Project Title: ***Anaerobic Lagoon Biological Enhancement Program***

Project Investigator/Project Leader: *Ronnie Gene Kennedy, Jr.*
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Project Objectives:

Current technology to "close or perform sludge removal" for anaerobic lagoon systems in North Carolina is the mechanical removal, haulage, and application of accumulated lagoon sludge which is very expensive, labor and equipment intensive, and poses numerous serious on-site and off-site threats to the environment. The use of an on-site "in place" bioremediation process using available bio-products in combination with compressed air diffusers has proven to be an environmentally safe and cost-effective technology to accomplish closure of inactive lagoons and for the management of sludge levels as required for routine lagoon maintenance. Currently in North Carolina, there are over 2400 active swine operations with approximately 4000 active anaerobic hog lagoons and an additional 1200 inactive hog lagoons for which complete closure is strongly recommended. Under current prevailing technology utilizing the physical removal of sludge from swine lagoons, there simply is very limited suitable agricultural land available for the number of closures of inactive swine lagoons and for the annual maintenance now necessitated for sludge removal. Obviously, the question of funds to conduct this work is a major hurdle. For most landowners with inactive lagoons, the costs are simply prohibitive for considering closure of the inactive lagoon. Federal and state agency funds fall far short of filling the gap. The proposed use of the on-site bioremediation will greatly reduce both the short-term and hopefully the long-term overall requirements of suitable lands necessary for sludge application at an appreciably reduced cost. By substantially reducing the cost to the land/farm owner, the advent of bioremediation should significantly encourage many more to close their inactive lagoons and to improve the operation of the active lagoons by performing much needed sludge management.

Summary of work to be performed:

Several swine operations will be targeted under this project. These will include operations of differing sizes and types of animals to fully understand and adjust the response of the bioremediation process to the differences in the lagoon environments for the varied facilities. At least one inactive operation will be considered. A total of _4__ swine operations will be implemented, monitored, maintained, and evaluated over the project's duration.
The bioremediation process is a multi-step procedure. Step one involves use of various bacillus added at stages to maximize the digestion of organic matter and sludge nutrients. To increase the efficiency of the process low energy air diffusers will be utilized for increasing treatment surface area and exposure to the microbes. The total process takes several days for equipment installation and will be monitored constantly over several months for the maximizing of microbial performance.

Project Background:

Hog production is a major business to the state of North Carolina. According to 2002 National Agricultural Statistics, N.C. produced 16% of the hogs in the United States. Currently there are over 2400 active swine farms with approximately 10 million animals in NC. The majority of the farms are concentrated in the eastern portion of the state where the topography is relatively flat and water tables are typically high. Virtually all of

these active farms in the state utilize an in-ground anaerobic lagoon and spray field waste system. This technology has been approved to meet federal and N.C. guidelines and is the most widely accepted system in practice. As a result, during the period of phenomenal expansion of the hog farm industry primarily in the late 1980's and up until a moratorium to halt the construction of new swine farms was instigated in 1997 by the state's legislature, most farms have installed and continued to utilize this system.

There are approximately 4000 active anaerobic hog lagoons and about 1200 inactive hog lagoons. Most farms were constructed with the blessing and the guidance of state and federal agencies of which the Natural Resources and Conservation Service has provided considerable assistance. The farms were constructed with the perception that the properly managed anaerobic lagoon and spray field system are an economical and environmentally acceptable long-term solution for treatment of the anticipated volume of animal waste. Most producers are quick to emphasize that a primary influence in the decision to pursue investing in hog production was their faith instilled in the performance of the waste systems and encouragement including financial and technical assistance from the federal and state governing agencies.

These farms have provided an incredibly positive economic impact particularly for many parts of the state where other opportunities are extremely limited. This has proved to be especially true given the woes of another primary source of agricultural income, which is tobacco. A substantial percentage of the swine farms have been developed by producers whose primary source of income once depended on tobacco production. Many have now found that their tobacco production quotas have fallen by more that 50% over the last 10 years. Thus eastern N.C. has become even further dependent on the swine industry.

However, there are some harsh realities rapidly facing an aging swine industry that annually treats an overwhelming estimate of swine wastes. These include potential environmental impacts from surface water, ground water, odors, atmospheric deposition of nitrogen and ammonia, and nutrient imbalance. Many of these pose a more immediate threat, but several have long-term implications as well. Perhaps one of the greatest challenges in the long-term management of swine wastes is the accumulation of sludge. Sludge is a natural byproduct of anaerobic biological digestion. This dead microbial material, which accumulates over many years in the bottom of anaerobic lagoons is rich in nutrients and organic matter, periodically must be removed from the lagoon. Typically, it is mechanically harvested and land-applied to crops. Improperly managing the sludge volume in a lagoon will result in higher concentrations of nitrogen in lagoon effluent, a faster rate of sludge buildup, and a greater potential for odors from the lagoon surface.

Sludge (also known as biosolids or residuals) is a thick, black, viscous substance that is rich in organic material and nutrients. It is comprised of the dead and degraded microbial cells that anaerobically digested the manure influent and of any other materials (excess feed, debris, etc.) that were introduced into the manure collection system and have settled to the bottom of the lagoon. Over 10 to 15 years in the life of the lagoon, the volume of sludge will accumulate until it reaches a level at which by design it should be removed. At this point, it is typically taken from the lagoon and land-applied. If the amount of sludge becomes too large, the permanent liquid treatment volume of the lagoon will effectively be reduced. The loss of treatment volume will adversely affect the overall treatment ability of the lagoon, causing the nitrogen content of the effluent to increase, more sludge to be produced, and more odors to be released from the lagoon's surface.

It can be quite difficult to find any hard numbers to indicate the quantity of sludge in N.C. lagoons. However, if one assumes the 4,650 lagoons with a conservative average acre size and with the designed sludge depth of 4 feet, would indicate approximately 810,960,000 cubic feet of sludge that will have to be dealt with at some point. Add to this additional sludge being introduced by active hog operations annually at a rate of

weanling;	6.7 gal/ yr	* 3.4 million animals	+
feeder-finishing;	33.0 gal/yr	* 5.4 million animals	+
farrowing;	78.0 gal/yr	* 1.0 million animals	=

825,980,000 gallons / (7.48 gal/cuft). =
110,425,000 cu.ft.

110,425,000 cu.ft annually + 810,960,000 cu.ft. = **921,385,000 cu.ft.**

This yields almost one billion cubic feet (921,385,000 cu.ft.) of sludge just in the swine lagoons of North Carolina. Obviously there is an incredible need for an incentive to promote alternative solutions to substantially increase the rate of sludge removal/management for the state.

An innovative solution to a growing problem:

Current technology to "close or perform sludge removal" for anaerobic lagoon systems in North Carolina is the mechanical removal, haulage, and land application of accumulated lagoon sludge. There are numerous problems and hazards that are inherent in the use of this method. These include:

- Expense; hiring a contractor ranges from 1.5 cents to 5 cents per gallon of sludge.
- Substantial capital for sludge handling equipment; (practically all farms must hire out this procedure as the capital for the equipment is prohibitive especially for a one-time or infrequent usage),
- Agitation of the sludge presents a serious threat to the integrity of the lagoon liner; (particularly a concern for maintenance for an active lagoon), also there is the potential to remove too much "active" sludge during lagoon maintenance and severely reduce (at least short-term) the lagoon's performance,
- Substantial labor and fuel requirements; (especially when the sludge must be hauled for appreciable distances from the point of origin),
- Safety; more sludge means more exposure to the potential pathogens, etc., more hauling in tanks across more miles impacting traffic and increasing the chance of accidents and incidents of exposure/spillage,
- Vast quantities of land required for the proper application of the sludge; (the high levels of phosphorous and metals in the sludge dictate the necessity of sometimes hundreds of acres for the proper land application,
- A limited application window; sludge is high in nutrients and must be land applied to an active crop for nutrient utilization (which may be very limited depending on soil moisture conditions which limit access by heavy equipment and inaccessibility due to limitations posed by crop growth stages).
- Increased odors; manipulating and broadcasting sludge creates tremendous odors. The more sludge that must be land applied, the more people likely to be impacted by the odors from agitation of the lagoon and land application of the sludge material.

The use of an on-site "in place" bioremediation process using available bio-products in combination with compressed air diffusers is proving to be an environmentally safe technology to improve lagoon sludge removal for closure of inactive lagoons and for lagoon sludge management and maintenance for active swine operations.

As a management and maintenance tool, Agriment Services, Inc. began testing this technology on a variety of anaerobic lagoons in Duplin County, North Carolina. Both physical measurements and laboratory sample analyses for several lagoons for different sized hog operations has demonstrated a reduced depth of sludge from an average depth of 6 feet to less than 2 feet in as little as 12 months. N.C. Department of Environment and Natural Resources (NCDENR) has authority for environmental management including regulatory enforcement in the state and accepts the NRCS Technical Guide Standard 709 as the requirement for lagoon closure. This states that all reasonable efforts must be made to agitate and remove all waste materials from the lagoon before it can be closed. A sludge depth is to be reduced to 1 foot or less prior to closure. Bioremediation has proven potential to effectively enhance lagoon management while reducing the environmental threat and financial costs of lagoon closure and/or maintenance. In addition the process will improve several issues related to the anaerobic lagoon system. Agriment Services, Inc. recognizes the extent and potential of the accumulated sludge and believes the investigation and documentation of the bioremediation method as an environmentally safer and more cost-effective method of anaerobic lagoon closure and maintenance has merit and should be pursued.

LAGOON PROCESS

Introduction

The bioremediation process is a multi-step process. The initial step is to add the bacillus that detoxifies the lagoon by oxidizing the hydrogen sulfide (H_2S) to sulfate. The reduction in hydrogen sulfide should significantly reduce the odor from the lagoon. After approximately two weeks, the secondary strain of bacillus is added. This bacillus helps accelerate the degradation of organic matter found in the lagoon. Air diffusers are added to turn the lagoon over and make the process more efficient. A proprietary blend of facultative bacteria had been specifically blended to attack the organic sludge layer at the bottom of the lagoon or pit.

ASI Start-Up

The initial phase is detoxification of the lagoon with diffused air. Within 2-10 days, the anaerobic lagoon will become detoxified which can result in the reduction of hydrogen sulfide levels by up to 95%. At the same time, a proprietary blend of facultative bacteria is added to the lagoon. (ASI Start-UP)

ASI Maintenance

A proprietary blend of facultative bacteria chosen for their ability to rapidly degrade and efficiently digest solid waste. Because the sulfides have been removed, a significant decrease in solids can be expected in a short period of time. ASI Maintenance is also used to maintain bacteria counts for sludge reductions and anaerobic lagoon enhancement programs.

Diffusers

Air diffusers are coupled to a ¾-1 h.p. rotary vain motor that will produce 2-3 cfm. This low energy input air diffusion system is only used to turn the lagoon over. Thus, eliminating dead spots in the lagoon. It is not intended to be used as an aeration system to eliminate BOD. The diffusers accelerate the elimination of odor by keeping more solids in suspension. This gives the bacteria more surface area to interact with the waste. Thus, eliminating odor quicker. The number of the diffusers will depend on the size of the lagoon and the volume of sludge in the lagoon.

Materials and Work Schedule

Materials include electrical wiring and placement of receptacles to power the diffusers. Measurements of sludge and collection of samples both liquid and sludge requires pH meters, sludge collection apparatus, etc. Placement of waterproof cabinets and compressors will follow the sampling and sludge measurements. Placement will be in precise locations so that the diffusers create an overlapping vortex of air, which will allow the most efficient rolling of the lagoon medium. Placement of the polyurethane hose and diffusers into the lagoon is performed by boat. Once all components are in place then the initial shock bacillus can be added. This phase of the process typically requires about two weeks for complete installation for each site to be implemented. No permits are required to implement this project. Diffuser materials consists of minimally the following: stainless steel diffuser stands, non-clogging fine bubble diffusers, 1/3-3/4 hp compressors with all plumbing, air control valves, pressure relief valves, thermal overload, internal and external filters and union. Objective: mixing and contact mechanism to promote and enhance bacterial cultures for bioremediation. The mechanism will provide a compressed air vortex to promote bacterial production and efficiency in solids removal. The combination effort of the diffused air system with bacillus additives will over a **3 - 5**-year period dramatically reduce sludge volumes by 40 – 80 percent, reduce the emissions of Hydrogen Sulfide, and reduce BOD levels.

Land requirements will be based upon the biomass and inorganic matter remaining after the project is complete. The residual should be the 20-30 percent of total sludge matter that cannot be further decomposed without appreciable additional costs. Labor requirements would require several days during the initial installation phase and initial bio-loading phase of the lagoons. Everyday responsibilities will require monitoring the system to insure it is functioning properly. Weekly maintenance will include bacillus additives at a specified dosage rate. Monthly duties will include but not be limited to: sludge depth measurements, collection of waste samples, check air filters on compressor for clogging and replacement if necessary.

Producer Participation:
There will be a total of 4 producers (EQIP eligible) participants in this program. They will be offering assistance by following project goals and objectives. They will follow program format and inspect equipment at a frequency to assure continued program efficiency. The producers will offer complete support as we address the environmental concerns associated with the waste management systems.

Benefit of Research to Industry:
Agriment Services Inc, realizes that Bioremediation is not a **cure all** to the sludge problems for North Carolina. However, bioremediation can be used as a maintenance/management tool to **improve** the current Anaerobic Lagoon Systems. Many new issues concerning sludge are now required. In April 2003, per Environmental Protection Agency mandates, NCDENR issued National Pollutant Discharge Elimination System (NPDES) permits to all swine operations considered to be "large" CAFOs (Confined Animal Feeding Operations). This includes a requirement for initial sludge depth evaluation as well as annual sludge depth evaluations. The removal of sludge is required if the level of the sludge is in excess of the designed storage specifically for sludge and/or is imposing into the active treatment volume of the lagoon. Unfortunately for many farmers, most lagoons were built without adequate additional storage depth intended for sludge accumulation. Thus it is perceived that sludge removal will be required for many swine farms to abide by the NPDES permit. It is practical to assume that producers will look for alternative methods when managing sludge. Therefore, it is practical to believe that producers will look to ways to **reduce the potential for their systems to build sludge**. Sludge accumulates when the lagoon loses the capacity to properly organically breakdown the waste stream. This usually occurs with age and when the lagoon loses its capacity to regenerate the natural occurring bacteria that provide the breakdown potential. As a result, the lagoon becomes less efficient to breakdown the waste loads and the result is sludge accumulation. To effectively manage sludge, **prevention** of this scenario is a very positive approach.

Data and quantitative measurements collected from farms analyzed thus far indicate that this process can drastically **improve** the current anaerobic action in the lagoon systems. This bioremediation program can effectively **reduce** the sludge blankets and improve the quality and nitrogen content of the sludge and the lagoon liquid. The bioremediation program that has been tested has functioned effectively to counteract the following: waste shock loads, disinfectants, cleanouts, and antibiotic usage, all of which can lower the efficiency level of the current lagoon system. This system will create a stable medium for the lagoon system to function to its **maximum** capability and **reduce** the potential for exponential sludge generation. Anaerobic swine sludge can be up to 95% organic. This organic matter can be broken down further given the proper biological environment. The inorganic materials will be trapped in remainder of the biomass that can no longer be organically consumed. For example, the amount of copper and zinc in five feet of sludge prior to bioremediation would remain after the completion of the process. However the remaining sludge that is currently not cost effective to reduce further will contain a much greater concentration of copper, zinc, and phosphorous in say 2 feet of sludge. However one would have 3 more feet of storage and treatment capacity returned to the lagoon system. The system has positive impacts on phosphorus but this will require further evaluation which may or may not be evaluated under the limited period requested for this grant. Of course, the phosphorus would be attached to the biomass and metals in the two feet of sludge remaining in the scenario

above. There are additional microbes under investigation that may be tested to address the phosphorus issue in some greater capacity.

It is important to note that this process has a **positive** impact to the anaerobic lagoon system systems and does not **hinder** the anaerobic lagoon system but should be considered as and operation and maintenance tool.

A comparison of the advantage of money savings from use of the bioremediation process can best be illustrated with an example. Current cost of closure in this area ranges from .02 to .05 cents per gallon sludge material using conventional pump-out, haul, and land application methods. Comparative costs for an actual lagoon now being considered for closure using the bioremedial technology is as follows:

ITEM	CONVENTIONAL	BIOREMEDIAL
A. biological material	$ 0	$1,163
B. Equip (diffusers,compressors)	$ 0	$1,485
C. Equip(cabinets, etc.)	$ 0	$ 600
D. pump,haul,apply@.0225/gal	$9,634	$ 0
E. Land Utilization Cost		
@$50/acre on Bermuda	$ 750	$ 0
TOTALS	**$10,384**	**$3,248**

The designed SSLW of this lagoon is 44,400 pounds; therefore, the total cost per 1,000 lbs. of SSLW is as follows:

Conventional = $10,384/ 44.4 = $ 233.87 /1000 lbs. SSLW
Bioremedial = $ 3,248/ 44.4 = $ 73.15 /1000 lbs. SSLW

Annualized over a ten year period yields the following:
Conventional = $ 233.87 /10 yr = $23.39 per 1000 lbs. SSLW
Bioremedial = $ 73.15 /10yr = $ 7.15 per 1000 lbs. SSLW

The projected 10 year annualized cost of operation and maintenance for both systems would be constant in that current regulations allow the landowner/operator the choice of retaining a fresh-water (non-effluent) pond or filling with suitable material and stabilizing with appropriate ground cover. Since the same lagoon with the same volume (44,400 cu/ft) would be the intended objective of both systems, the cost of reclamation and stabilization with appropriate ground cover as well as maintenance would be the same.

Ideally funding for three years of operation is desired to adequately begin to validate the steady state performance of this proposed technology. Of course the bulk of the expenses would be incurred in the first year for the establishment of the sites, the capital costs of the majority of the operating equipment, and customary start up costs. A funding of one year should yield impressive results and hopefully will provide the proof in the project reports to demonstrate the benefits for future funding.

Overall, the anaerobic lagoon system has proven to be an effective system in all conditions. However, most lagoon systems did not take in account sludge accumulation when designed resulting in less anaerobic performance as sludge chokes the system in a variety of ways. Most lagoons in NC are approaching an average age of 10 yrs of service, which is bringing to light the sludge issues. New rules are requiring producers to perform Sludge Surveys, which is bringing to light the sludge issues with regulators. We are finding differences with the types of facilities (wean to feeder, farrow to wean, feeder to finish) when it comes to sludge buildup in relation to age and type of buildings (flush and pit). With our bioremediation program, we are trying to build up and improve the current anaerobic lagoon system so the system can return to early performance status.

Project Objectives: Reduce Sludge, Offset specific activities in growing animals that adversely effect the anaerobic lagoon system, reduce nitrogen content, gain storage and life of the lagoon system, look at specific strains of bacillus that may have a positive impact in reducing phosphorus, achieve an overall program and monitoring of what foreign substances that adversely effect the biological activity of the lagoon can be replaced by other more compatible products. Agriment Services, Inc. is conveniently located near the central offices of some of the largest pork producers in the world. Agriment Services, Inc. has an excellent network of contacts with these companies and can easily make project accomplishments available for distribution to company and contract pork producers across the country.

Procedures to achieve objectives: Install a complete, specific, bioremediation program on three of the most abundant styles of Swine Operations in NC and one non-active facility.

Conservation Priority: Our North Carolina State Conservationist for the Conservation Innovation Grants submitted the following conservation priorities to the USDA-NRCS national headquarters:

1. Effective technologies for reducing the nutrients to be land applied from CAFOs, particularly swine and poultry.

2. Effective solutions for reducing the off-site transport of soluble or easily dissolvable nutrients from the land application of manure. Most NRCS BMPs have substantial impacts on particulate phosphorous, but significantly less impact on nutrients in solution in runoff.

3. Effective solutions for addressing animal mortality. N. Carolina is currently using NRCS BMPs for composting and incineration. Many NC growers are also using burial, as allowed by state law. Incineration raises concerns associated with air quality. Composting, while effective, requires a very high level of management and input to do correctly. There are a number of companies looking at innovative alternatives to conventional composting to reduce management input, and increase efficiency.

Our biological programs will positively address priorities 1 and 2.

Description of Quality Assurance/Quality Control Plan: Agriment Services would devote the man-hours and staff support needed for quality control.

Schedule/timeline: We would like to start in the fall of 04 and have at least 1 year of research. Milestones would be to reduce the sludge blanket to a level, which would be considered compliant under design criteria of the lagoons. Also we would like to improve the quality of the manure that is land applied by intense water quality testing. We would be testing the specific parameters of direct concern with state regulatory authorities. We would like the option to renew this grant for 3-4 years to see the effects of the program in subsequent years on these facilities.

October 1 – November 30
Measure and determine sludge levels and volumes on all lagoons under program
Take Baseline water quality samples on the liquid waste and Anaerobic Lagoon Sludge
Determine loading rates and size the hardware for each lagoon

November 30 – Mar 1
Install all system components for all lagoons under this program.

Allow for Anaerobic Lagoon Systems to reach equilibrium/stabilization by letting systems operate with no additives for 15 – 90 days.

Mar 1 – Aug 15
Inoculate all lagoons under this program
Monitor Each system at a frequency to assure program efficiency
Incorporate an intense maintenance program to maintain biological colonies

Aug 15 – Sep 30
Re- Measure and determine sludge levels and volumes on all lagoons under program
Re-Take Baseline water quality samples on the liquid waste and Anaerobic Lagoon Sludge
Evaluate Program Effectiveness

Value of proposed research: We have farms available that are representative of the entire industry and the most abundant types of operations. **(See addendum for sites with maps, acres, etc.)**

Project Management: This Project will be managed out of the central office of Agriment Services, Inc. Detailed information will be collected, organized, and housed in Pink Hill, NC. Ronnie G. Kennedy Jr. will utilize company personnel, sub-contractors, and Technical Specialist to carry out the goals and objectives of the project. The project will have government oversight from the North Carolina Dept of Natural Resources under the Division of Water Quality. The Division of Water Quality will assist by reviewing and monitoring data gathered by Agriment Services, Inc and its affiliates. All project operations will be under direct supervision of Ronnie G. Kennedy Jr, President of Agriment Services, Inc., his credentials are as follows:

EDUCATION/TRAINING

BS, URBAN & REGIONAL PLANNING, GEOLOGY
EAST CAROLINA UNIVERSITY, GREENVILLE, N.C.
MAY 1993

SURVEY, LAYOUT, DESIGN OF CONSERVATION PRACTICES
U.S. DEPT. OF AGRICULTURE, RALEIGH, N.C.
AUGUST, 1993

NUTRIENT MGT. PLANNING
U.S. DEPT. OF AGRICULTURE, RALEIGH, N.C.
DECEMBER, 1994

REGULATORY IV, INTERAGENCY WETLANDS IDENTIFICATION
U.S. ARMY CORPS OF ENGINEERS, WILIMINGTON, N.C.
OCTOBER, 1995

STATE TECHNICAL SPECIALIST
DESIGN/INSTALLATION OF WASTE UTILIZATION PLANS
N.C. DIVISION OF SOIL & WATER CONSERVATION, RALEIGH, N.C.
MAY, 1996

ANIMAL WASTE MGT. SYSTEM OPERATOR CERTIFICATION
N.C. DEPT. OF ENVIR, HEALTH, AND
NATURAL RESOURCES, RALEIGH, N.C.
JUNE, 1996

LAND APPLICATION/RESIDUALS OPERATOR CERTIFICATION
N.C. WATER POLLUTION CONTROL SYSTEM OPERATORS `
COMMISSION, RALEIGH, N.C.
JUNE, 1996

SPRAY IRRIGATION SYSTEM OPERATOR CERTIFICATION
N.C. WATER POLLUTION CONTROL SYSTEM OPERATORS `
COMMISSION, RALEIGH, N.C.
JULY, 1998

WETTABLE ACRE DESIGNATION
N.C. DIVISION OF SOIL & WATER CONSERVATION, RALEIGH, N.C.
MARCH, 1999

ON-FARM ODOR/ENVIRONMENTAL ASSISTANCE PROGRAM
NATIONAL PORK PRODUCERS COUNCIL
MAY, 1999

GRADE 1 BIOLOGICAL WASTE WATER OPERATOR
N.C. WATER POLLUTION CONTROL SYSTEM OPERATORS `
COMMISSION, RALEIGH, N.C.
JULY, 2001

EXECUTIVE SUMMARY

Ronnie G. Kennedy Jr. is presently serving as President of Field Operations for Agriment Services, Inc., a North Carolina company of Waste Management Consultants with over 130 facility clients, mostly intensive swine operations, and 77 years of experience in animal waste management systems.
In this position, Mr. Kennedy provides swine facility owners with a variety of waste management system services to insure compliance with pertinent local, state, and federal rules, regulations, and standards established for the enhancement of water quality and the general environment of North Carolina. These services include the design, construction, monitoring, sampling, land application, and overall operation of intensive (confined) livestock operations. He is a State (North Carolina) designated technical specialist, granted under authority of the North Carolina Soil and Water Conservation Commission and according to the North Carolina Administrative Code, T15A:OGF.005., which authorizes Mr. Kennedy to implement the Non-discharge Rule for Animal Waste Management Systems throughout the state and provide technical assistance/guidance to swine operations, operators, and owners in North Carolina.