installation report, construction costs.

7. Field Systems Monitoring Report (per system, per event)

Subject to details specified in the QAPP, the provider, in cooperation with the homeowner and the maintenance entity, will operate field technologies for a base period of up to 24 months and monitored for at least the following parameters: temperature, pH, alkalinity, DO, ORP, TKN, NH₃, NO_x, TSS, C-BOD₅. Additional parameters will be monitored less frequently for other parameters of interest (COD, TP, PO₄, fecal coliform, total ~~Enterococci~~, and SO₄ and H₂S for systems with sulfur-based denitrification). Up to 8 sample events will be conducted on each of the systems monitored.

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The provider will submit deliverables after each monitoring event for the systems installed in Task B6, which will also include results for flowrate or treated volume, electricity and/or media use, field parameter results, chain of custody forms for samples delivered to analytical laboratory, analytical laboratory reports, and compiled results.

Deliverables: Monitoring reports in tabular form.

8. Field Systems Operation, Maintenance, and Repairs Report (per system)

The provider, in cooperation with the homeowner, maintenance entity, and county health department, will maintain copies of records of repairs, maintenance actions, inspection results and system observations. The provider will develop a report form for each entity and a summary report for each treatment system. Records will include date, description of repair and pertinent factors, and repair cost.

Deliverable: Report form for each system, summary report of observations.

9. Technical Description of Nitrogen Reduction Technology Report

The provider will develop a technical description for each nitrogen reduction technology studied, including information such as if the technology is vendor supplied or custom design, trade name, model number, unit specifications, purported operating principals, description of process flows and hydraulics, physical features including tanks, fixed film media, pumps, aerators, and other appurtenances, addition of chemicals or other materials, performance claims, observations, operational experience and measured performance during the study. The report will include a brief description of nitrogen removal processes and factsheets for each nitrogen removal system studied.

Deliverable: Draft and final nitrogen reduction technology report.

10. Acceptance of System by Owner Report (per system)

At the conclusion of system monitoring, a homeowner acceptance document will be provided that transfers complete ownership and operational responsibility of the system to the homeowner. In the event the homeowner does not desire to keep the study systems, funds from Task B6, up to the funding limit available, will be utilized to restore the system to its original condition.

Deliverable: Acceptance of System by Owner Report.

11. Life Cycle Cost Analysis draft (template and user guidelines)

The provider will develop a Life Cycle Cost Analysis (LCCA) template, with the PNRS I LCCA as a starting point and will summarize the features of the template in a user guidelines document. Costs will be expressed in a variety of ways, such as uniform annual cost, cost effectiveness of nitrogen removal, marginal cost effectiveness of additional treatment components etc. The analysis will include equipment, material and installation costs for treatment systems, recurrent costs for energy, maintenance, repair, permitting and monitoring, and replacement of materials such as reactive media or electron donor supply for denitrification. Materials costs include the purchase cost and delivery cost of vendor systems, or costs to purchase and prepare materials and media for custom designed systems. Use of a common LCCA template will enable all nitrogen removal technologies to be evaluated on an equivalent basis, and will be useful for future systems that are not evaluated within this project. In developing the template, the provider will illustrate its use with existing data, such as developed as part of Task A, the Keys Onsite Wastewater Nutrient Reduction Systems study or the information obtained from homeowners surveyed during this task.

Deliverable: Draft LCCA template and user guidelines.

12. Life Cycle Cost Analysis final (template and user guidelines)

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The department will gather comments on the draft LCCA from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final LCCA template and user guidelines.

13. Life Cycle Cost Analysis Report (per system)

Based on the LCCA Template, the provider will conduct an LCCA analysis for each nitrogen reduction technology evaluated during field testing using actual purchase prices, installation cost estimates, and operational costs records.

Deliverable: LCCA Report (per system tested) including cost analysis.

14. Task B Final Report (draft)

The provider will develop a final report that will summarize the results of the Task B evaluations of treatment technologies, including an aggregation of technology reports and LCCA completed over the course of the study. The report will provide summary recommendations for deploying the tested technologies to meet the objectives of the Florida Onsite Nitrogen Removal Strategy. The report will include the data on which it is based, in tabular form.

Deliverable: Draft Task B Final Report.

15. Task B Final Report (final)

The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Task B Final Report.

16. Change-order Allowance

From time to time the Department may find it necessary to make minor changes or adjustments to activities under this task based on results that indicate a potential improvement to the project by making a change. Examples of such changes include additional or revised sample locations and parameters, minor modifications to test systems or field activities based on problems encountered, or conditions that develop requiring expedient actions to correct a potentially serious problem. Up to \$ 50,000 will be allocated from the contract budget for such minor changes to research activities under this task. Upon determination by the Department that changes should be made, all or a portion of these funds may be authorized by written notification from the Department to the Provider directing specific changes to research activities be made, and the amount budgeted for the changes specified.

Deliverable: As specified in the authorization.

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Task C. Evaluation of Nitrogen Reduction Provided by Soils and Shallow Groundwater

The objectives of Task C are:

- Critical characterization of nitrogen reduction in Florida soils and groundwater
- Develop Quality Assurance Project Plan
- Establish a controlled test facility
- Identify home sites and make use agreements
- Instrument field systems at test facility and home sites
- Operate and monitor field systems
- Compile data in report format
- Close-out of home sites and controlled test facility
- Provide Final Report for Task C

Sub-tasks and Deliverables

1. Literature Review (draft)

The provider will review available literature to assess the current status of knowledge related to nitrogen fate and transport in saturated and unsaturated soils. Literature from other fields (e.g. agriculture, agronomy, hydrogeology, soil science, environmental science, ecology, biosystems engineering) will be reviewed for its application to OSTDS in Florida. Particular focus will be placed on studies that have measured and documented denitrification rates in soil and groundwater. This review will expand on the literature review on denitrification in soil performed for the department's Wekiva study and a complementary literature review, recently completed by the Colorado School of Mines. Results of the literature reviewed in this task will be added to the searchable literature reference database established in Task A.

Deliverable: Draft literature review and updated reference database. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

2. Literature Review (final)

The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final report and updated reference database. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

3. Quality Assurance Project Plan for field and test center sites (draft)

The provider will develop a QAPP to document Task C objectives and the monitoring framework for field sites. Information gained during the literature review conducted as part of Task D will be incorporated, as appropriate, into the monitoring framework to ensure data required for model inputs will be collected. The monitoring framework will encompass the "Observational Approach" to allow information obtained in the field and during other tasks (e.g., Task D2, D7, D10, etc.) to be utilized to direct subsequent monitoring. The QAPP will describe the number and type of homeowner systems to be monitored, sample frequency and duration, analytical parameters and methods, data handling and management, and document control.

It is anticipated that each site will be monitored to delineate the OSTDS effluent quality, hydraulic and nitrogen loading rates to the soil, and potential groundwater impacts. Flow meters will be installed as needed to determine actual soil loading rates. Shallow piezometers will be installed within the soil treatment unit and downgradient of the system to evaluate nitrogen fate and transport. Tracer tests using a conservative tracer will be conducted **where necessary** to determine connectivity of the OSTDS-vadose zone-groundwater system as well as evaluate subsurface travel times. Water quality analyses will be conducted on all field samples and will include temperature, total nitrogen, ammonium nitrogen, nitrate-nitrogen, and chloride. Less frequent analyses will be conducted on samples as necessary and will include pH, alkalinity, cBOD5, total phosphorus, anions, cations, fecal coliform, and E. coli. Should a total nitrogen plume be identified from an OSTDS, additional piezometers may be installed to enable further hydrogeologic characterization affecting fate and transport (i.e., groundwater velocity, hydraulic gradient) and assessment of nitrogen concentrations over time. This field monitoring framework will enable evaluation of the current nitrogen reduction in soil and groundwater and provide input to parameter selection for Task D. Results will also enable validation and verification of simple models developed and refined as described in Task D.

It is anticipated that ~~subsurface monitoring sites will be established at each of three dispersed locations in Florida to provide geographical variety. Example candidate locations are the Wakulla area (north Florida), the Wekiva area (central Florida), and a south Florida site to be determined. It is anticipated that four monitoring events will be conducted at each site~~ **unless results indicate no value from additional monitoring events**. Sites will be selected and monitored to encompass a range of conditions affecting nitrogen mass loading to the environment and the resulting groundwater concentrations. Site selection will be leveraged, to the extent possible, with Task B to enable complete evaluation of the onsite system from STE through nitrogen treatment units and including soils. The key conditions of importance will be the hydraulic loading rate of effluent to the soil, and the effluent quality discharged to the soil.

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It is anticipated that a soil treatment and groundwater monitoring test center will also be established in this task to provide performance evaluations of multiple wastewater treatment systems; systems that will provide a broad range of nitrogen removal capabilities. The subsequent application of treated effluent to soil treatment and dispersal units will result in separate, non-comingled plumes which can be used for monitoring of nitrogen fate and transport in the subsurface. Subsurface monitoring will be used to develop data sets for nitrogen fate and transport for parallel systems receiving widely varying nitrogen concentrations. Subsurface sites at the test center will be monitored for a variety of parameters at different frequencies, including pH, alkalinity, DO, ORP, TKN, NH₃, NO_x, C-BOD₅, TP, PO₄, fecal coliform, and total ~~Enterococci~~. Duration and frequency of monitoring at each of the sites will be specified in the QAPP.

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Deliverables: Draft QAPP for field sites and test center. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

4. Recommendation for Process Forward

Based on the details agreed upon in the draft QAPP, the provider will develop a revised cost estimate and a recommendation whether or not to proceed with the remainder of Task C as outlined below, or recommend an amendment to this contract. Both the provider and FDOH shall reach a written agreement prior to moving forward with Task C.

Deliverable: Meeting summary and recommended scope and budget revisions. **THIS SUBTASK WAS 50% COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

5. **Quality Assurance Project Plan (final)**

The department will gather comments on the draft final report from RRAC and FDOH internal review and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments. If the provider subsequently recommends modifying or adding procedures to address conditions encountered in the field, the QAPP may be revised or appended upon mutual agreement between provider and the department.

Deliverable: Final QAPP acceptable to FDOH. **THIS SUBTASK WAS 80% COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

6. **Soil Treatment and Groundwater Monitoring Test Facility Design (50%)**

The Gulf Coast Research & Education Center of the University of Florida has been evaluated by the provider for establishing a controlled test site for side-by-side evaluation of multiple soil treatment unit regimes and the resulting nitrogen groundwater fate and transport. This task will be leveraged with tasks B and D.

Since both the Task A and Task C test facilities will be located at the GCREC, the provider will design the test facility for Task C in concert with the Task A test facility. The Task C test facility 50% design submittal will include preliminary layout sketches and design concepts and criteria. Provisions for supporting installation, operation, and monitoring of treatment systems and groundwater plumes, including controllable dosing flowrates, effluent quality, soil hydraulic loading rates, and staging for field efforts. The monitoring framework will support evaluation of time and spatial variations of soil treatment and groundwater plume configurations (e.g. groundwater flow velocity, concentrations, etc.). Provisions will be made for supporting the installation and operation of in-tank treatment systems or unsaturated groundwater monitoring systems, including supply of power, treatment system sub-components, a common wastewater source at controllable flowrates, provision for effluent routing to soil treatment units, sampling collection and monitoring apparatuses, and staging of field analytical work and sampling will be included.

The 50% design documents will be submitted to FDOH for review and comment. Comments will be provided by the department within two weeks of receipt.

Deliverable: 50% design documents. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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7. Soil Treatment and Groundwater Monitoring Test Facility Design (100%)

The provider and the department will agree on the test facility design and experimental concepts based on review of the 50% design submittal. The provider will prepare the test facility 100% design submittal based on these concepts. The 100% design submittal will include all design details and technical specifications necessary to estimate construction cost. These documents will be submitted to FDOH for review and comment. Comments will be provided by the department within two weeks of receipt.

Deliverable: 100% design documents. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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8. Soil Treatment and Groundwater Monitoring Test Facility Design (Final)

In preparing the test facility final design submittal, the provider will include final revisions based on the review of the 100% design submittal. This will result in a set of signed and sealed construction plans suitable for facility construction.

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Deliverable: Signed and sealed construction plans. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

9. Soil and Groundwater Test Facility Construction Support and Administration

The provider will work with a construction contractor for facility construction using a design-build methodology within the amount budgeted for construction in this attachment or its amendments. Construction will be completed in two phases, with Phase 1 relating mostly to PNRSII pilot test facilities while Phase 2 will primarily involve construction of facilities related to Task C soil treatment and groundwater monitoring studies. This subtask will cover the Phase 2 construction. There will be some overlap between PNRSII and Task C facilities, for example power supply for the test facility will be constructed in Phase 1 (Task A) but will also serve the Task C facilities. The in-situ biofilter systems for PNRSII will be constructed in Phase II along with the mini-mounds for Task C.

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Provider will be onsite during construction to review materials and equipment being used to determine if work is conducted in accordance with the construction plans and will assist with installation of monitoring equipment. Construction will be reviewed for completeness by the provider and for conformance with the design intent. The provider will propose a contract amendment to increase funds or test facility design changes to decrease costs as necessary and feasible to maintain budget. Provider will respond to Contractor requests for information and prepare any necessary addenda. Construction will be reviewed for completeness by the provider and conformance with contract documents.

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Deliverable: Compensation for this subtask will be in two phases: 50% upon start of facility construction and the remaining 50% at construction completion.

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10. Soil and Groundwater Test Facility Construction (50% construction)

The provider will monitor facility construction as needed to monitor progress and conformance with design documents. For budgeting purposes, the provider and the department have assumed a construction cost value in this scope and budget. At the time the contractor is onsite and construction is started, invoices for materials and

mobilization will be submitted to the Department by the Provider for payment. When the provider determines that approximately 50% of the facility construction is complete, a construction progress report will be provided for documentation and this subtask will be deemed complete, and the remaining amount in the Section C. cost schedule for this subtask will be paid to provider.

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Deliverables: Documentation of contractor and equipment onsite and Construction Progress Report (at 50% complete).

11. Soil and Groundwater Test Facility Construction (100% construction)

Provider will monitor facility construction as needed to monitor progress and conformance with design documents. This task will include the construction cost of the facility based on the construction estimate and any approved additional costs. For budgeting purpose the provider and the department have assumed a construction cost value in this scope and budget. This subtask will be based on this amount as a cost reimbursable item not to exceed the estimated total construction cost value, and will be documented by contractor invoices, material and equipment bills, and other provider incurred expenses The amount paid will be the total documented Task C construction cost less the amount paid to provider in subtask C-10 above.

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Deliverable: Construction progress report.

12. Soil and Groundwater Test Facility Construction (substantial completion)

Provider will conduct a site inspection to determine if the project is substantially complete. The inspection will result in the preparation of a punch list to be delivered to the contractor in writing for final completion.

Deliverable: Construction punch list.

13. Soil and Groundwater Test Facility Construction (accept construction)

The provider will conduct one final inspection for the project to determine if the work has been completed in accordance with the contract documents and the punch list. Subsequent to this final inspection, the provider will make final payment to the subcontractor. Written notice shall be provided to FDOH that the work is complete. As-built drawings will then be developed by the provider for the facility.

Deliverable: As-built drawings of the test facility.

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14. Soils and Hydrogeologic Characterization and Monitoring Plan for Test Facility Site

The soil and groundwater characteristics of the test facility site will be determined by the provider as described in the QAPP. Characterization will include soils analyses, aquifer testing, piezometer installation and tracer testing with a conservative tracer to establish groundwater flow parameters. Based on the results of this characterization, a monitoring plan will be established for the six mini-mound systems at the soil and groundwater test facility. The location, number and frequency of sampling will be as generally defined in the QAPP, but refined based on results of this task. Additionally, field assessment for Task D model parameter estimation, model verification and validation will also be included as available from results of this task.

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Deliverable: Soil and groundwater characterization memo and revised QAPP element for test facility.

15. Tracer testing at research sites (per tracer test)

Groundwater tracer tests will be conducted at the research sites based on the protocols outlined in the QAPP. First, an ambient groundwater tracer test will be conducted at or immediately adjacent to the site of the Soil and Groundwater Test Facility to determine existing groundwater flow characteristics using a conservative tracer substance. Second, a groundwater tracer test will be initiated at the GCREC Mound system to delineate groundwater flow characteristics downgradient of the mound. Third, a groundwater tracer test will be conducted at one of the mini-mounds at the Soil and Groundwater Test Facility after start-up to characterize groundwater flow and contaminant transport from these systems. Deliverables for this task will be a tracer test memo describing each test and the results, and payment will be per test memo. The Department may authorize the Provider in writing to perform additional tracer tests as part of this project.

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Deliverables: Tracer Test Memo (per tracer test).

16. Soil and Groundwater Test Facility Sample Event Reports (per system sampling event)

The monitoring and data collection framework for the soil and groundwater test facility will be described in the revised QAPP including number of sampling points for each plume, sampling frequency and duration, and analytical parameters. Monitoring reports, based on the QAPP framework, will be provided that describe site conditions and interim sample results (i.e., compiled data from field and analytical laboratory analyses). A brief description of the monitoring progress will be provided.

Deliverable: Sampling event report (per sampling event).

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17. Soil and Groundwater Test Facility Data Summary Reports

The provider will provide data reports that verify completion of analyses by an analytical laboratory and that include compiled data from field and analytical laboratory analyses in electronic and paper form. This task is contingent on the previous task.

Deliverables: Data Summary Reports (per sampling event).

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18. Test Facility Closeout Report

At the conclusion of controlled test site monitoring, the provider will determine if the test facility infrastructure will be transferred to the property owner or the site restored to prior condition. If the property owner wishes to keep the facility, the provider will submit an acceptance document to the department that documents transfer of ownership and complete responsibility of test site infrastructure to the owner. A report will be provided to document close-out of the site.

Deliverable: Test Facility Closeout Report.

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19. Field Site Selection (per property owner agreement)

Candidate field sites will be identified by the provider for subsurface monitoring activities. FDOH permit information will be gathered by the provider as available on candidate sites, and a system inspection and evaluation conducted on selected sites. Monitoring

at the sites will be used to assess the current level of nitrogen reduction obtained by Florida soils, to assess groundwater impacts due to conventional systems, and to provide data for parameter estimation, and verification and validation of models developed in Task D. Sites will be monitored by the provider to encompass a range of conditions affecting nitrogen mass loading to the environment and the resulting groundwater concentrations. Specifically, key conditions of importance will be the hydraulic loading regime, the rate of effluent discharged to the soil, and the effluent quality (e.g. BOD, nitrogen) discharged to the soil. Factors considered during site selection include property owner amenability, site access, occupancy, system age, type of system and daily wastewater flow. While numerous subtleties exist between individual OSTDS, monitoring a range of these key conditions and factors will enable comparison of sites. Based on the previous subtasks and the process forward meeting, the first site to be monitored will be the existing mound system at the GREC, for which the property owner agreement has already been established in subtask A12. This will allow establishment of materials and methods for subsequent field site monitoring, and provides a large, unobstructed area to study a nitrogen plume in more detail than could be accomplished at a private home site.

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Agreements will be established with property owners by the provider for establishing monitoring systems. It is anticipated that up to seven (7) field sites will be identified for potential inclusion in the study. Availability of funding and site characteristics will be used to establish which of these will be included for monitoring.

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Deliverable: Property Owner agreement.

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20. Instrumentation of GREC Mound System & Plume

The QAPP documents the objectives, monitoring framework, sample frequency and duration and analytical methods to be used at the GREC existing mound system site. Additional soil and groundwater testing will be conducted if necessary, based on the results in Task C 14. Instrumentation of the site, in accordance with the QAPP, will include providing all materials and assembly needed to establish the monitoring framework at the site, and will be performed by the provider. A monitoring installation report will be provided by the provider for the GREC site describing the monitoring system and any additional characterization

Deliverable: GREC Mound Characterization and Monitoring Installation report. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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21. GREC Mound Sample Event Report (per sampling event)

The monitoring framework established at the GREC will be described in the QAPP including number of sampling points, sampling frequency and duration, and analytical parameters. Monitoring reports, based on the QAPP framework, will be provided that describe site conditions and interim sample results (i.e., compiled data from field and analytical laboratory analyses).

Deliverable: GREC Mound sampling event report (per sampling event).

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22. GCREC Mound Data Summary Reports

The provider will provide data reports that verify completion of analyses by an analytical laboratory and that include compiled data from field and analytical laboratory analyses in electronic and paper form. This task is contingent on the previous task.

Deliverables: Data Summary Reports (per sampling event).

23. Instrumentation of Remaining Field Sites Report (per site)

The QAPP will document the objectives, monitoring framework, sample frequency and duration and analytical methods to be used at the remaining field sites, presumably individual private home sites. Instrumentation of the sites, in accordance with the QAPP, will include providing all materials and assembly needed to establish the monitoring framework at each home site, and will be performed by the provider. A monitoring installation report will be provided by the provider for each of up to ~~four (4)~~ individual home sites describing the monitoring system.

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Deliverable: Monitoring Installation report.

24. Field Sites Sample Event Report (per sampling event, per site)

The monitoring framework will be described in the QAPP including number of sampling points at each site, sampling frequency and duration, and analytical parameters. Monitoring reports, based on the QAPP framework, will be provided that describe site conditions and interim sample results (i.e., compiled data from field and analytical laboratory analyses).

Deliverable: Sampling event report, (per sampling event, ~~per site~~)

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25. Field Sites Data Summary Reports

The provider will provide data reports that verify completion of analyses by an analytical laboratory and that include compiled data from field and analytical laboratory analyses in electronic and paper form. This task is contingent on the previous task.

Deliverables: Data Summary Reports (per sampling event, ~~per site~~).

26. Draft Site Summary and Close-out Memo (each site)

The provider will ~~prepare data tables~~ summarizing the observations for each site, including site conditions, onsite system characteristics and soil and ground water concentrations and conditions found.

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At the conclusion of home site monitoring, the provider will submit homeowner acceptance documents to the department that either transfer ownership and responsibility of monitoring points to the homeowner (e.g., piezometers), or all monitoring points will be removed by the provider and the site shall be returned to its original configuration.

A report will be provided to the department to document close-out of each home site. The draft close-out ~~memos~~ will be submitted to FDOH for review and comment.

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Deliverable: Draft Site Close-out ~~memo~~

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27. Final Site Close-Out Memo (per site)

Comments will be provided by the department within two weeks of receipt and the provider will prepare a final close-out memo.

Deliverable: Final site close-out memo acceptable to FDOH.

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28. Task C Final Report (draft)

The final report will summarize results of Task C activities on nitrogen reduction in Florida soil and shallow groundwater. The report will include task objectives, methods, results, discussion, conclusions and recommendations.

Deliverable: A draft report will be provided for comment prior to submittal of the final report.

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29. Task C Final Report (final)

The department will gather comments on the draft final report from RRAC and FDOH review and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final report.

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30. Change-order Allowance

From time to time the Department may find it necessary to make minor changes or adjustments to activities under this task based on results that indicate a potential improvement to the project by making a change. Examples of such changes include additional or revised sample locations and parameters, minor modifications to test systems or field activities based on problems encountered, or conditions that develop requiring expedient actions to correct a potentially serious problem. Up to \$ 40,000 will be allocated from the contract budget for such minor changes to research activities under this task. Upon determination by the Department that changes should be made, all or a portion of these funds may be authorized by written notification from the Department to the Provider directing specific changes to research activities be made, and the amount budgeted for the changes specified.

Deliverable: As specified in the authorization.

Task D Nitrogen Fate and Transport Modeling

The objectives of Task D are:

- Literature Review
- Plan Development
- Model Development
 - Simple soil tool to estimate nitrogen removal in different Florida soils
 - Complex soil treatment module for input into the groundwater modeling tool
 - Analytical modeling tool to predict temporal and spatial concentrations and fluxes of nitrate in groundwater
 - Integration of complex soil treatment module with the groundwater analytical model
 - Incorporation of multiple spatial inputs (i.e., development scale model)

- Performance Evaluation
 - Select existing site data for model-performance evaluation
 - Calibrate/corroborate models using existing site data (including from Task C)
 - Validate models
 - Conduct uncertainty analysis of model input parameters
- Decision Support Framework
 - Guidance for determining model input parameters
 - Risk-based approach for model selection

Subtasks and Deliverables

1. Literature Review of Nitrogen Fate and Transport Models (draft)

A literature review will be conducted to determine the current practice for modeling nitrogen fate and transport in soils and groundwater. Particular attention will be paid to data gathered from the Task C literature reviews that have relevance to model parameterization of nitrogen fate and transport. If feasible, sensitivity analysis will be conducted based on previous work for conditions relevant to Florida soil and hydrology to help direct Task C monitoring and future modeling efforts.

Currently available models for nitrogen fate and transport will be reviewed, and the hydraulic and transport/transformation parameters for the models and estimation tools that the provider deems to be applicable, will be summarized so that a plan for fieldwork can begin to be developed at an early stage in the project. Existing available models specific to OSTDS or similar source types will be included in this review to determine the appropriate starting point for model development for this project.

Results of the literature reviewed in this task will be added to the searchable literature reference database established in Task A.

Deliverable: Draft literature review and updated reference database. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

2. Literature Review of Nitrogen Fate and Transport Models (final)

The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final literature review and updated reference database. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

3. Selection of Existing Data Sets for Calibration Report

The provider will select data from existing sites in Florida or elsewhere to evaluate the performance of a soil and aquifer model, and will provide recommendations for future data collection efforts for subsequent model calibration. The sites shall have information on a nitrogen plume, and data will be obtained via document review and by working with FDOH.

Deliverable: Brief memo describing calibration data sets. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

4. Quality Assurance Project Plan Nitrogen Fate and Transport Models (draft)

A detailed QAPP will be drafted describing the subtasks to be completed in Task D. The overall goal will be to develop a model representing soil and shallow groundwater that is capable of predicting nitrogen concentrations at a specified location downgradient of an OSTDS source and determining nitrogen loadings/mass flux at a specified location. A simplified, user friendly modeling approach (e.g., programmed Microsoft Excel spreadsheet) will be employed that includes parameters that model the dominant soil and hydraulic factors that influence nitrogen reduction. The development of the fate and transport model will be accompanied with a parallel assessment of soil characterization at individual sites that provide data for model parameterization and calibration (Task C). The Florida soils classification system is one potential source of soil characterization data that could be used for a simple estimation of unsaturated zone transport.

The development of a model can include several steps from the concept over implementation of a mathematical model, assurance of numerical accuracy (code verification), adjustment of model parameters to best match a real world experimental data set (calibration), comparison of predictions from a calibrated model to different experimental data (model validation or verification), analysis of the effect of uncertainty in model parameter values on model results or of uncertainty and variability in data sets on calibrated parameter values (sensitivity analysis) and adjustments of the concept, mathematical, or calibrated model to better represent observations (model redesign) can be potentially a never-ending circular process as new data become available for comparison over time. The QAPP will describe how model development will proceed from the literature review, initial model development, calibration to existing data, model verification with other existing data or data gathered during this study, and model redesign to a final model product. It will also describe how the developed models and sensitivity analyses can guide data gathering efforts (in particular for task C), provide insights into nitrogen behavior in the environment, and provide a framework for decision making.

The final product of Task D is anticipated to be a simplified site scale model that predicts nitrogen concentration and mass flux at selected distances downgradient from the source loading location. Comparisons of this modeling approach with the results of non-steady state models and complex soil models will characterize the limitations of this model. The model will be a combination of a simple soil model and averaged aquifer model. The simple soil model will predict nitrogen reduction in unsaturated soil and the loading of nitrogen to the aquifer at the groundwater table surface. The simplified soil model may take the form of a simple algorithm or correlation that predicts nitrogen reduction as a function of such unsaturated soil characteristics as grain size distribution, water content and organic matter. The aquifer model will likely be time averaged and predict nitrogen concentration and attenuation with distance from the source. Input information includes the direction of groundwater flow at the average groundwater flow velocity and organic matter content. Model parameter values will be derived from calibration for Florida locations using data from Task C and suggested model parameters will be provided.

Deliverable: Draft Task D QAPP. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

5. Recommendation for Process Forward (per meeting)

Based on the details agreed upon in the final QAPP, the provider will develop a recommendation whether or not to proceed with the remainder of Task D as outlined below, a revised cost estimate, or recommend an amendment to this contract. Both the provider and FDOH shall reach a written agreement prior to moving forward with Task D.

Deliverable: Meeting summary and recommended scope and budget revisions. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

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6. Quality Assurance Project Plan Nitrogen Fate and Transport Models (final)

The department will gather comments on the draft QAPP from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final QAPP acceptable by FDOH. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 3 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

7. Simple Soil Tools

The simple soil tools will be a series of look-up tables providing estimated nitrogen removal based on common OSTDS operating conditions. The tables will be generated from the complex soil model developed in subsequent tasks (subtask D8 through D13), or from existing numerical models (e.g., HYDRUS-2D). The model will be corroborated and calibrated for a subset of conditions for which data exist. The specific conditions included in the simple soil model tools will be limited (not to exceed 60 conditions) and agreed upon by FDOH.

Deliverable: White paper describing simple soil tool development, tool use, and the look-up tables.

8. Complex Soil Model

This subtask includes development of the conceptual framework for the complex soil model including the coding and code evaluation required to implement the theory. The complex soil model will be based on unsaturated soil transport mechanisms adapted to Florida-specific soil and climate data, but incorporated into a simplified approach (e.g., STUMOD programmed into a Microsoft Excel spreadsheet) that includes parameters representing dominant soil properties. The soil treatment module will enable estimation of site-specific soil treatment in the vadose zone with the model output being the loading at the water table (input to aquifer models). This soil-treatment module will be developed to account for evapotranspiration, and the effect of high/seasonal variable water tables on nitrogen removal in the soil.

Deliverables: Complex Soil Model Specification Memo including theory for coding and code evaluation progress.

9. Complex Soil Model Performance Evaluation

The general user will most likely assess performance by comparing model output to field observations (e.g., simplified comparison of values). Similar implementation checks will be performed using robust field data sets (as available). Performance evaluation will also include corroboration/calibration to better understand the quality and quantity of data required by comparing simulated parameter values to the corresponding measured values (calibration targets). Calibration targets will include nitrogen concentrations (weighted equally in space) and mass loading of contaminant from the OSTDS. In addition, a parameter sensitivity analysis will be performed to identify the most relevant model parameters. An uncertainty analysis will also be performed where probability-based ranges for model input parameters will be used to generate probable model outcomes.

A more rigorous performance evaluation approach is required for technical users. For this case, the model-performance assessment will be conducted by using model-evaluation statistics to determine whether the model can appropriately simulate the observed data. Multiple methods for evaluating the model performance will be used to ensure model quality assurance evaluation that is not hindered by the specific limitations of a single calibration statistic or identify if further evaluation of the model is warranted.

Deliverable: White paper describing performance evaluation methods and results with the draft model in electronic format (e.g., Microsoft Excel spreadsheet).

10. Validate/Refine Complex Soil Model

Based on the results from subtask D9, the complex soil model will be revised/improved. As additional data is available from Task C, the model will be revised to incorporate more complex mechanisms. Validation will be used to compare the corroborated/calibrated model to actual field data. Model validation ensures that the model meets the intended requirements and identifies the range of appropriate conditions (e.g., capabilities and limitations). Data from Task C home sites as well as other available data sources will be used to validate the model.

Deliverable: Complex Soil Model white paper, nomographs for conditions represented in D7, and the final complex soil model in electronic format (e.g., Microsoft Excel spreadsheet).

11. Aquifer Model Combined with Complex Soil Model Development

A steady state or non-steady state aquifer model will be developed, possibly by revising an existing model, to simulate nitrogen concentrations and mass flux in space and time from a single OSTDS source, or a surface area that can be estimated as a single OSTDS source. This aquifer model and the complex soil model (D.10) will be integrated together to produce groundwater output predictions for nitrogen concentration or mass flux from a single OSTDS source.

Deliverables:

- a. Aquifer Model Specification Memo describing review and development of the aquifer model (subtask is 50% complete).
- b. Aquifer-Complex Soil Model Specification Memo describing progress status for integrating the two models (subtask is 75% complete).
- c. Draft integrated model in electronic format (subtask is 100% complete).

12. Aquifer-Complex Soil Model Performance Evaluation

Performance evaluation of the aquifer-complex soil model will include implementation checks, corroboration/calibration, parameter sensitivity analysis and an uncertainty analysis. Data sets from Florida identified during subtask D3 and Task C will be used. Metrics will include average concentration in the plume or mass flux crossing a boundary between actual field data (as available) and model output, the range in calibrated parameter set values that result in similar agreement between model results and data, model-parameter correlation and bias, and the potential for different parameter combinations to achieve the same agreement between model results and data.

Similar to the complex soil model, a more rigorous performance evaluation is also required. Model-evaluation statistics will be used to determine whether the model can appropriately simulate the observed data. Multiple methods for evaluating the model performance will be used to ensure model quality assurance evaluation that is not hindered by the specific limitations of a single calibration statistic or identify if further evaluation of the model is warranted.

Deliverables:

- a. Aquifer-Complex Soil Model Specification Memo describing progress status for performance evaluation (subtask is 50% complete).
- b. White paper describing performance evaluation methods and preliminary results (subtask is 100% complete).

13. Validate/Refine Aquifer-Complex Soil Model with Data Collection from Task C

Based on the results from subtask D12, the integrated aquifer and complex soil model will be revised/improved using site-scale field data collected from Task C. Validation will be used to compare the corroborated/calibrated model to actual field data. The validation/refinement procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself (parameterization or improvements). Data from Task C home sites as well as other available data sources will be used to validate the model.

Deliverable: Integrated Aquifer-Complex Soil Model white paper and the final integrated model in electronic format (e.g., Microsoft Excel spreadsheet).

14. Development of Aquifer-Complex Soil Model for Multiple Spatial Inputs

A model will be developed, possibly by revising an existing model, to simulate nitrogen concentrations and mass flux in space and time from several OSTDS in a development-scale area. The model will be calibrated using existing data from a development-scale plume, based on metrics such as average concentration in the plume or mass flux crossing a boundary.

Deliverable: Aquifer-Complex Soil Model for Multiple Spatial Inputs white paper and the model in electronic format (e.g., Microsoft Excel spreadsheet).

15. Decision-Making Framework Considering Uncertainty

A methodology will be developed to describe how planners can include the uncertainty associated with both calibrated and non-calibrated models in the decision-making

process. The report will be in the form of a guidance manual to guide users through the assessment of parameters, tool selection, and how to use those tools.

Deliverable: Modeling decision-making framework white paper.

16. Task D Guidance Manual (Draft)

The Task D draft final report will be developed based on a compilation of Task D white papers, progress reports, and technical memos to summarize the results of the Task D modeling. The report will be in the form of a Guidance Manual and User's Guide providing a decision support framework (Task D.15), model development, input parameter selection, and uncertainty assessment. The Guidance Manual will provide an introduction to each tool, assumptions/limitations of the tool, and how to use the tools. The complementary User's Guide will provide detailed technical data including fundamental assumptions that were incorporated into tool development, description of the tool development, and description of parameters that affect nitrogen reduction performance.

Deliverable: Draft Task D Guidance Manual

17. Task D Guidance Manual (Final)

The department will gather comments on the draft guidance manual from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final Task D Guidance Manual with final models in electronic format.

18. Change-order Allowance

From time to time the Department may find it necessary to make minor changes or adjustments to activities under this task based on results that indicate a potential improvement to the project by making a change. Examples of such changes include additional or revised sample locations or parameters, minor modifications to test systems or field activities based on problems encountered, or conditions that develop requiring expedient actions to correct a potentially serious problem. Up to \$10,000 will be allocated from the contract budget for such minor changes to research activities under this task. Upon determination by the Department the changes should be made, all or a portion of these funds may be authorized by written notification from the Department to the Provider directing specific changes to research activities be made, and the amount budgeted for the changes specified.

Deliverable: As specified in the authorization

Task E Project Management, Coordination and Meetings

The objectives of Project management, coordination and meetings are:

- Conduct project kickoff meeting
- Prepare progress reports
- Attend and Make presentations to RRAC and TRAP meetings
- Conduct PAC meetings

Deleted: Task D Nitrogen Fate and Transport Modeling

The objectives of Task D are:

- <#>Literature review on fate and transport models
- <#>Quality Assurance Project Plan
- <#>Space time variable aquifer model with simplified soil treatment
- <#>Development-scale aquifer model creation and calibration
- <#>Space time variable model with complex soil treatment
- <#>Development-scale model with aquifer and soil treatment
- <#>Uncertainty analysis
- <#>Validate and refine models using data from Task C
- <#>Develop decision making framework
- <#>Final Report for Task D

Sub-tasks and Deliverables

Literature Review of Nitrogen Fate and Transport Models (draft)

A literature review will be conducted to determine the current practice for modeling nitrogen fate and transport in soils and ground-water. Particular attention will be paid to data gathered from the Task C literature reviews that have relevance to model parameterization of nitrogen fate and transport. If feasible, sensitivity analysis will be conducted based on previous work for conditions relevant to Florida soil and hydrology to help direct Task C monitoring and future modeling efforts.

Currently available models for nitrogen fate and transport will be reviewed, and the hydraulic and transport/transformation parameters for the models and estimation tools that the provider deems to be applicable, will be summarized so that a plan for fieldwork can begin to be developed at an early stage in the project. Existing available models specific to OSTDS or similar source types will be included in this review to determine the appropriate starting point for model development for this project.

Results of the literature reviewed in this task will be added to the searchable literature reference database established in Task A.

Deliverable: Draft literature review and updated reference database.

THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.

Sub-tasks and Deliverables

1. Project Kick-Off Meeting (conference call)

The provider will hold a project kick-off meeting to establish contact information, routes of communication, points of contact, and administrative procedures. A list of attendees, contact information sheet and meeting minutes will be produced by the provider.

THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE

2. PM - Project Progress Reports (per ~~bimonthly~~ report)

~~Bimonthly~~ progress reports will be provided that summarize the general status of each task, progress during the reporting period, activities planned in the next reporting period, and any issues, problems or decisions with significant effect on project implementation. This task includes time for the project manager, for project team and Program Coordination, Subcontract maintenance, project financial analysis, and invoicing.

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3. RRAC or TRAP Presentation (per meeting)

The provider shall present project result updates to the RRAC, TRAP or other occasions as requested by the department in writing.

4. RRAC or TRAP Meeting Attendance (per meeting)

The provider shall attend meetings of the RRAC, TRAP or other occasions as requested by the department in writing.

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5. Project Advisory Committee PAC Meetings (per meeting)

Project Advisory Committee (PAC) ~~review panel will be assembled and a project review meeting coordinated with the project team. Prior to the review meeting, PAC members will be provided information concerning the background and motivation for this project, goals, methods, and initial results. At the review meeting project team members will present the technical approach and findings such that the PAC can critique the project work. A summary report that documents PAC input and team response will be provided.~~

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~~Deleted: meetings will be held as agreed upon between the department and the provider to evaluate the strategic direction of the project, review project activities and reports, provide technical review, and make comments and recommendations on project activities. The provider will submit to the department for each review meeting a summary report that documents PAC input.~~

Task F. Other Services

Other subtasks, including deliverables and prices, may be defined and added to this contract by amendment. These subtasks shall be within the general scope of the original Invitation to Negotiate leading to this contract. Criteria to initiate an amendment will include: either RRAC direction or changes in funding and/or direction by the Legislature, and agreement between the department and the provider. Any amendments shall be prospective, and the provider shall not perform the revised tasks until the amendment has been fully executed. All task amendments shall be within the scope of the original Invitation to Negotiate.

b) Task Limits

Services are limited to the contract specifications and the availability of funds.

The provider shall not perform any tasks related to the project other than those described in Section B, Manner of Service Provision, Paragraph 1(a), Task List without the express written consent of the department.

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2. Staffing Requirements

a) Staffing levels

Provider will have at least one project manager and a qualified person to do field work available on staff. The provider shall maintain an adequate administrative organizational structure and support staff sufficient to discharge its contractual responsibilities. In the event the department determines that the provider's staffing levels do not conform to those promised in the proposal, it shall advise the provider in writing who shall have thirty (30) days to remedy the identified staffing deficiencies.

The provider shall replace any employee whose continued presence would be detrimental to the success of the project as determined by the department with an employee of equal or superior qualifications. The department's contract manager will exercise exclusive judgment in this matter.

b) Professional Qualifications

Qualifications shall include evidence of either work experience or training in sampling of water quality.

c) Staffing Changes

If such staff ceases to be available, provider may substitute staff with equivalent qualifications, provided that the substitute shall be trained on the project by the provider, and the department is given two weeks notice of such a change and the provider's plan for the transition.

d) Subcontractors

Subcontractors may be used by the provider; their role shall be described in the associated QAPP documents.

1. Service Location and Equipment

a) Service Location

Field work shall be performed in the State of Florida. Analytical work and data analysis shall be performed in the field, at the laboratory, or office locations as chosen by the provider, and subject to the associated QAPP documents.

b) Service Delivery Location

Services listed under Section B, Manner of Service Provision, Paragraph 1(a), Task List will be delivered at the following location:

Department of Health, Division of Environmental Health
Bureau of Onsite Sewage Programs
4052 Bald Cypress Way, Bin #A-08
Tallahassee, Florida 32399-1713

c) Change in Location

Upon any change in location, provider shall report to the department within two weeks of such a change and the provider's plan for the transition. All changes in location must be approved by the department.

d) Equipment

The provider and its subcontractors will be responsible for supplying, at its own expense, either directly or indirectly, all equipment necessary to perform, conduct, and complete the contract including, but not limited to, computers, telephones, copiers, fax machines, sampling equipment, supplies and maintenance, as well as needed office supplies. Liability for the use of equipment shall be exclusively the domain of the provider. See the provisions in the standard contract for liability.

4. Deliverables

a) Service Unit

See Section B, Manner of Service Provision, Paragraph 1(a), Task List for list of deliverables and the associated tasks.

b) Reports

The provider shall provide an expenditure report for the project together with the final invoice. The expenditure report shall include date, amount, recipient, and category of expenditures.

c) Records and Documentation

Copies of deliverables shall be kept at the provider's office in electronic and paper format. Field records shall be kept at the provider's office in the format they were obtained. See the provisions of the standard contract for length of record keeping.

5. Performance Specifications

a) Outcomes and Outputs

Outcomes shall be measured in service tasks as specified in Section B, Manner of Service Provision, Paragraph 1(a), Task List. The deliverables will be evaluated for accuracy and percentage completed.

b) Monitoring and Evaluation Methodology

The department shall monitor performance of the provider by review of the deliverables and by attending at least one of the sampling events to observe if sampling procedures outlined in the QAPP are followed. Any observed shortcomings shall be noted to and resolved by the provider.

6. Provider responsibility

All unique activities that the provider is responsible for are outlined in this contract under section B, Manner of Service Provision, Paragraph 1(a), Task List.

7. Department responsibility

The department has final authority over approving quality acceptability of service deliverables. The department reserves the right to renegotiate or terminate this contract if the performance standards are not satisfactorily met.

The department shall facilitate review of QAPP, other deliverables, and reports.

Department staff shall also perform one contract monitoring evaluation to demonstrate that the terms of the contract are met.

C. METHOD OF PAYMENT

1. Payment Clause.

This is a fixed price (unit cost) contract except Task A.22 and Task C.11 which will be cost reimbursable. The department shall pay the provider, upon satisfactory completion of the services outlined in the Attachment I of this contract in accordance with the terms of this contract for a total dollar amount not to exceed \$4,999,999.00, subject to the availability of funds. There shall be no equipment budget. The purchase of any equipment is the responsibility of the provider as are any cost overruns.

Fixed Price Presentation

Deliverables, listed in Section B, Manner of Service Provision, Paragraph 1(a), Task List., developed during completion of the tasks described in Section B, Manner of Service Provision, Paragraph 1(a), Task List shall be paid according to the schedule on the following pages:

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TASK NO.	Task	Per Deliverable Subtotal	No. of Deliverables			Total Cost			Total
			PH1	PH2	PH3	PH1	PH2	PH3	
A	Task A: Technology Selection & Prioritization					\$352,144	\$336,514	\$35,480	\$724,138
A.1	Draft Literature Review Report	\$ 13,796.00	1	0	0	\$13,796	\$0	\$0	\$13,796
A.2	Final Literature Review Report	\$ 6,092.00	1	0	0	\$6,092	\$0	\$0	\$6,092
A.3	Draft Classification of Technologies Report	\$ 12,830.60	1	0	0	\$12,831	\$0	\$0	\$12,831
A.4	Draft Technology Ranking Criteria Report	\$ 10,096.00	1	0	0	\$10,096	\$0	\$0	\$10,096
A.5	Draft Priority List for Testing Report	\$ 14,858.60	1	0	0	\$14,859	\$0	\$0	\$14,859
A.6	Technology Classification, Ranking and Prioritization Workshop	\$ 18,242.60	1	0	0	\$18,243	\$0	\$0	\$18,243
A.7	Final Classification of Technologies Report	\$ 5,044.00	1	0	0	\$5,044	\$0	\$0	\$5,044
A.8	Final Technology Ranking Criteria Report	\$ 7,944.00	1	0	0	\$7,944	\$0	\$0	\$7,944
A.9	Final Priority List for Testing Report	\$ 7,786.60	1	0	0	\$7,787	\$0	\$0	\$7,787
A.10	Draft Innovative Systems Applications Report (per technology)	\$ 11,655.00	0	1	0	\$0	\$11,655	\$0	\$11,655
A.11	Final Innovative Systems Applications Report (per technology)	\$ 9,219.00	0	1	0	\$0	\$9,219	\$0	\$9,219
A.12	Identification of Test Facility Sites (per site agreement)	\$ 2,538.25	2	0	0	\$5,077	\$0	\$0	\$5,077
A.13	Draft PNRS II QAPP	\$ 13,170.50	1	0	0	\$13,171	\$0	\$0	\$13,171
A.14	Recommendation for Process Forward (per meeting)	\$ 6,236.50	1	0	0	\$6,237	\$0	\$0	\$6,237
A.15	Final PNRS II QAPP	\$ 4,496.00	1	0	0	\$4,496	\$0	\$0	\$4,496
A.16	Materials Testing for FDOH Additives Rule	\$ 4,000.00	2	2	0	\$8,000	\$8,000	\$0	\$16,000
A.17	PNRS Specification Reports	\$ 18,715.00	1	1	0	\$18,715	\$18,715	\$0	\$37,430
A.18	PNRS II Test Facility Design 50%	\$ 11,721.48	1	0	0	\$11,721	\$0	\$0	\$11,721
A.19	PNRS II Test Facility Design 100%	\$ 16,200.50	1	0	0	\$16,201	\$0	\$0	\$16,201
A.20	PNRS II Test Facility Construction Support and Administration (2 deliverables, 50% at start, 50% at completion)	\$ 16,601.00	2	0	0	\$33,202	\$0	\$0	\$33,202
A.21	PNRS II Test Facility Construction 50% (2 deliverables, start and 50% complete)	\$ 25,000.00	2	0	0	\$50,000	\$0	\$0	\$50,000
A.22	PNRS II Test Facility Construction 100% (cost reimbursable)	\$ 40,000.00	1	0	0	\$40,000	\$0	\$0	\$40,000
A.23	PNRS II Test Facility Construction Substantial Completion	\$ 10,000.00	1	0	0	\$10,000	\$0	\$0	\$10,000
A.24	PNRS II Test Facility Accept Construction	\$ 9,650.00	1	0	0	\$9,650	\$0	\$0	\$9,650
A.25	Monitoring and Sample Event Reports (per sample event)	\$ 28,985.00	1	6	0	\$28,985	\$173,910	\$0	\$202,895
A.26	Data Summary Report (per sample event)	\$ 3,365.00	0	7	0	\$0	\$23,555	\$0	\$23,555

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A.27	Draft PNRS II Report	\$ 34,220.00	0	1	0	\$0	\$34,220	\$0	\$34,220
A.28	Final PNRS II Report	\$ 17,240.00	0	1	0	\$0	\$17,240	\$0	\$17,240
A.29	Draft Task A Final Report	\$ 26,000.00	0	0	1	\$0	\$0	\$26,000	\$26,000
A.30	Task A Final Report	\$ 9,480.00	0	0	1	\$0	\$0	\$9,480	\$9,480
A.31	Change-order Allowance	\$ 40,000.00	0	1	0	\$0	\$40,000	\$0	\$40,000
B	Task B: Field Testing of Technologies					\$50,202	\$599,610	\$529,243	\$1,179,054
B.1	Identification of Home Sites (per homeowner agreement)	\$ 9,341.67	1	9	0	\$9,342	\$84,075	\$0	\$93,417
B.2	Vendor Agreement Report (per vendor agreement)	\$ 7,580.00	2	0	0	\$15,160	\$0	\$0	\$15,160*
B.3	Draft QAPP for Field Testing	\$ 25,700.00	1	0	0	\$25,700	\$0	\$0	\$25,700
B.4	Recommendation for Process Forward (per meeting)	\$ 6,780.00	0	1	0	\$0	\$6,780	\$0	\$6,780
B.5	Final QAPP Field Testing	\$ 11,060.00	0	1	0	\$0	\$11,060	\$0	\$11,060
B.6	Field Systems Installation Report (per system)	\$ 37,900.00	0	4	3	\$0	\$151,600	\$113,700	\$265,300*
B.7	Field Systems Monitoring Report (per system, per event)	\$ 8,402.33	0	32	24	\$0	\$268,875	\$201,656	\$470,531
B.8	Field Systems Operation, Maintenance and Repairs Report (per system)	\$ 8,630.00	0	0	7	\$0	\$0	\$60,410	\$60,410
B.9	Technical Description of Nitrogen Reduction Technology Report	\$ 17,271.00	0	0	1	\$0	\$0	\$17,271	\$17,271
B.10	Acceptance of System by Owner Report (per system)	\$ 4,758.00	0	0	7	\$0	\$0	\$33,306	\$33,306
B.11	LCCA Template Report (draft template and user guidelines)	\$ 18,140.00	0	1	0	\$0	\$18,140	\$0	\$18,140
B.12	LCCA Template Report (final template and user guidelines)	\$ 9,080.00	0	1	0	\$0	\$9,080	\$0	\$9,080
B.13	LCCA Report (per system)	\$ 5,040.00	0	0	7	\$0	\$0	\$35,280	\$35,280
B.14	Draft Task B Final Report	\$ 45,120.00	0	0	1	\$0	\$0	\$45,120	\$45,120
B.15	Task B Final Report	\$ 22,500.00	0	0	1	\$0	\$0	\$22,500	\$22,500
B.16	Change-order Allowance	\$ 50,000.00	0	1	0	\$0	\$50,000	\$0	\$50,000
C	Task C: Evaluation of Nitrogen Reduction by Soils & Shallow GW					\$216,164	\$1,095,977	\$598,860	\$1,911,001
C.1	Draft Literature Review on Nitrogen Reduction in Soil Report	\$ 11,300.00	1	0	0	\$11,300	\$0	\$0	\$11,300
C.2	Final Literature Review on Nitrogen Reduction in Soil Report	\$ 6,900.00	1	0	0	\$6,900	\$0	\$0	\$6,900
C.3	Draft QAPP Evaluation of N Reduction by Soils & Shallow GW	\$ 38,939.50	1	0	0	\$38,940	\$0	\$0	\$38,940
C.4	Recommendation for Process Forward (per meeting)	\$ 5,906.50	1	0	0	\$5,907	\$0	\$0	\$5,907
C.5	Final QAPP Evaluation of N Reduction by Soils & Shallow GW	\$ 9,189.73	1	0	0	\$9,190	\$0	\$0	\$9,190
C.6	S&GW Test Facility Design 50%	\$ 26,470.50	1	0	0	\$26,471	\$0	\$0	\$26,471
C.7	S&GW Test Facility Design 100%	\$ 26,570.50	1	0	0	\$26,571	\$0	\$0	\$26,571
C.8	S&GW Test Facility Design Final	\$ 21,207.00	1	0	0	\$21,207	\$0	\$0	\$21,207

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C.9	S&GW Construction Support & Administration (2 deliverables, 50% at start, 50% at completion)	\$ 13,560.00	0	2	0	\$0	\$27,120	\$0	\$27,120*	Formatted Table
C.10	S&GW Test Facility Construction 50% (2 deliverables, start and 50% complete)	\$ 15,000.00	2	0	0	\$30,000	\$0	\$0	\$30,000	
C.11	S&GW Test Facility Construction 100% (cost reimbursable)	\$ 40,000.00	0	1	0	\$0	\$40,000	\$0	\$40,000	
C.12	S&GW Test Facility Construction Substantial Completion	\$ 3,680.00	0	1	0	\$0	\$3,680	\$0	\$3,680	
C.13	S&GW Test Facility Accept Construction	\$ 7,480.00	0	1	0	\$0	\$7,480	\$0	\$7,480	
C.14	Soils & Hydrogeologic and Monitoring Plan for S&GW Test Facility	\$ 43,074.00	0	1	0	\$0	\$43,074	\$0	\$43,074	
C.15	Tracer Testing at GCREC (per tracer test)	\$ 18,910.00	0	3	0	\$0	\$56,730	\$0	\$56,730	
C.16	S&GW Sample Event Reports (per sample event)	\$ 47,523.28	0	3	3	\$0	\$142,570	\$142,570	\$285,140	
C.17	S&GW Data Summary Report (per sample event)	\$ 13,240.00	0	3	3	\$0	\$39,720	\$39,720	\$79,440	
C.18	Test Facility Closeout Report	\$ 13,080.00	0	0	1	\$0	\$0	\$13,080	\$13,080	
C.19	Field Site Selection (per property owner agreement)	\$ 9,932.67	1	6	0	\$9,933	\$59,596	\$0	\$69,529	
C.20	Instrumentation of GCREC Mound System	\$ 59,495.00	0.5	0.5	0	\$29,748	\$29,748	\$0	\$59,495	Formatted Table
C.21	GCREC Mound Sample Event Report (per sampling event)	\$ 38,290.00	0	4	0	\$0	\$153,160	\$0	\$153,160*	
C.22	GCREC Mound Data Summary Report (per sampling event)	\$ 8,160.00	0	4	0	\$0	\$32,640	\$0	\$32,640	
C.23	Instrumentation of Remaining Field Sites Report (per site)	\$ 43,075.00	0	4	0	\$0	\$172,300	\$0	\$172,300	
C.24	Field Sites Sample Event Reports (per sample event, per site)	\$ 36,520.00	0	6	7	\$0	\$219,120	\$255,640	\$474,760	
C.25	Field Sites Data Summary Report (per sample event, per site)	\$ 4,840.00	0	6	7	\$0	\$29,040	\$33,880	\$62,920	
C.26	Draft Site Summary and Close-out Memo (per site)	\$ 8,680.00	0	0	5	\$0	\$0	\$43,400	\$43,400	
C.27	Final Site Close-Out Memo (per site)	\$ 2,670.00	0	0	5	\$0	\$0	\$13,350	\$13,350	
C.28	Draft Task C Final Report	\$ 40,040.00	0	0	1	\$0	\$0	\$40,040	\$40,040	
C.29	Task C Final Report	\$ 17,180.00	0	0	1	\$0	\$0	\$17,180	\$17,180	
C.30	Change-order Allowance	\$ 40,000.00	0	1	0	\$0	\$40,000	\$0	\$40,000	
D	Task D: Nitrogen Fate and Transport Models					\$74,357	\$93,477	\$640,189	\$808,023	Formatted Table
D.1	Draft Literature Review on Nitrogen Fate & Transport Model Report	\$ 15,533.23	1	0	0	\$15,533	\$0	\$0	\$15,533	
D.2	Final Literature Review on Nitrogen Fate & Transport Model Report	\$ 5,211.08	1	0	0	\$5,211	\$0	\$0	\$5,211	
D.3	Selection of Existing Data Set for Calibration Report	\$ 15,092.20	1	0	0	\$15,092	\$0	\$0	\$15,092	
D.4	Draft QAPP N Fate and Transport Models	\$ 32,186.76	1	0	0	\$32,187	\$0	\$0	\$32,187	
D.5	Recommendation for Process Forward (per meeting)	\$ 6,334.00	1	0	0	\$6,334	\$0	\$0	\$6,334	
D.6	Final QAPP N Fate and Transport Models	\$ 15,657.38	0	1	0	\$0	\$15,657	\$0	\$15,657	
D.7	Simple Soil Tools	\$ 52,448.00	0	1	0	\$0	\$52,448	\$0	\$52,448*	
D.8	Complex Soil Model	\$ 86,641.00	0	0	1	\$0	\$0	\$86,641	\$86,641	

D.9	Complex Soil Model Performance Evaluation	\$ 48,577.00	0	0	1	\$0	\$0	\$48,577	\$48,577
D.10	Validate/Refine Complex Soil Model	\$ 72,132.04	0	0	1	\$0	\$0	\$72,132	\$72,132
D.11	Aquifer Model Combined with Complex Soil Model Development	\$ 113,411.22	0	0	1	\$0	\$0	\$113,411	\$113,411
D.12	Aquifer-Complex Soil Model Performance Evaluation	\$ 127,922.99	0	0	1	\$0	\$0	\$127,923	\$127,923
D.13	Validate/Refine Aquifer-Complex Soil Model with Data Collection from Task C	\$ 95,733.70	0	0	1	\$0	\$0	\$95,734	\$95,734
D.14	Development of Aquifer-Complex Soil Model for Multiple Spatial Inputs	\$ 25,371.84	0	1	0	\$0	\$25,372	\$0	\$25,372
D.15	Decision-Making Framework Considering Uncertainty	\$ 52,638.54	0	0	1	\$0	\$0	\$52,639	\$52,639
D.16	Task D Guidance Manual (Draft)	\$ 20,590.63	0	0	1	\$0	\$0	\$20,591	\$20,591
D.17	Task D Guidance Manual (Final)	\$ 12,541.41	0	0	1	\$0	\$0	\$12,541	\$12,541
D.18	Change-order Allowance	\$ 10,000.00	0	0	1	\$0	\$0	\$10,000	\$10,000
E	Task E: Project Management, Coordination, and Meetings					\$90,695	\$52,642	\$234,446	\$377,782
E.1	Project Kick-Off Meeting (conference call)	\$ 7,724.00	1	0	0	\$7,724	\$0	\$0	\$7,724
E.2	PM-Project Progress Reports (per bimonthly report)	\$ 9,298.00	6	4	12	\$55,788	\$37,192	\$111,576	\$204,556
E.3	RRAC or TRAP Presentation (per meeting)	\$ 11,732.25	2	1	5	\$23,465	\$11,732	\$58,661	\$93,858
E.4	RRAC or TRAP Meeting Attendance (per meeting)	\$ 3,718.05	1	1	6	\$3,718	\$3,718	\$22,308	\$29,744
E.5	PAC Meetings (per meeting)	\$ 41,900.00	0	0	1	\$0	\$0	\$41,900	\$41,900
F	Task F: Other								
PROJECT TOTALS						\$783,561	\$2,178,220	\$2,038,217	\$4,999,999

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2. Invoice Requirements.

The provider shall submit an invoice to the contract manager at the address listed in the department's standard contract on a monthly basis using the form of Attachment III within 30 days following the end of the period for which payment is being requested. Payment shall be authorized only for service tasks on the invoice that are in accord with the above list and other terms and conditions of this contract. Documentation of completion of service tasks shall be submitted to the contract manager prior to, or with the invoice. Partially completed tasks may be invoiced and paid based on the percentage of the service task completed.

This amendment shall begin on ~~October 1, 2011~~, or the date on which the amendment has been signed by both parties and the project officer at the Environmental Protection Agency has approved it, whichever is later.

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All provisions in the contract and any attachments thereto in conflict with this amendment shall be and are hereby changed to conform with this amendment.

All provisions not in conflict with this amendment are still in effect and are to be performed at the level specified in the contract.

This amendment and all its attachments are hereby made a part of the contract.

IN WITNESS THEREOF, the parties hereto have caused this 39 page amendment to be executed by their officials thereunto duly authorized.

STATE OF FLORIDA
DEPARTMENT OF
HEALTH

PROVIDER: Hazen and Sawyer, P.C.

SIGNED

BY: _____

NAME: Damann L. Anderson

TITLE: Vice President

DATE: _____

FEDERAL ID NUMBER:

13-2904652

SIGNED

BY: _____

NAME: Jean Kline, R.N., B.S.N., M.P.H.

TITLE: Deputy Secretary of Health

DATE: _____

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Task D Nitrogen Fate and Transport Modeling

The objectives of Task D are:

- Literature review on fate and transport models
- Quality Assurance Project Plan
- Space time variable aquifer model with simplified soil treatment
- Development-scale aquifer model creation and calibration
- Space time variable model with complex soil treatment
- Development-scale model with aquifer and soil treatment
- Uncertainty analysis
- Validate and refine models using data from Task C
- Develop decision making framework
- Final Report for Task D

Sub-tasks and Deliverables

Literature Review of Nitrogen Fate and Transport Models (draft)

A literature review will be conducted to determine the current practice for modeling nitrogen fate and transport in soils and ground-water. Particular attention will be paid to data gathered from the Task C literature reviews that have relevance to model parameterization of nitrogen fate and transport. If feasible, sensitivity analysis will be conducted based on previous work for conditions relevant to Florida soil and hydrology to help direct Task C monitoring and future modeling efforts.

Currently available models for nitrogen fate and transport will be reviewed, and the hydraulic and transport/transformation parameters for the models and estimation tools that the provider deems to be applicable, will be summarized so that a plan for fieldwork can begin to be developed at an early stage in the project. Existing available models specific to OSTDS or similar source types will be included in this review to determine the appropriate starting point for model development for this project.

Results of the literature reviewed in this task will be added to the searchable literature reference database established in Task A.

Deliverable: Draft literature review and updated reference database. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

Literature Review of Nitrogen Fate and Transport Models (final)

The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final literature review and updated reference database. **THIS SUBTASK WAS 80% COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

Selection of Existing Data Sets for Calibration Report

The provider will select data from existing sites in Florida or elsewhere to evaluate the performance of a soil and aquifer model, and will provide recommendations for future data collection efforts for subsequent model calibration. The sites shall have information on a nitrogen plume, and data will be obtained via document review and by working with FDOH.

Deliverable: Brief memo describing calibration data sets. **THIS SUBTASK WAS COMPLETED PRIOR TO AMENDMENT 1 AND IS ONLY INCLUDED HERE TO MAINTAIN COMPLETENESS OF SCOPE.**

Quality Assurance Project Plan Nitrogen Fate and Transport Models (draft)

A detailed QAPP will be drafted describing the sub-tasks to be completed in Task D. The overall goal will be to develop a model representing soil and shallow groundwater that is capable of predicting nitrogen concentrations at a specified location downgradient of an OSTDS source and determining nitrogen loadings/mass flux at a specified location. A simplified, user friendly modeling approach (e.g., programmed Microsoft Excel spreadsheet) will be employed that includes parameters that model the dominant soil and hydraulic factors that influence nitrogen reduction. The development of the fate and transport model will be accompanied with a parallel assessment of soil characterization at individual sites that provide data for model parameterization and calibration (Task C). The Florida soils classification system is one potential source of soil characterization data that could be used for a simple estimation of unsaturated zone transport.

The development of a model can include several steps from the concept over implementation of a mathematical model, assurance of numerical accuracy (code verification), adjustment of model parameters to best match a real world experimental data set (calibration), comparison of predictions from a calibrated model to different experimental data (model validation or verification), analysis of the effect of uncertainty in model parameter values on model results or of uncertainty and variability in data sets on calibrated parameter values (sensitivity analysis) and adjustments of the concept, mathematical, or calibrated model to better represent observations (model redesign) can be potentially a never-ending circular process as new data become available for comparison over time. The QAPP will describe how model development will proceed from the literature review, initial model development, calibration to existing data, model verification with other existing data or data gathered during this study, and model redesign to a final model product. It will also describe how the developed models and sensitivity analyses can guide data gathering efforts (in particular for task C), provide insights into nitrogen behavior in the environment, and provide a framework for decision making.

The final product of Task D is anticipated to be a simplified site scale model that predicts nitrogen concentration and mass flux at selected distances

downgradient from the source loading location. Comparisons of this modeling approach with the results of non-steady state models and complex soil models will characterize the limitations of this model. The model will be a combination of a simple soil model and averaged aquifer model. The simple soil model will predict nitrogen reduction in unsaturated soil and the loading of nitrogen to the aquifer at the groundwater table surface. The simplified soil model may take the form of a simple algorithm or correlation that predicts nitrogen reduction as a function of such unsaturated soil characteristics as grain size distribution, water content and organic matter. The aquifer model will likely be time averaged and predict nitrogen concentration and attenuation with distance from the source. Input information includes the direction of groundwater flow at the average groundwater flow velocity and organic matter content. Model parameter values will be derived from calibration for Florida locations using data from Task C and suggested model parameters will be provided.

Deliverable: Draft Task D QAPP.

Recommendation for Process Forward (per meeting)

Based on the details agreed upon in the final QAPP, the provider will develop a recommendation whether or not to proceed with the remainder of Task D as outlined below, a revised cost estimate, or recommend an amendment to this contract. Both the provider and FDOH shall reach a written agreement prior to moving forward with Task D.

Deliverable: Meeting summary and recommended scope and budget revisions.

Quality Assurance Project Plan Nitrogen Fate and Transport Models (final)

The department will gather comments on the draft QAPP from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final QAPP acceptable by FDOH.

Simple Soil Model Development

This model will use a simple classification approach for soil treatment of nitrogen based on prior research. A soil classification model will be adapted (such as developed by D. Otis for the Wekiva study) or developed. A more detailed model for soil treatment will be developed in a subsequent task (subtask D15), however, a simple soil treatment model will allow aquifer model development to proceed much sooner, and is expected to be easier to use for many sites where detailed information for such a soil treatment model is not available.

Deliverable: Simple Soil Model Specification memo.

Non-steady state aquifer model with simple soil model

A non-steady state aquifer model will be developed, possibly by revising an existing model, to simulate nitrogen concentrations and mass flux in space and time from a single OSTDS source, or a surface area that can be estimated as a single OSTDS source. The simple soil model from D7 will be linked to this model, and it is anticipated that aerial nitrogen input and loading will depend on

factors such as pretreatment, recharge, soil conditions, and property size. Model development will be based on information gained in the literature review.

Deliverable: Brief modeling memo and model in electronic format (e.g., Microsoft Excel spreadsheet).

Aquifer model with averaged output with simple soil model

A model will be developed, possibly by revising the model developed in Task D8, to produce averaged output predictions for nitrogen concentration or mass flux.

Deliverable: Brief modeling memo and model in electronic format.

Multiple source aquifer model

A model will be developed, possibly by revising an existing model, to simulate nitrogen concentrations and mass flux in space and time from several OSTDS in a development-scale area.

Deliverable: Brief modeling memo and model in electronic format.

Calibrate non-steady state aquifer model to existing data sets

The models will be initially calibrated using existing data sets from Florida or other sites identified during subtask 3. The aquifer model performance will be evaluated using measures of difference between available actual field data and model results. By comparing predictions from a calibrated model to another data set, this task may result in verification of the model. Experience during calibration or sensitivity analysis of the model will likely be useful to better understand the quality and quantity of data required to enable a rigorous calibration using data from Task C.

Deliverable: Model calibration memo.

Calibrate aquifer model with averaged output to existing data sets

The aquifer model will be calibrated using existing data sets based on metrics such as average concentration in the plume or mass flux crossing a boundary.

Deliverable: Model calibration memo.

Calibrate multi-source aquifer model to existing data sets

The aquifer model will be calibrated using existing data from a development-scale plume, based on metrics such as average concentration in the plume or mass flux crossing a boundary.

Deliverable: Model calibration memo.

Complex Soil Model

The complex soil model will be based on unsaturated soil transport mechanisms, and based on Florida-specific soil and climate data, but still incorporated into a simplified approach (e.g., programmed into a Microsoft Excel spreadsheet) useable by most practitioners with basic training. For example, the complex soil model may incorporate a field-capacity/mass-balance approach for water flow similar to that used by the Yucca Mountain project to estimate infiltration, which

addresses the capacity of soil to store water and tracks water entering and leaving the soil. The soil treatment module would enable estimation of site-specific soil treatment in the vadose zone, and model output will be the loading at the water table to the aquifer models. Development of the complex soil treatment module will be further described in the QAPP.

Deliverable: Complex Soil Model specification memo.

Non-steady state aquifer model with complex soil model

The complex soil-treatment model from D14 will be interfaced with the non-steady state aquifer model. Development of the non-steady state aquifer model based on a complex soil treatment module will be further described in the QAPP.

Deliverable: Brief modeling memo and model in electronic format.

Aquifer model with averaged output, with complex soil model

The complex soil-treatment model will be interfaced with the averaged aquifer model. Development of the averaged aquifer model based on a complex soil treatment module will be further described in the QAPP.

Deliverable: Brief modeling memo and model in electronic format.

Multi-source aquifer model, with complex soil model

The complex soil-treatment model will be interfaced with the averaged aquifer model, taking into account numerous OSTDS in an area.

Deliverable: Brief modeling memo and model in electronic format.

Calibrate non-steady state and averaged aquifer and complex soil model to existing data sets

Aquifer model performance will be evaluated using available actual field data and rigorous calibration techniques for the integrated soil-treatment/aquifer model. By comparing predictions from a calibrated model to another data set, this task may result in verification of the model. Experience during calibration or sensitivity analysis of the model will likely be useful to better understand the quality and quantity of data required to rigorously calibrate the model (Task C).

Deliverable: Model calibration memo.

Calibrate multi-source aquifer model and complex soil model to existing data sets

Aquifer model performance will be evaluated using data from a development-scale plume and rigorous calibration techniques for the integrated soil treatment/aquifer model.

Deliverable: Model calibration memo.

Uncertainty Analysis for Non-Calibrated Models

A methodology will be developed whereby the developed models can be used for decision making even if sufficient site-specific data does not exist to calibrate the model. Probability-based ranges for model input parameters will be used to

generate probable model outcomes, providing planners with the option of using the most probable model outcome in the decision making process, or the model outcome that would lead to a more conservative or liberal decision as the specific case warrants. To the extent possible (without precluding model-performance evaluation of the aquifer model in year 1), model uncertainty and sensitivity analyses will be conducted.

Deliverable: Uncertainty analysis memo.

Validate/Refine non-steady state aquifer model with data collection from Task C

Aquifer model performance will be evaluated using ground-water data collected from Task C and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

Validate/Refine complex soil model with data collected from Task C

Soil treatment model performance will be evaluated using field data collected from Task C (soil, vadose zone, shallow water table) and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

Uncertainty analysis for calibrated models

The uncertainty in results produced by calibrated models (e.g., nitrogen concentration or mass flux) will be characterized based on factors such as range in calibrated parameter set values that result in similar agreement between model results and data, model-parameter correlation and bias, and the potential for different parameter combinations to achieve the same agreement between model results and data.

Deliverable: Model uncertainty analysis memo.

Validate/Refine non-steady state aquifer, complex soil model with Data Collected from Task C

Soil/aquifer integrated model performance will be evaluated using site-scale field data collected from Task C and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

Decision-Making Framework Considering Uncertainty

A methodology will be developed based on the results of subtask 20 to describe how planners can include the uncertainty associated with both calibrated and non-calibrated models in the decision-making process.

Deliverable: Modeling decision-making memo.

Validate/Refine multi-source aquifer model, complex soil model with data collected from Task C

Soil/aquifer integrated model performance will be evaluated using development-scale plume field data collected from Task C and rigorous calibration techniques. The calibration procedure will be an iterative process and may suggest revisions in the data collection plan or in the model itself.

Deliverable: Model validation memo.

Task D Final Report (draft)

The draft final report will be developed to summarize the results of the Task D modeling development.

Deliverable: Draft Task D Report.

Task D Final Report (final)

The department will gather comments on the draft final report from RRAC and any other interested parties and transmit such comments to the provider within one month of receiving the draft. The provider will address these comments in preparing final deliverables within one month of receiving comments.

Deliverable: Final Task D Report.

TASK NO.	Task	Per Deliverable Subtotal	Jun-09	Jul-09	Aug-09	Sep
A	Task A: Technology Selection & Prioritization					
A.1	Draft Literature Review Report	\$ 13,796.00	1	0	0	
A.2	Final Literature Review Report	\$ 6,092.00	1	0	0	
A.3	Draft Classification of Technologies Report	\$ 12,830.60	1	0	0	
A.4	Draft Technology Ranking Criteria Report	\$ 10,096.00	1	0	0	
A.5	Draft Priority List for Testing Report	\$ 14,858.60	1	0	0	
A.6	Technology Classification, Ranking and Prioritization Workshop	\$ 18,242.60	1	0	0	
A.7	Final Classification of Technologies Report	\$ 5,044.00	0	0	1	
A.8	Final Technology Ranking Criteria Report	\$ 7,944.00	0	0	1	
A.9	Final Priority List for Testing Report	\$ 7,786.60	0	0	0	
A.10	Draft Innovative Systems Applications Report (per technology, up to five)	\$ 11,655.00	0	0	0	
A.11	Final Innovative Systems Applications Report (per technology, up to five)	\$ 9,219.00	0	0	0	

A.12	Identification of Test Facility Sites (per site agreement)	\$ 2,538.25	1.8	0	0
A.13	Draft PNRS II QAPP	\$ 13,170.50	1	0	0
A.14	Recommendation for Process Forward (per meeting)	\$ 6,236.50	0	0	0
A.15	Final PNRS II QAPP	\$ 4,496.00	0	0	0
A.16	Materials Testing for FDoH Additives Rule	\$ 4,000.00	0	0	0
A.17	PNRS Specification Reports	\$ 23,635.00	0	0	0
A.18	PNRS II Test Facility Design 50%	\$ 11,721.48	0	0	1
A.19	PNRS II Test Facility Design 100%	\$ 16,200.50	0	0	0
A.20	PNRS II Test Facility Construction Support and Administration (2 deliverables, 50% at start, 50% at completion)	\$ 19,991.00	0	0	0
A.21	PNRS II Test Facility Construction 50% (2 deliverables, start and 50% complete)	\$ 25,000.00	0	0	0
A.22	PNRS II Test Facility Construction 100% (cost reimbursable)	\$ 40,000.00	0	0	0
A.23	PNRS II Test Facility Construction Substantial Completion	\$ 11,000.00	0	0	0
A.24	PNRS II Test Facility Accept Construction	\$ 10,650.00	0	0	0
A.25	Monitoring and Sample Event Reports (per sample event)	\$ 32,489.00	0	0	0
A.26	Data Summary Report (per sample event)	\$ 3,368.25	0	0	0
A.27	Draft PNRS II Report	\$ 34,220.00	0	0	0
A.28	Final PNRS II Report	\$ 17,240.00	0	0	0
A.29	Draft Task A Final Report	\$ 26,000.00	0	0	0
A.30	Task A Final Report	\$ 9,343.00	0	0	0
B	Task B: Field Testing of Technologies				
B.1	Identification of Home Sites (per homeowner agreement)	\$ 9,341.67	0	0	0
B.2	Vendor Agreement Report (per vendor agreement)	\$ 7,580.00	0	0	0
B.3	Draft QAPP for Field Testing	\$ 25,700.00	0	0	0
B.4	Recommendation for Process Forward (per meeting)	\$ 6,780.00	0	0	0
B.5	Final QAPP Field Testing	\$ 11,060.00	0	0	0
B.6	Field Systems Installation Report (per system)	\$ 47,060.00	0	0	0
B.7	Field Systems Monitoring Report (per event)	\$ 35,200.00	0	0	0
B.8	Field Systems Operation, Maintenance and Repairs Report (per system)	\$ 9,130.00	0	0	0
B.9	Technical Description of Nitrogen Reduction Technology Report	\$ 19,660.00	0	0	0

B.10	Acceptance of System by Owner Report (per system)	\$ 4,758.00	0	0	0
B.11	LCCA Template Report (draft template and user guidelines)	\$ 18,140.00	0	0	0
B.12	LCCA Template Report (final template and user guidelines)	\$ 9,080.00	0	0	0
B.13	LCCA Report (per system)	\$ 5,040.00	0	0	0
B.14	Draft Task B Final Report	\$ 57,600.00	0	0	0
B.15	Task B Final Report	\$ 29,760.00	0	0	0
C	Task C: Evaluation of Nitrogen Reduction by Soils & Shallow GW				
C.1	Draft Literature Review on Nitrogen Reduction in Soil Report	\$ 11,300.00	1	0	0
C.2	Final Literature Review on Nitrogen Reduction in Soil Report	\$ 6,900.00	0	0	0
C.3	Draft QAPP Evaluation of N Reduction by Soils & Shallow GW	\$ 38,939.50	0	0	0
C.4	Recommendation for Process Forward (per meeting)	\$ 5,906.50	0	0	0
C.5	Final QAPP Evaluation of N Reduction by Soils & Shallow GW	\$ 9,189.73	0	0	0
C.6	S&GW Test Facility Design 50%	\$ 26,470.50	1	0	0
C.7	S&GW Test Facility Design 100%	\$ 26,570.50	0	0	0
C.8	S&GW Test Facility Design Final	\$ 21,207.00	0	0	0
C.9	S&GW Construction Support & Administration (2 deliverables, 50% at start, 50% at completion)	\$ 17,740.00	0	0	0
C.10	S&GW Test Facility Construction 50% (2 deliverables, start and 50% complete)	\$ 15,000.00	0	0	0
C.11	S&GW Test Facility Construction 100% (cost reimbursable)	\$ 30,000.00	0	0	0
C.12	S&GW Test Facility Construction Substantial Completion	\$ 4,680.00	0	0	0
C.13	S&GW Test Facility Accept Construction	\$ 10,380.00	0	0	0
C.14	Soils & Hydrogeologic and Monitoring Plan for S&GW Test Facility	\$ 31,845.00	0	0	0
C.15	Tracer Testing at GCREC (per tracer test)	\$ 20,410.00	0	0	0
C.16	S&GW Sample Event Reports (per sample event)	\$ 39,413.28	0	0	0
C.17	S&GW Data Summary Report (per sample event)	\$ 3,240.00	0	0	0
C.18	Test Facility Closeout Report	\$ 15,580.00	0	0	0
C.19	Field Site Selection (per property owner agreement)	\$ 9,932.67	0	0	0
C.20	Instrumentation of GCREC Mound System	\$ 56,075.00	0	0	0
C.21	GCREC Mound Sample Event Report (per sampling event)	\$ 45,265.00	0	0	0

C.22	GCREC Mound Data Summary Report (per sampling event)	\$ 3,840.00	0	0	0
C.23	Instrumentation of Remaining Field Sites Report (per site)	\$ 40,075.00	0	0	0
C.24	Field Sites Sample Event Reports (per sample event, per site)	\$ 46,545.00	0	0	0
C.25	Field Sites Data Summary Report (per sample event, per site)	\$ 2,840.00	0	0	0
C.26	Draft Site Summary and Close-out Report (per site)	\$ 8,680.00	0	0	0
C.27	Final Site Close-Out Report (per site)	\$ 2,670.00	0	0	0
C.28	Draft Task C Final Report	\$ 50,040.00	0	0	0
C.29	Task C Final Report	\$ 19,680.00	0	0	0
D	Task D: Nitrogen Fate and Transport Models				
D.1	Draft Literature Review on Nitrogen Fate & Transport Model Report	\$ 15,533.23	1	0	0
D.2	Final Literature Review on Nitrogen Fate & Transport Model Report	\$ 5,211.08	0	0	0
D.3	Selection of Existing Data Set for Calibration Report	\$ 15,092.20	1	0	0
D.4	Draft QAPP N Fate and Transport Models	\$ 32,186.76	0	0	0
D.5	Recommendation for Process Forward (per meeting)	\$ 6,334.00	0	0	0
D.6	Final QAPP N Fate and Transport Models	\$ 15,657.38	0	0	0
D.7	Simple Soil Model Development	\$ 4,263.26	0	0	0
D.8	Non-Steady State Aquifer Model, Simple Soil Model	\$ 17,053.04	0	0	0
D.9	Aquifer Model with Averaged Output, Simple Soil Model	\$ 20,008.30	0	0	0
D.10	Multi-Source Aquifer Model	\$ 22,834.75	0	0	0
D.11	Calibrate Non-Steady State Aquifer Model to Existing Data Sets	\$ 34,033.63	0	0	0
D.12	Calibrate Aquifer Model with Averaged Output to Existing Data Sets	\$ 11,634.88	0	0	0
D.13	Calibrate Multi-Source Aquifer Model to Existing Data Sets	\$ 22,834.75	0	0	0
D.14	Complex Soil Model Development	\$ 63,936.61	0	0	0
D.15	Non-Steady State Aquifer Model, Complex Soil Model	\$ 27,401.40	0	0	0
D.16	Aquifer Model with Averaged Output, Complex Soil Model	\$ 12,942.88	0	0	0
D.17	Multi-Source Aquifer Model, Complex Soil Model	\$ 12,942.88	0	0	0
D.18	Calibrate Non-Steady State Aquifer Model, Complex Soil Model to Existing Data Sets	\$ 16,480.93	0	0	0
D.19	Calibrate Multi-Source Aquifer Model, Complex Soil Model to Existing Data Sets	\$ 16,480.93	0	0	0
D.20	Uncertainty Analysis for Non-Calibrated Models	\$ 43,658.81	0	0	0

