

## PROJECT DESCRIPTION

### INTRODUCTION

Region 2 consists of New York, New Jersey, Puerto Rico and the US Virgin Islands. It is a densely populated region that includes hundreds of miles of the Atlantic coast, Caribbean island marine environments, Great Lakes, and numerous major rivers, lakes and wetland systems. In many areas of our region, population growth and the subsequent land development have considerably impacted water quality. Increased point source discharges and nonpoint sources (NPS) water pollution have resulted in impairments to our waterways due to increased nutrients, sediments, and pathogens. Increased land development has also adversely affected farming in many areas of our region, creating competition for agricultural lands and placing increased pressure on farmers to minimize impacts. In New Jersey alone, where approximately three fourths of the waterways assessed are exceeding water quality criteria for at least one parameter, the New Jersey Department of Agriculture has issued draft Animal Feed Operation (AFO) regulations to reduce the water quality impacts from these dairy farms. Additionally, two-thirds of the streams assessed in Puerto Rico are water quality impaired. Animal feeding operations in Puerto Rico are well regulated, and new more stringent regulations went through public hearings last December. It is only a matter of time before New York and the Virgin Islands follow suit. The need in Region 2 is to educate the farmers and regulators, to construct demonstration projects that follow the new regulations, and to help farmers to comply with these regulations.

Furthermore, the states in Region 2 are aggressively moving forward to develop USEPA mandated Total Maximum Daily Loads (TMDLs) for impaired water bodies. In New Jersey, over 200 TMDLs have been prepared that focus mainly on fecal coliform and nutrient impairments. TMDLs for phosphorus have been prepared for approximately 288 square miles of watersheds in New Jersey. The implementation plans of these TMDLs target over 75 square miles of agricultural land use with required load reductions as high as 94%. TMDL's are also being prepared for some of the water bodies in Puerto Rico by both the University of Puerto Rico's Water Resources Research Institute and private consulting companies. Similarly in New York's Delaware County in the Catskills when the phosphorus concentration in the Cannonsville Reservoir is above 0.02 mg/l, economic development in the watershed is being restricted. It is clear that innovative incentive-based and cost effective approaches need to be developed to assist farmers and state regulators to address excess nutrients in the waterbodies. Therefore, better understanding of the effectiveness of agricultural management practices will also prove crucial to improve water quality and for farms to remain sustainable. Effective water quality improvement is a multidisciplinary task and includes the skills of environmental planners, agronomists, engineers from non-traditional fields (i.e., biomedical engineers, chemical engineers, civil engineers, and agricultural engineers). The Region 2 team has already reached out to a diverse group of University faculty members, experts from state and federal agencies, and other stakeholders to form working groups to address these water quality problems.

*One goal of the Region 2 Project is to enhance the communication among the land grant universities to better support local, state and regional initiatives for improving water quality.* As the project moves forward over the next three years, communication procedures will be improved to disseminate the information generated by these and other regional efforts. More faculty and stakeholders will be involved in the different aspects of the regional initiatives, namely nutrient management, animal waste management, onsite wastewater treatment systems management, and watershed management. One big change in the project will be a stronger



collaboration with the individual state's Water Resources Research Institutes (WRRIs). Bi-monthly working group meetings (mainly via conference calls) will be held to better coordinate the activities of these initiatives. Additionally, specialty conferences will be held on an annual basis to further engage and inform local, state and federal stakeholders of the Region 2 Project efforts. Furthermore, semi-annual electronic newsletters will be produced on ongoing watershed activities in the region.

*A second goal of the Region 2 Project is to develop and implement a regionally coordinated and integrated education, extension, and research program that takes advantage of the expertise at the land grant universities, minimizes the duplication of effort, and leverages multiple funding sources to effectively address water quality issues.* The land grant universities have the wide range of expertise that can support the water quality restoration and protection efforts of stakeholders in the region. There is also wide clientele that expects advice from the land grant universities. Prior to the inception of the Regional Water Quality Coordination Projects, little effort was spent coordinating the activities between universities to address the water quality problems of the region. Although the region is somewhat disjointed from a geographical perspective (US Virgin Islands, Puerto Rico, New Jersey and New York), the jurisdictions have many similarities in the water quality issues they are facing and access to the resources – specialist and research faculties - from all institutions within the Region. The agricultural operations in the whole region are facing encroachment from urbanization, facing stricter environmental regulations, and struggling to remain sustainable.

*A third goal of the Region 2 Project is to expand our working relationship with federal, state and local partners to better share resources and compound expertise to develop sound scientific solutions to our water resources problems throughout the region.* During the first four years of this project, a strong working relationship with USEPA Region 2 has been established. This relationship will continue to be nurtured as the project moves forward. Additionally, the Region 2 Project will reach out to other local, state and federal partners and invite these partners into the focus area working groups being created by this project.

In an effort to expand the project's focus and to get better faculty in the land grant universities, Christopher Obropta at Rutgers Cook College will serve as the Regional Water Quality Coordinator for the project. At Cornell, Tammo Steenhuis and Larry Chase will provide the leadership. In Puerto Rico, Jorge Rivera and Rafael Davila will provide the leadership. In the U.S. Virgin Islands, Kofi Boateng will lead. These investigators have a proven track record in securing significant grant funding and will attract greater faculty involvement in the project. The project leadership represents a range of scientists, engineers, and applied extension personnel.

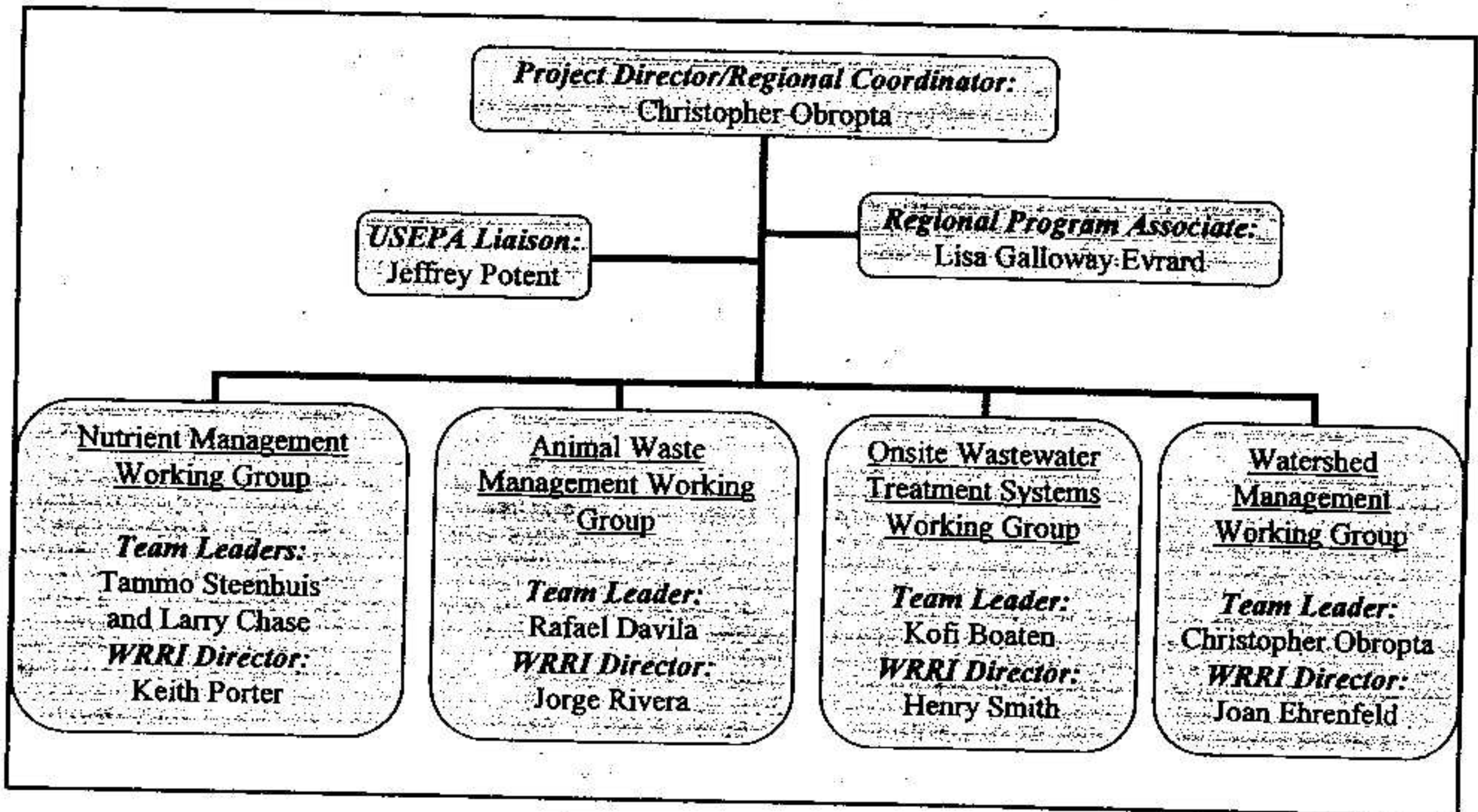
To further strengthen the project, an organizational structure of working groups has been outlined below, which assigns a responsible party to each of the regional initiatives. This formation of working groups with team leaders is the key to facilitating collaboration among academia and the state and federal partners by providing a contact point for the stakeholders. For each of the regional initiatives, the working groups are responsible for identifying on-going research, extension and education activities in USEPA Region 2 and for developing a plan that builds and expands upon the on-going efforts.

Also, the project will provide grants in each of the regional initiative areas to help researchers collect preliminary data that will allow them to leverage additional grant funding. Jeffrey Potent will be the USEPA Liaison and will focus on coordinating collaboration between the Land Grant Universities, USEPA, and other state and federal agencies. Lisa Galloway Evrard



will be the Regional Program Associate who will assist in coordinating the working groups and help them disseminate information.

Figure 1: Organizational Structure



#### GOALS AND OBJECTIVES

One goal of the Region 2 Project is to enhance the communication among the land grant universities to better support local, state and regional initiatives for improving water quality. This goal will be accomplished by achieving the following objectives:

Objective 1: The communication among the land grant universities will be enhanced through the use of the regional web site, newsletters, meetings, conference calls and electronic mail. Rutgers currently hosts the Regional Water Quality Project Web Site. The site will be enhanced to serve as a clearinghouse for reports, meeting minutes, fact sheets, and other materials that are generated by the Region 2 Project.

Objective 2: A Regional Program Associate (PA) from Rutgers will be provided to serve as a coordinator of the working groups to help disseminate the information generated at each of their meetings and conference calls. This will assure that all the information is regularly reported in a clear and concise manner and can be quickly assimilated onto the regional web site. The PA will be directly supervised by Obropta. One common problem with faculty and stakeholder working groups is that if a person is not assigned to conduct the follow up, it rarely gets accomplished. The PA will be in a position to conduct the follow up and assure that all the action items that were discussed at the meeting are accomplished.

Objective 3: The existing infrastructure will be used to enhance coordination. For this proposal, the Region 2 Project has reached out to the state WRIIs. These WRIIs have a long history of funding scientific research and have an infrastructure in place that includes a senior faculty



advisory panel and an external advisory panel. By working closely with these groups, the Region 2 Project can expand its reach to engage other faculty members and further communicate efforts of the Region 2 Project to a broader array of experts. The State Water Quality Coordinators have strong working relationships with the WRRIs that will allow for quickly achieving this objective.

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Objective 4: Working groups will be formed in each of the regional initiatives. Although preliminary working groups have already been established, the next three years of the project will see these working groups formalized and leading the effort to achieve all the goals outlined in this proposal for each of the regional initiatives. The working groups will each have a team leader who is directly related to the Region 2 Project, along with supporting faculty and local, state, and federal partners. Each working group will develop a research, education and extension agenda. The first step with the working groups will be to identify on-going research, education and extension efforts in the Region that can benefit from collaboration with the Region 2 Project.

Objective 5: Multi-state, multi-institutional, and/or multi-disciplinary proposals will be developed to leverage additional funds to address water resources issues in the Region. The working groups have the expertise and experience to review the needs of the Region and to identify funding sources for research, education and extension projects to address these needs. Members of each working group will collaborate on writing proposals, thereby minimizing each individual's proposal writing effort while generating superior proposals given the expertise involved. Since the members of each working group have a solid history of scholarship, recruiting additional group members to work on proposal and projects should be fairly easy.

*A third goal of the Region 2 Project is to expand our working relationship with federal, state and local partners to better share resources and compound expertise to develop sound scientific solutions to our water resources problems throughout the region.* This goal will be accomplished by achieving the following objectives:

Objective 6: Additional federal, state and local agencies will be engaged as project partners. A criticism of the Region 2 Project in the past has been that it is too centered on USEPA's needs and failed to engage other partners. Most of the faculty members who are involved in the working groups already have well-established relationships with local, state and federal agencies. These working groups will be the key to recruiting non-academic representation to each of the working groups. Resource sharing and funding sources will open up simply by bringing these stakeholders into the working groups.

Objective 7: The visibility of the USDA CSREES Water Quality Program will be expanded within the Region. The working groups will play a key role in achieving this objective by hosting workshops, professional roundtables, stakeholder meetings, and needs assessments. Additionally, the web site will be enhanced to quickly post pertinent regional water resource information and materials generated by the working groups, as well as by other organizations.



## **METHODS**

During the first four years of this project, water quality needs assessments were conducted to identify key regional issues. Based upon these assessments, four of the eight USDA CSREES National Integrated Water Quality Program (NIWQP) themes were selected as focus areas for the Region 2 Project: Animal Waste Management, Nutrient Management, Watershed Management, and Water Conservation and Agricultural Water Management. Within these focus areas, regional initiatives on animal waste system management on small farms, water quality trading, and onsite wastewater treatment management have been developed to help stakeholders focus on specific issues within the theme areas. These initiatives have proven to be very successful as rallying points to stimulate stakeholder collaboration. Several small grants have been used to engage faculty in these areas. Several of these faculty members have used the funding to leverage larger grants.

A leadership team (see Figure 1) has been formed consisting of extension and research faculty, State Water Quality Coordinators, and a USEPA Liaison. The Directors of the State WRRIs will serve on this leadership team to assure the participation of the WRRIs in the Region 2 Project. The State Water Quality Coordinators have a strong extension, as well as applied research experience, that will allow them to help develop practical solutions for the diverse group of agricultural and non-agricultural stakeholders. During the first year, the leadership team will meet on a bi-monthly basis to guarantee the project is moving forward and showing impact.

### **A. ANIMAL WASTE MANAGEMENT ON SMALL FARMS**

Many farms with animals in confinement in Region 2 are small farms and do not fall under the category of Concentrated Animal Feeding Operations (CAFO's). Therefore, they are not covered by federal regulations. However, the waste from these farms has a potential detrimental effect on the quality of surface and groundwater if it is not handled properly.

During the first two years of the Region 2 Project, input was received from small farmers and other stakeholders to identify factors that directly affect them. Some of these are: not enough land area, proximity to urban development, hilly topography, karst soils, pressure from environmental activists and limited technical resources to help them with practical and economical alternatives to deal with what they realize are serious problems. The farms that are most affected are: small dairies, swine, poultry farms and horse farms. The issue of handling dead animals is also critical and must be addressed.

Small farmers cannot afford the economic burden of implementing an adequate waste management plan. Economic incentives are limited and the technical resources offered through the Agricultural Extension Service (AES) and the Natural Resources and Environmental Conservation Service (NRCS) are not enough to meet the demand.

Many times conventional waste treatment methods like wastewater lagoons, tanks and spraying systems do not work, and different approaches are needed so that these farmers can stay in business. County agents and other technical personnel working with farmers need to have access to continuing education in animal waste management.

### **Ongoing Research, Education and Extension**

The University of Puerto Rico has been working closely with small farmers to help them implement appropriate animal waste management systems. These systems are designed to be protective of the environment, while being cost effective. For example, they designed a chicken waste lagoon and waste management plan for an egg laying operation. These projects not only



corrected an immediate environmental concern but provided models for other farmers facing similar circumstances. Additionally, during the first two years of the Region 2 Project, a computer template to aid in designing waste management system components was put together and is being used by some of the AES County Agents in Puerto Rico.

Cornell University has been a national leader in research in non-conventional animal waste treatment systems. Numerous research and demonstration projects have been completed in anaerobic waste treatment and biogas production since the 1980's. Solid liquid separators have also been widely studied. Preliminary work with bench top digesters in Puerto Rico has shown that waste from small animal operations can be treated to an acceptable level using anaerobic digestion and at the same time a combustible gas with multiple possible uses in the farm is produced. Odor control, which is essential for community relations, has also been achieved by using this technique. The technical knowledge developed in Cornell under severe winter conditions could be applied in tropical conditions in Puerto Rico with potentially better results. The professional relations that have been developed through regional collaboration have led to technical discussions in this topic.

As part of the Rutgers effort in this focus area, funding from the Region 2 Project was used by David Lee, County Agricultural Agent of Salem County and Michael Westendorf, Associate Extension Specialist to research Animal Waste and Water Quality. The project has tested the nutrient levels and pathogen population in four critical areas of the impaired region of Salem River. Nutrient analyses were conducted on four participating bovine farms and four equine farms in this region of the watershed. The aggregate results from the nutrient analyses of the farms were compared to the nutrient levels in the watershed. These data have been presented at several educational meetings for agriculture landowners.

Additionally, Rutgers is currently retrofitting their on-campus animal facility with innovative animal waste management practices using funding provided by the State of New Jersey. A short-term storage facility will be constructed at the Equine Science Center and be used as an educational component for twilight meetings and workshops. As other elements of the manure management facilities are implemented, the effectiveness of these facilities on minimizing impacts to water quality from animal waste will be evaluated. The results of this research along with a "how to" session on designing these facilities will be incorporated into the Equine Science Center's overall education/extension program. One of the key aspects of this proposal is the development of a composting facility to manage most of the manures produced on the Cook College Farm. This will allow us to conduct research and program demonstrations for New Jersey horse and livestock farmers.

#### **Region 2 Project Proposed Contributions**

The computer template developed by the University of Puerto Rico to aid in designing waste management system components will be promoted and expanded using Region 2 Project funding. A training meeting in animal waste management in each of the five regional offices of the Agricultural Extension Service (AES) will be offered. AES county agents and personnel from the State Department of Agriculture and Environmental Quality Board will be invited to these meetings.

A small demonstration anaerobic digester is planned in one of the agricultural experiment station farms in Puerto Rico in which a dairy farm is operated. This experiment station farm is used as a training center for the AES county agents and the State Department of Agriculture agronomists. The proposed location is in the Lake Loiza watershed. Lake Loiza provides



potable water to one million people in the metropolitan area of San Juan and has been a priority watershed for nonpoint pollution control. This demonstration project will not only have an impact on the farming community but also on all the population that benefits from the lake.

Cornell University has just been awarded a USDA-NRCS grant which has led to the formation of a steering committee for "Transferring Innovative Manure Management Technology in the Northeast" under the leadership of Norm Scott. Participation in this committee will promote further cooperation in the region and expand our research, education and extension base.

Another issue of importance to small farmers is the disposal of dead animals. The farmers most affected are the poultry and swine farmers. Disposal of dead animals on manure pits is not permitted in Puerto Rico. A dead animal disposal pit, separated from the rest of the waste treatment system is required. These pits are a source of offensive odors and of many complaints by neighbors close to them. Dead birds and pigs have successfully been disposed of in composting piles elsewhere in the region. This expertise could benefit both Puerto Rico and the Virgin Islands.

Solid liquid separators have been used successfully in small swine farms in Puerto Rico and are accepted by the regulatory agencies. The UVI has shown interest in establishing a demonstration project to evaluate the effectiveness of solid liquid separators in Saint Thomas. In the first year of the project, one of these systems will be built and tested in the VI. A simple research protocol to test its effectiveness will be developed with the help of Cornell.

Rutgers Equine Science Center will serve as a New Jersey location to disseminate information from the Region 2 Project efforts in this focus area. Training workshops and undergraduate and graduate courses are already being scheduled to take advantage of this center. The innovative animal waste management practices will be taught at these courses and workshops, taking full advantage of the research, education and extension efforts of the Region 2 Project.

#### **Schedule for the First Year of this Project**

Months 1-2: Identification and evaluation of ongoing projects by working group.

Deliverable: Project abstracts and status report on the working group web page.

Months 2-4: Development of research, education and extension agenda.

Deliverable: Agenda posted on web site.

Months 4-8: Development of extension workshops for animal waste management.

Development of preliminary design for demonstration anaerobic digester in Lake Loiza watershed.

Deliverable: Two workshops given on animal waste management: 1) Puerto Rico and 2) NJ.

Preliminary engineering plans for demonstration project and study design.

Months 8-12: Development of preliminary design for demonstration solid liquid separators in Saint Thomas.

Deliverable: Preliminary engineering plans for demonstration project and study design.

#### **Expected Results**

By developing demonstration projects and offering workshops, the animal waste management focus groups will be able to reach a large audience. In addition to the above-referenced deliverables, we expect a large number of farmers will use the information provided in



the workshops to address environmental issues on their farms, thereby bringing them into compliance with new regulations.

Team Leader: *Rafael Davila*, Professor, University of Puerto Rico

Supporting Faculty and Partners: *Gustavo Martinez*, Professor, Dept. of Agronomy, UPR (Soil Chemist); *Victor Snyder*, Dept. of Agronomy, UPR (Soil Physicist); *Jorge Rivera*, Professor, Civil Engineering, Head of the PR WRRI; *Amos Morales*, Economic Development Bank of Puerto Rico; *Michael Westendorf*, Associate Professor, Dept. of Animal Sciences, Rutgers University; *Monique Purcell*, NJ Dept. of Agriculture; *Karyn Malinowski*, Dean of Outreach and Extension and Director of Equine Science Center, Rutgers University; *Norm Scott*, Professor, Dept. of Biological and Environmental Engineering, Cornell University; *Brian Aldrich*, Senior Extension Associate, Dept. of Biological and Environmental Engineering, Cornell University; *David Belcher*, Extension Specialist, Dept. of Biological and Environmental Engineering, Cornell University.

## **B. ONSITE WASTEWATER TREATMENT SYSTEM MANAGEMENT**

Onsite wastewater treatment systems (OWTS) have been identified by our clientele, consisting of people in academia, regulatory agencies and the general public, as a significant issues affecting water quality in Region 2. Many of the TMDLs being developed in the Region have identified onsite wastewater treatment systems as a significant source of nutrients and pathogens impairments.

Conventional OWTS are utilized to handle domestic wastewaters in areas where connections to public treatment systems are not accessible or are overloaded. For these systems to be effective they must be designed, constructed and managed adequately. The primary advantage of these systems is that they do not represent additional load to the public treatment systems. The main disadvantage is that they are limited by soil characteristics, the size of the residential lots, the pollutant removal capacity of the technology being utilized, and the limited or nonexistent management that these systems generally receive.

The limitations on the use of the conventional OWTS in rural and suburban areas of the region include limited available land area and poor soil and drainage characteristics. Conventional systems, which consist of a septic tank with two compartments and an infiltration field, can be replaced with an array of innovative technologies that incorporate multiple stages of wastewater treatment. Unfortunately many designers are not familiar with innovative OWTS and need to be trained on their use.

### **Ongoing Research, Education and Extension**

As a result of collaboration within Region 2 and other regions, a workshop on decentralized wastewater systems was offered in Puerto Rico and the Virgin Island last year. The workshop was presented by a team of trainers from the Consortium of Institutions for Decentralized Wastewater Treatment Systems, lead by George Loomis who is the Director of the Onsite Wastewater Training Center at the University of Rhode Island. These workshops were well attended by our clientele and created enthusiasm on the use of these systems and on improved management of existing systems.

An example of the need for innovative wastewater treatment technologies is a government sponsored low cost housing project in Puerto Rico, the "Special Communities Project." The Special Communities Project includes 300 low income communities throughout the Island with new housing units on lots of 350 square meters (approximately 1/10 of an acre).



involved in the establishment of a New Jersey chapter of the National Onsite Wastewater Recycling Association (NJOWRA), assisted with local onsite wastewater system management projects (including developing a GIS-based management system for one municipality), and worked with the Rutgers Office of Continuing Professional Education to update curricula use for practitioner training.

In New York, funds from the Region 2 Project have been used to enhance a Cornell University municipal officials training program to include additional information on onsite system management and the newly published USEPA and onsite system Management guidelines. We're also assisted in the planning and presentation of a major conference in central New York on onsite systems and are actively working with the State of New York on their efforts to improve onsite system management statewide.

Through our USEPA Liaison, we have worked closely with USEPA Region 2 to convene regional forums on onsite system management and innovative technologies and have actively contributed to USEPA's development of a regional strategy for onsite system management.

### **Region 2 Project Proposed Contributions**

The regional program has established a leadership position on onsite system management within our region and nationally. We will utilize this reputation to engage additional faculty and agency partners, and to secure additional sources of funding. In the first year of funding under this new grant, the regional team plans to continue with efforts in capacity development for onsite system management among our partner universities and with federal and state agencies throughout the region. This will include conducting "train the trainer" sessions led by extension educators, participating in additional local demonstration projects, and collaboration with an expanded group of university faculty to identify and help initiate an array of relevant research and educational projects addressing needs identified through our needs assessment. We will continue to work with USEPA Region 2 in the execution of their onsite system strategy, to maintain a leadership role for the Land Grant Universities, as related to research, education and extension.

The workshop that was presented by a team of trainers from the Consortium of Institutions for Decentralized Wastewater Treatment Systems was a great success in both educating the stakeholders in the Virgin Islands and Puerto Rico but also to help UVI and UPR build capacity to hold follow up workshops and training sessions. Additional workshops that focus on alternative systems and proper management of onsite wastewater treatment systems will be held in the Virgin Islands and Puerto Rico. Furthermore, Rutgers has taken the information gained from attending this workshop and is introducing some of the materials into their ongoing continuing professional education curriculum on septic system design and management.

Very little work has been completed in Puerto Rico and Virgin Islands to assure the proper management of onsite wastewater treatment systems. Rutgers and Cornell have both been examining tracking software that could be used to better manage these systems. The Region 2 Project will work closely with stakeholders in the Virgin Islands and Puerto Rico to set up



demonstration projects using tracking software as a component of an onsite wastewater management program. A few sensitive areas in the Virgin Islands and Puerto Rico like bays and estuaries have been identified and many have special programs. In fact, we are just starting to work on Jobos Bay and we have identified about 250 cesspools. By locating sub-standard systems, targeted educational programs can begin to better manage these systems and possible upgrade these systems with alternative technologies that would be more protective of the environment.

#### **Schedule for the First Year of this Project**

- Months 1-2: Identification and evaluation of ongoing projects by working group.  
Deliverable: Project abstracts and status report on the working group web page.
- Months 2-4: Development of research, education and extension agenda.  
Deliverable: Agenda posted on web site.
- Months 4-8: Development of educational workshops for OWTS.  
Identification of sensitive areas to implement onsite wastewater management system management demonstration projects using the tracking software in the Virgin Islands and Puerto Rico.  
Deliverable: Minimum of two workshops given on onsite wastewater treatment systems in Virgin Islands and Puerto Rico.  
Study design for demonstration projects.
- Months 8-12: Implement demonstration projects in Virgin Islands and Puerto Rico.  
Deliverable: Project report for posting on web site and dissemination through Region 2 Project.

#### **Expected Results**

By developing demonstration projects and offering workshops, the onsite wastewater treatment system management focus groups will be able to reach a large audience. In addition to the above-referenced deliverables, we expect a large number of municipal officials and contractors to use the information provided in the workshops to address onsite wastewater treatment system problems in the Region.

**Team Leader:** *Kofi Boaten*, Department Chair, University of the Virgin Islands.

**Supporting Faculty and Partners:** *Rafael Davila*, UPR; *Jeffrey Potent*, Senior Extension Specialist, Cornell University; *Jose Norat*, School of Public Health, Medical Sciences Campus, UPR (Environmental Planner); *Glorisel Negros*, Environmental Specialist with the Extension Service of UPR; *Raul Sanpini*, Coastal Zone Management Program, Dept. of Natural and Environmental Resources; *Julie Wright*, NRCS on UVI; *Dale Morton*, UVI Extension; *Fred Bowers*, NJDEP; *Kevin Bricke*, USEPA Region 2; *John Mele*, Chair of New Jersey Onsite Wastewater Recycling Association; *Christopher Obropta*, Extension Specialist in Water Resources and Assistant Professor, Rutgers University; *Tammo Steenhuis*, Professor, Cornell University; *Larry Geohring*, Senior Extension Associate, Cornell University.

#### **C. NUTRIENT MANAGEMENT**

A new regional initiative will be launched with this second round of grant funding that will address the broad array of nutrient management practices and their effect on water quality issues facing our region. Many impaired water bodies are receiving nutrient loadings from a



complex mix of both point and nonpoint sources. States in our region are actively developing TMDLs and watershed plans that identify needed nutrient load reductions from point sources as well as from agriculture and other unregulated nonpoint sources. Currently, the processes of planning, selecting and implementing nutrient management practices are limited by: 1) *the need for integration of computer algorithms* that can apply existing scientific knowledge to aid producers and environmental planners in optimizing farm and business economics while minimizing environmental losses; and 2) *lack of scientific quantification* of the effects of management decisions and climatic conditions on availability and transport of nutrients, particularly phosphorus, in the runoff water from agricultural and forests lands. Consequently, the next phase of nutrient management planning to help managers meet TMDL water quality criteria (as well as their business objectives) requires the development and implementation of integrated nutrient management tools. The implementation of these nutrient management planning tools has great potential to reduce costs for the farm and the community in meeting environmental objectives especially related to nutrient trading.

To facilitate better and more efficient nutrient management practices, the regional initiative will draw on the internationally recognized expertise of faculty under the leadership of Tammo Steenhuis and Larry Chase. The initiative will also build on the accomplishments achieved through numerous nutrient and watershed management research, planning and assessment programs that have been carried out throughout Region 2. Successful initiatives where land grant university faculty have played an active role include the New York City Watershed Program, the Great Lakes Program and several estuary initiatives within our region that are elements of the National Estuary Program. The goal of this regional initiative will be to create a structure that fosters new collaborations among faculty and agency partners to address complex nutrient management issues in the unique landscapes in this region. Significant external funding has been secured in this area by the investigators, and funds from these projects will be utilized to further enhance collaborations in support of the goals and objectives of the Region 2 Project and the USDA CSREES National Integrated Water Quality Program.

We have convened a nutrient management workgroup that will serve as the focal point in this initiative. Larry Chase and Tammo Steenhuis will serve as team leaders and engage supporting faculty and partners from throughout the region. The effort will be supported by the Region 2 Project through dissemination of information through web based fact sheets, newsletter articles, and will link the regional nutrient management website to the project web site.

#### **Ongoing Research, Education, and Extension**

Cornell currently has a multi-faceted approach in the area of nutrient management. For example, the Town Brook working group, consisting of representatives from Cornell, USDA, Penn State, the NYCDEP and the USGS, has done extensive field testing of nutrient management practices in the Catskills area. They have also developed models that will be used to realistically evaluate nutrient management practices. These models will be used by NYCDEP for evaluating practices to reduce phosphorus (P) in source water. Another initiative is the development of a P index for New York. A number of field demonstration projects have also been conducted on dairy farms to examine the potential impact of the CNCPS program on nutrient inputs and excretion by dairy cattle. Nitrogen excretion has been decreased by 5 to 25% in these on-farm trials while milk production was maintained. Phosphorus excretion has also been reduced by 10 to 30% in these same trials. A major effort is underway to obtain whole farm mass balance data on a number of New York dairy farms to determine the potential for



decreasing nutrient inputs and outputs. Previous work (older data based on a limited number of farms) has indicated that about 60-75% of the nitrogen and phosphorus imported onto the dairy farm remain are not removed from the sale of milk and meat. The current effort is designed to include a wider spectrum of farms that represent various sizes, levels of milk production and herd management practices. One example would be to compare farms using rotational grazing versus conventional feeding practices.

The nutrient management initiative will also build on the work of the Region 2 Project in water quality trading. Over the past two years the regional team has engaged faculty and other stakeholders to assess trading feasibility in several critical watersheds throughout the region, and has begun developing nutrient trading projects in areas where this innovative, incentive-based approach has the potential to optimize the utilization of available resources to improve water quality. Obropta and Potent began by facilitating a dialogue among stakeholders in New Jersey to provide basic information on trading and to explore its potential feasibility. This led to Rutgers conducting a preliminary trading feasibility study for the Raritan Basin in central New Jersey. The New Jersey Department of Environmental Protection subsequently requested that Rutgers prepare a proposal for a trading project for the Upper Passaic River watershed, which faces severe nutrient impairments and is currently undergoing the development of a phosphorus TMDL. This Rutgers-led project, involving a partnership with Cornell University faculty, the New Jersey DEP, a local association of wastewater treatment plant operators, the Regional Water Quality Program and several other organizations, has successfully secured \$900,000 in funding from the USEPA.

The Region 2 Project also held discussions with faculty, USEPA management and stakeholders in New York and Puerto Rico to explore trading project opportunities in those jurisdictions. Additionally, the Region 2 Project has been involved in discussions on a possible trading project for the Lake Loiza watershed, which is a drinking water supply for over one million people in the City of San Juan, Puerto Rico. Experience gained in developing trading projects in New York and New Jersey will be brought to bear in developing a project in Puerto Rico and other subsequent trading efforts throughout our region.

Furthermore, the UPR has been working with the Puerto Rico Department of Natural Resources and the Environment, the School of Public Health and the Department of Agriculture in Jobos Bay, which is part of the National Estuary Program. We will start sampling for salts and nutrients in various wells in farms property of the Land Authority of Puerto Rico with the objective of getting a quantitative idea of the levels these elements in the groundwater and if needed, recommend best management practices. This project builds upon the Water Resources and the Environment Institute's work in this estuary including conducting inventories, monitoring, and modeling.

#### **Region 2 Project Proposed Contributions**

Our work on integrated optimization tools for managing nutrients is essential for 1) evaluating potential reductions in nutrient importation via purchased feeds and fertilizers, 2) improving decisions regarding the allocation of manure and fertilizer to the land base, and 3) addressing potential loss of nutrients to watercourses. We will develop planning tools that can incorporate decision processes in context with spatial position controls and that will further improve the producer's ability to address both economic and environmental concerns and aid can aid in nutrient trading programs. These planning tools will be developed with the help of stakeholders, extension personnel and researchers throughout the region during the remainder



2005 and the beginning of 2006. In 2007 the package will be field tested as a planning tool with participation of all regions. A workshop on its use will be held.

Additionally, funding will be used for obtaining nutrient mass balance data on dairy farms throughout Region 2, where current datasets are based only on New York farms. In addition, on-farm demonstration projects will be conducted to quantify the changes in nutrient intake and excretion that can be attained on dairy farms. The farms selected would represent farm sizes and types for which we currently do not have data. The results will be included in educational materials presented at nutrient management meetings.

With respect to water quality trading, we will move forward with the three trading projects described above in addition to strengthening our working relationships in this area with USEPA and other federal and state agencies. The current regional team will continue to lead this effort; however we will work closely with the new nutrient management team to coordinate efforts where appropriate. In the latter part of 2005, we will collaborate with USEPA Region 2 to host a regional training session and with USEPA Regions 2 and 3 to host a national forum on incentive-based approaches in environmental management. Additionally, UPR will continue their work in the Jobos Bay watershed. All research, education and extension information generated from these projects will be disseminated through the Region 2 Project.

#### **Schedule for the First Year of this Project**

Months 1-2: Identification and evaluation of ongoing projects by working group.

Deliverable: Project abstracts and status report on the working group web page.

Months 2-4: Development of research, education and extension agenda.

Deliverable: Agenda posted on web site.

Months 4-8: Development of integrated management tool structure in consultation with stakeholders; identify sites for farm nutrient management demonstrations.

Deliverable: Web pages with integrated model structure and preliminary plans for demonstration sites.

Months 8-12: Initial coding of shell for integrated management tool; implementation of plans of demonstration farms.

Deliverable: Preliminary shell code; summary of initial results of demonstration farms.

#### **Expected Results**

The proposed nutrient management tool development and demonstrations are intended to facilitate farm operations and long-term sustainability while remaining in compliance with environmental regulations. A component of the project is designed to determine the economics of various nutrient management options essential to sustain or improve both water quality and the farm business. The outreach efforts of the proposed project will be train-the-trainer oriented and developed to meet producer educational programs. Since both public and private efforts currently exist as viable components of various farming operations, the acceptance and delivery of the proposed nutrient management tools to both public and private sector personnel is essential. The development and delivery of these tools is essential to facilitate the complex and often contradictory decision-making processes faced by both the planners and producers in nutrient trading.

**Team Leaders:** *Tammo Steenhuis*, Professor, Biological and Environmental Engineering, Cornell University and *Larry Chase*, Professor, Animal Science, Cornell University



Supporting Faculty and Partners:

**Keith Porter**, Director of the WRRI, Cornell University; **Christopher Uchirin**, P.E., Professor, Dept. of Environmental Sciences, Rutgers; **Peter Strom**, Professor, Dept. of Environmental Sciences, Rutgers; **William Goldfarb, J.D.**, Professor of Environmental Law, Dept. of Environmental Sciences, Rutgers; **Gregory Poe**, Professor, Dept. of Applied Economics and Management, Cornell University; **Richard Boisvert**, Professor, Dept. of Applied Economics and Management, Cornell University; **Quirine Ketterings**, Prof. Asst., Crop & Soil Sciences, Cornell University; **Brian Richards**, Sr. Research Associate, Biological & Environmental Engineering, Cornell University; **Jeffrey Potent**, Senior Extension Specialist, Cornell University; **Patrick Matarazo**, Executive Director of the Passaic River Basin Alliance, A Coalition of Wastewater Treatment Plants in the Passaic Basin; **Barbara Hirst**, Director of Bureau of Evaluation and Restoration, NJDEP; **Kevin Bricke**, USEPA Region 2.

**D. WATERSHED MANAGEMENT INITIATIVE/WATER REUSE AND AG WATER MGT.**

It is difficult to separate water quality issues with water quantity issues especially in rapidly urbanizing watersheds where agricultural land uses and urban land uses are competing for the same resources. This effort would build upon on-going research being conducted at Rutgers and throughout the region. Currently, Rutgers has several projects being funded by NJDEP's 319h program that can be incorporated into this regional initiative. Through the efforts of the working group assembled for this focus area, the Regional Water Quality Project would allow the on-going research to be expanded and/or complemented with education and extension components.

Ongoing Research, Education and Extension

Rutgers is currently conducting research on Regional Stormwater Management Planning as a Total Maximum Daily Load (TMDL) implementation tool. These Regional Plans address both water quality and water quantity issues on a watershed basis. Hydrologic, hydraulic and water quality modeling are used to identify flooding issues, water quality issues and groundwater recharge issues. The plans attempt to balance the various land uses within the watershed to minimize water resources problems and restore or protect the designated uses of the waterways. These Regional Plans require the cooperation of local, state and federal stakeholders to restore and protect a common resource (a waterway) that may span multiple municipalities, several counties, and a wide variety of land uses. These plans ultimately recommend watershed management strategies that are based on good science including water conservation, best management practice (BMP) installation, and agricultural water management practices. Rutgers is currently preparing three regional stormwater management plans in mixed land use watersheds.

Additionally, Rutgers is currently working on three Watershed Restoration Plans: one in a mixed use watershed and two in agriculturally dominated watersheds. These plans are to serve as a comprehensive TMDL implementation plan for impaired waterways. These plans require the collection of data to improve the TMDL for the waterway as well as identify where management practices are needed to achieve the required TMDL reductions. These projects rely strongly on multi-disciplinary partnerships that include engineers, scientists, economists, and lawyers. Additionally, the projects require multi-agency partnerships including NRCS, the local soil conservation districts, the NJ Department of Agriculture, local agriculture commodity groups, State and federal regulators, and University faculty researchers and cooperative extension agents.



Furthermore, Rutgers is currently working with farmers on agricultural water management and water reuse. Several nursery operations in the southern part of New Jersey have installed tailwater recovery systems, which collect irrigation and rainfall runoff so that it can be reused. When these systems are not reusing the water, they tend to discharge high nutrient loads directly to an already impaired stream. Rutgers has designed a treatment wetland to receive the discharge from a tailwater recovery pond to evaluate if a wetland is an effective means to reduce the pollutants entering the stream.

### **Region 2 Project Proposed Contributions**

Although the working group will evaluate these projects, as well as any others that they identify within the Region for this focus area and determine the best method to enhance these projects, listed below are some initial efforts that would be conducted under the Region 2 Project. The Regional Water Quality Project will be used to enhance the educational and extension components of these projects, as well as provide additional research opportunities. All the information generated from these projects will be disseminated through the Region 2 Project via web site, fact sheets, white papers, and peer-reviewed publications. Regional extension workshops will be held on how to develop regional stormwater management plans and watershed restoration plans, as well as how to implement these plans. Additionally, these plans in part will rely on voluntary agricultural management practices to restore water quality in the watershed. The Region 2 Project will provide educational opportunities for the farmers on these practices, as well as educational opportunities for municipalities to help them understand the impact of agricultural operations versus other land uses such as residential, commercial and industrial land uses. The working group will also collaborate on preparing proposals to build upon the existing projects. The 319(h) programs and federal USDA and USEPA programs would be suitable for funding these efforts, especially since some data have already been collected as part of these ongoing studies.

Additionally, Rutgers is hoping to expand its education program to develop a Watershed Management/Water Conservation/Agricultural Water Management Curriculum to build upon the research being conducted in the above-referenced projects. These projects provide a strong foundation for an academic curriculum in Watershed Management/Agricultural Water Management to incorporate undergraduate and graduate students into these research activities. This effort clearly helps connect water quality and water quantity issues, which is very much in line with USDA CSREES' agenda. On an annual basis under Joan Ehrenfeld, the New Jersey WRRI currently awards competitive grants to graduate students to conduct research. To complement this ongoing program, funding from the Region 2 Project will be used to award competitive undergraduate summer internships to conduct research in watershed management, water conservation, and agricultural water management throughout New Jersey. Additionally, funds will be allocated for special undergraduate projects within the Delaware River Basin, which will promote collaboration among USEPA Region 2 and 3.

The Region 2 Project is also currently developing a statewide NEMO network with the assistance of the NEMO National Facilitation Project. Currently, Rutgers, Monmouth University, Burlington Community College and New Jersey Sea Grant are working together to bring NEMO programming to New Jersey. This effort builds upon work originally funded by the Region 2 Project in the Barnegat Estuary Watershed and will continue to flourish under the Region 2 Project.



Additionally, Rutgers has begun to develop a volunteer monitoring training center at the Rutgers EcoComplex, one of Rutgers NJAES facilities. This effort will work closely with the National Facilitation Project on Volunteer Monitoring. Existing resources from the National Project will be used in the training program and new programming will be created by this working group to train volunteer monitors who are sampling the benthic macroinvertebrate communities. All newly developed programming will be shared with the National Facilitation Project.

#### **Schedule for the First Year of this Project**

Months 1-2: Identification and evaluation of ongoing projects by working group.  
Deliverable: Project abstracts and status report on the working group web page.

Months 2-4: Development of research, education and extension agenda.  
Deliverable: Agenda posted on web site.

Months 4-8: Development of extension workshops for ongoing projects.  
Preparation of working group proposals to enhance research, education, and/or extension components of ongoing projects.  
Development of volunteer monitoring programming for macroinvertebrate sampling.  
Deliverable: Minimum of one regional workshop given on ongoing projects.  
Minimum of one proposal prepared and submitted for grant funding.  
Minimum of one training workshop for volunteer monitors.

Months 8-12: Development of Watershed Management/Water Conservation/Agricultural Water Management Curriculum.  
Development of NEMO Workshop that suits New Jersey's needs.  
Deliverable: Curriculum posted on web page and submitted to peers for review.  
Minimum of one NEMO Workshop in New Jersey.

#### **Expected Results**

The development of working groups to address a critical issue is common place among the academic partners and local, state and federal partners of this project. Clearly, these working groups are most successful in situations where the partners are benefiting by their participation. This could be in terms of successful proposals, peer-reviewed publications, and/or satisfying extension responsibilities. By providing technical support to assist in assembling multi-disciplinary proposals and coordinating the proposal writing effort, the Region 2 Project will clearly make it beneficial for partners to actively participate in the working groups.

Due to all the ongoing research projects, this working group can have an immediate impact by providing extension workshops for stakeholders, as well as developing a comprehensive curriculum that can be used to educate the next generation of Agricultural Engineers, Civil Engineers, Environmental Scientists, and Soil Scientists.

**Team Leader:** *Christopher Obropta*, Extension Specialist in Water Resources and Assistant Professor, Department of Environmental Sciences, Rutgers University

#### **Supporting Faculty and Partners:**

*Joan Ehrenfeld*, Director of New Jersey WRR, Rutgers; *Christopher Uchrin, P.E.*, Professor, Dept. of Environmental Sciences, Rutgers; *Peter Strom*, Professor, Dept. of Environmental



Sciences, Rutgers; *William Goldfarb, J.D.*, Professor of Environmental Law, Dept. of Environmental Sciences, Rutgers; *James Johnson*, Cumberland County Extension Agent; *Lenny Rera*, Soil Conservation District Officer; *Michael Weinstein*, NJ Sea Grant

## **METHODS CONTINUED (FOR ALL FOCUS AREAS)**

### **Evaluation of the Results**

Measures will be used to evaluate the results of the efforts of each working group will include stakeholder evaluations, the number of peer-reviewed journal articles, the number of people and farm businesses affected together with the dollars saved using better nutrient management practices, and the reduction in pounds of pollutants that are discharged to the waterways in the Region.

### **Data Analysis and Interpretation**

Data from the individual projects will be analyzed and interpreted using the appropriate scientific methods. Since this is a regional "coordination" project, each coordinated activity will have to be approached in a unique fashion. The working groups will provide a review of quality assurance and control procedures when reviewing existing and proposed studies.

### **Communication Plan**

The web site will be one key method to disseminate information to the stakeholders and the general public. Additionally, specialty conferences and workshops will be held on an annual basis to further engage and inform local, state and federal stakeholders. Furthermore, semi-annual electronic newsletters will be produced on each of the initiatives. Also, regular publications of the partnering organizations will be used to further disseminate information. Each working group will identify newsletters, magazines, and peer-reviewed journals that would be appropriate for disseminating research results and other information.

### **Potential Pitfalls**

One potential pitfall is the reliance of the voluntary actions of farmers to implement water quality and water conservation measures. Although US Farm Bill funding is available to many of these farmers to implement environmental controls, some farmers are hesitant to apply for Farm Bill funding. To change this attitude, we need to explore the "human dimension" of the problem, namely why are farmers unwilling to take action and what motivation factors need to be put in place to encourage them to take action. Rutgers Human Ecology Department may be able to play a role in addressing this issue. William Hallman, Karen O'Neill and Caron Chess are faculty in this department who may be able to assist in this endeavor. Some of the funding that has been allocated for student research projects under the New Jersey WRRI can be targeted for work to explore the "human dimension" and how to motivate stakeholders to address water resources issues.

Another potential pitfall is the lack of available funding on the local, state and federal level for water quality projects. Strong teams have been assembled for each of the focus areas, but without funding opportunities to pursue, these teams will have very little ability to conduct the research, education and extension activities that are needed to solve the water quality problems in USEPA Region 2. As funding opportunities continue to diminish on the state and federal level, these teams may have to pursue private foundation funding or direct legislative appropriations to generate the funds needed to conduct their research and extension projects.



### Limitations to Proposed Procedures

Formation of working groups with diverse expertise has been a very effective way of addressing environmental issues throughout the country. Although these groups tend to work better when face to face meetings are frequently held, the geographic nature of the Region would require extensive travel funds to have these face to face meetings. Therefore, the working groups will have to rely on conference calls, emails, and possibly video conferencing to effectively communicate. Through the efforts of the leadership team and the Regional Program Associate, the limitation of not being able to have frequent face to face meeting can be overcome.

### **COOPERATIVE AND INSTITUTIONAL UNITS INVOLVED**

Christopher Obropta will serve as the Project Director and the Regional Water Quality Coordinator for this project. His consultant experience as a project manager of large environmental projects and his grant management experience from his academic career make him an excellent candidate to run this project. A strong leadership team has been assembled of senior faculty members from each of the Land Grant Universities. The State WRRIs have been incorporated into the project to enhance the projects' ability to reach out to more research faculty and take advantage of the existing infrastructure that is in place to coordinate these faculty. Additionally, the working groups for each focus area have reached out to the various local, state and federal agencies that can lend expertise and share resources to solve the problems of each particular focus area. Furthermore, the Region 2 Project's working relationship with USEPA Region 2 is very strong. We have worked closely together over the last four years on animal waste management issues, TMDL research, onsite wastewater treatment systems management, and water quality trading projects.

For each focus area, working group members are listed. The Team Leader for each working group will ultimately be responsible for that working groups deliverables. The Project Director/Regional Water Quality Coordinator will ultimately be responsible for assuring that the Team Leaders are on task and on schedule.

### **FACILITIES AND EQUIPMENT**

The facilities and equipment that are available to the faculty members from all four Land Grant Universities in Region 2 will be used to support this project including computers, offices, classrooms, conference rooms, laboratories, vehicles, and various types of field equipment as needed. No equipment will be purchased for the project. This project will be run out of the Rutgers EcoComplex, a New Jersey Agricultural Experiment Station Research and Extension Center. The EcoComplex is a state-of-the-art facility with laboratory space, a conference center and video conferencing capabilities.

### **PROJECT TIMETABLE**

For each regional initiative, a one year schedule has been provided in the "Methods" section of this proposal. Below is a summary of the overall project schedule.

<b>Month</b>	<b>Task</b>	<b>Deliverable</b>
1-2	Identification and evaluation of ongoing projects by each working group for each regional initiative.	Project abstracts and status report for ongoing projects within each regional initiative.
2-4	Development of research, education and extension agenda by each working group for each regional initiative.	Research, education and extension agenda for each regional initiative.
4-8	Development of workshops in animal waste management, OWTS, regional stormwater	Two workshops in animal waste management (1-PR and 2- NJ), two workshops on OWTS (1-PR



	management/watershed restoration planning, and volunteer monitoring.	and 2- VI), one NJ workshop in planning, and one NJ workshop in volunteer monitoring.
4-8	Design demo anaerobic digester in PR.	Preliminary engineering plans for demo project.
4-8	Identification of sites for OWTS demo projects in PR and VI and farm nutrient mgt. projects in NY.	Study design for demo projects in PR, VI, and NY.
4-8	Development of integrated nutrient management tool.	Web pages with integrated model structure.
4-8	Preparation of group proposal for watershed management.	One proposal prepared and submitted.
8-12	Development of design of solid liquid separators for VI demonstration project.	Preliminary engineering plans for demo project.
8-12	Implement demo OWTS projects in PR and VI.	Summary of initial results of the projects.
8-12	Development of initial coding of shell for integrated management tool	Preliminary shell code and status report
8-12	Implementation of farm nutrient management demonstration projects in NY.	Summary of initial results of project.
8-12	Development of watershed management curriculum.	Curriculum posted on the web for peer review.
8-12	Development of NEMO workshop.	One workshop in NJ and workshop posted on web.
8-12	Plan Annual Regional Conference.	Host Annual Conference for Region 2 Project.
1-12	Bi-monthly meetings of the working groups.	Meeting minutes posted on the web.
12	Preparation of annual project report and impact statements	Impact statements and project report posted on the web and submitted to USDA CSREES.
13-36	Quarterly meetings of the working groups.	Meeting minutes posted on the web.
13-36	For all regional initiatives, the working groups will continue their research, education and extension activities, building upon the first years activities.	Group proposals, workshops, specialty conferences, peer-reviewed publications, stakeholder evaluations, and impact statements that quantify dollars saved and pollutants removed.
20-24	Plan Annual Regional Conference.	Host Annual Conference for Region 2 Project.
24	Preparation of annual project report and impact statements	Impact statements and project report posted on the web and submitted to USDA CSREES.
32-36	Plan Annual Regional Conference.	Host Annual Conference for Region 2 Project.
36	Preparation of annual project report and impact statements	Impact statements and project report posted on the web and submitted to USDA CSREES.
1-36	Contribute to the National Project by participating in USDA CSREES meetings and conferences.	Web based materials to link to National Web Site, impact statements and progress reports.

## PROGRESS REPORT

After conducting several needs assessments for the Region, four regional focus areas were selected for the Region 2 Project: Animal Waste Management, Onsite Wastewater Management, Water Quality Trading, and Watershed Management. For each focus area, research, education and extension projects were begun to generate information that could be used throughout the Region. For animal waste management on small farms, two grants were awarded to county agents in New Jersey. One project evaluated the water quality impact of small farms on a watershed scale for pathogens and nutrients. The second project examined pathogen and nutrient build up in pastures on a farm scale. The University of Puerto Rico has been working with farmers to implement innovative and cost effective animal waste management strategies in sensitive watersheds. Additionally, University of Puerto Rico, Rutgers, and Cornell have all been conducting research and extension activities related to composting manure and dead animals. Several workshop and extension twilight meetings have been held throughout the Region to disseminate the information. Furthermore, extension publications have been used to



provide this information directly to farmers and other stakeholders. Project partners have included the USEPA, NJDEP, NYDEC, NJDA, Farm Bureau, NRCS, and local soil conservation districts.

The Region 2 Project has hosted a two day symposium on onsite wastewater treatment systems. This event helped establish a preliminary research and extension agenda for the Region 2 Project. Several training sessions were held throughout the Region on effective management strategies and alternative system design. One set of workshops was held in the Virgin Islands and Puerto Rico, and the Region 2 Project obtained the assistance of the Consortium of Institutions for Decentralized Wastewater Treatment Systems, lead by George Loomis who is the Director of the Onsite Wastewater Training Center at the University of Rhode Island, to present at this workshop. This workshop was a great success and helped both the Virgin Islands and Puerto Rico build capacity to provide training in this focus area. In both New York and New Jersey, the Region 2 Project has been working closely with local rural communities to develop management programs that will help minimize the water quality impact of onsite wastewater treatment systems. Additionally, the Region 2 Project was instrumental in helping start a New Jersey Chapter of the National Onsite Wastewater Recycling Association and co-hosted its first annual conference.

A water quality trading initiative was established by the Region 2 Project two years ago to reduce nonpoint source pollution and to improve the economic efficiency of point source control where feasible. In general, water quality trading was not being actively considered as a solution to water quality impairments. Through continued discussion, coordination and seeking opportunities for trading there has been much success in the past year. A water quality trading feasibility study of the Raritan Watershed in New Jersey was conducted by the New Jersey State Water Quality Coordinator. It was determined that water quality trading was feasible in certain watersheds in New Jersey. This past year, the Rutgers Cooperative Research & Extension Water Resources Program applied for and received a USEPA Targeted Watershed Grant to implement a water quality trading program in the Passaic River Watershed in New Jersey. The funds will be used to implement a water quality trading program, the first of its kind in New Jersey. The Region 2 Project has begun exploring water quality trading opportunities in the Upper Susquehanna River in New York and Lake Lioza Watershed in Puerto Rico. Numerous educational sessions have been offered by the Region 2 Project on water quality trading.

In the area of watershed management, Rutgers is currently working with New Jersey Sea Grant, Monmouth University, and Burlington Community College to bring NEMO to New Jersey. Several New Jersey specific presentations have been developed and delivered in New Jersey. Additionally, Rutgers is developing a volunteer monitoring training center. Both the NEMO and the Volunteer Monitoring efforts will take full advantage of the National USDA CSREES Facilitation projects in these areas. The Region 2 Project also helped expose Puerto Rico to Cornell's LEAPE project. The University of Puerto Rico has received state funding to adapt LEAPE to Puerto Rico. Additionally, the Region 2 Project is working closely with farmers on water conservation and agricultural water management. Several demonstration projects are underway along with educational workshops.

For more detailed information on the progress of the USDA CSREES Region 2 Water Quality Project, please visit our web site at [www.rwqp.rutgers.edu](http://www.rwqp.rutgers.edu).