

**Tennessee Water Resources Research Center
Annual Technical Report
FY 2006**

Introduction

Water Resources Issues and Problems of Tennessee

Tennessee is fortunate to have what many consider to be an abundant and good quality water supply. Historically, federal government agencies, such as the Tennessee Valley Authority (TVA), Corps of Engineers, Soil Conservation Service, U.S. Geological Survey and others, have been the primary contributors to the management and monitoring of water resources. In recent years, however, the State, through the Tennessee Departments of Environment and Conservation, Wildlife Resources, Agriculture and others, have begun to develop a more active and aggressive role in the management and protection of these resources. The State has moved to establish an integrated and coordinated policy and administrative system for the management of water resources in Tennessee.

While the situation is improving, there remain many of the additional types of water problems. Although the overall supply of water is adequate, the distribution is still not optimal. Local shortages occur during dry periods. The summer of 1980 was a particularly hot and dry one. During this period over 35 water districts out of a total of 671 public systems in Tennessee experienced lesser degrees of difficulty in supply water. The situation continued to worsen in the late 1980's. Beginning in 1985 and continuing on through the summer of 1988, Tennessee experienced another major drought period which severely strained the water supplies of many communities across the state. In recent years, many of the small municipal water suppliers and utility districts that rely on wells, springs, or minor tributaries for their water sources continue to face severe water shortage problems. All across the state many private, domestic, and commercial use wells have become severely strained, forcing users to seek alternative sources of water. Providing an adequate supply of water for industrial, commercial, and domestic uses and the protection of these surface and groundwater resources are of major concern in all regions of the state and vital to the economic development and growth of the state.

Groundwater presents a particular challenge in Tennessee. Over 50% of the population of Tennessee depends on groundwater for drinking water supply. In West Tennessee, nearly all public suppliers, industries, and rural residents use groundwater. However, not enough is known about the quality and quantity of groundwater in the state, and consequently, maximum benefit from and protection of this resource cannot be easily accomplished. More information about the quality of the state's groundwater, particularly about the potential impact of recharge areas, is needed in order to develop an effective management and protection program for this valuable resource.

There is also the problem of potential contamination of groundwater from agricultural and urban non-point sources. The "fate and transport" of agricultural chemicals (herbicides and pesticides) and toxic substances in groundwater is a problem area that must be addressed if the state's groundwater protection strategy is to be effective in protecting this vital resource.

Although the danger of large-scale, main-stem flooding is controlled by mainstream and tributary dams that have been constructed by TVA and the Army Corps of Engineers, localized flooding and even general flooding in unregulated watersheds remain substantial problems across the state. A lack of effective local floodplain management land-use controls is apparent in West Tennessee, where related problems of excessive erosion, sedimentation, drainage, and the loss of wetlands constitutes what many consider to be the greatest single water resource issue in the state from an economic and environmental point of view. Effective regulation of private levee design, construction, maintenance, and safety is needed.

Water quality problems continue to persist from past industrial practices, from the surface mining of coal and other minerals (especially from abandoned mines), from agricultural and urban nonpoint sources and from improperly planned, designed and operated waste disposal sites. As has been the situation in the past, the state program for the construction of municipal wastewater treatment facilities and improved operation and management of the facilities have experienced numerous set-backs due to shortfalls in funding and administrative delays. In major urban areas that have combined storm and sanitary sewers, urban storm water runoff causes increased pollution and, during periods of wet weather, bypasses treatment facilities, which allows raw sewage to enter receiving waters untreated. Tennessee cities, both large and small, are concerned about current (and future) impacts of the new NPDES storm water discharge permit requirements on clean up needs and costs. In certain regions of the state, failing septic fields and the practice of blasting bedrock for new septic fields are serious threats to surface and groundwater resources.

There are existing programs which can address many of these problems. However, some problems do not have easy solutions. Additional research can also play a role in understanding and solving these problems, but the greatest impediments are the lack of agreement between competing interests and a shortage of financial support for existing programs. From the viewpoint of the State government, the legal, institutional, and administrative aspects of water management are major concerns. The state is still working to develop new policy and to refine administrative structure for the effective management of its water resources.

To address the problems and issues of effective water resources management in the state of Tennessee, a truly interdisciplinary and well-coordinated effort is necessary. The Tennessee Water Resources Research Center has the capability and organization that can call upon the diverse set of disciplinary expertise necessary to address the key water issues of the state and region.

The Tennessee Water Resources Research Center: Overview of Program Objectives and Goals:

The Tennessee Water Resources Research Center serves as a link between the academic community and water-related organizations and people in federal and state government and in the private sector, for purpose of mobilizing university research expertise in identifying and addressing high-priority water problems and issues and in each of the respective state regions.

The Tennessee Water Resources Research Center, located at the University of Tennessee, is a federally-designated state research institute. It is supported in part by the U.S. Geological Survey of the U.S. Department of Interior under the provisions of the Water Resources Research Act of 1984, as amended by P.L. 101-397 and 10 I - 1 47. The Act states that each institute shall:

I. plan, conduct or otherwise arrange for competent research that fosters the entry of new research scientists into the water resources fields; the training and education of future water scientists, engineers and technicians; the preliminary exploration of new ideas that address water problems or expand understanding of water and water-related phenomena, and the dissemination of research results of water managers and the public.

II. cooperate closely with other colleges and universities in the state that have demonstrated capabilities for research, information dissemination, and graduate training, in order to develop a statewide program designed to resolve state and regional water and related land problems.

In supporting the federal institute mandate, the TWRRC is committed to emphasizing these major goals:

1. To assist and support all the academic institutions of the state, public and private, in pursuing water resources research programs for addressing problem areas of concern to the state and region.
2. To provide information dissemination and technology transfer services to state and local governmental bodies, academic institutions, professional groups, businesses and industries, environmental organizations and others, including the general public, who have an interest in water resources matters.
3. To promote professional training and education in fields relating to water resources and to encourage the entry of promising students into careers in these fields.
4. To represent Tennessee in the Universities Council on Water Resources, the American Water Resources Association (including Tennessee Section), the Ohio River Basin Consortium for Research and Education, the Southeast Watershed Forum, the Water & Environment Federation, the Southeast Stormwater Management Association and the ORNL-TVA-UT Research Consortium and the National Institutes for Water Resources (NIWR) Directors. To work with these and other associations and with state, local and federal government agencies dealing with water resources in identifying problems amenable to a research approach and in developing coherent programs to address them. Particularly, to cooperate with the other state institutes and their regional groupings for assisting the U.S. Geological Survey in developing a national water resources strategy.

In fulfilling the Center's major goals indicated previously, TWRRC emphasizes the application of Section 104 grant and required matching funds for primarily supporting the research and training/education needs of the state. While the information dissemination and technology transfer portion of the Center's overall program does not receive direct or significant section 104 funding, this is accomplished primarily from the research and training activities of the Center from other funding sources--state, private, or non-profit. The Center recognizes that education and training, research, and information transfer are not independent objectives or are not mutually exclusive. Instead these goals are achieved through the administration of a coordinated, fully- integrated program within the limitations of the resources available to the Center.

Research Program

Ash Pond Modeling and Computer Simulation to Predict and Efficiently Control Ammonia/Nitrates and Heavy Metals Discharge

Basic Information

Title:	Ash Pond Modeling and Computer Simulation to Predict and Efficiently Control Ammonia/Nitrates and Heavy Metals Discharge
Project Number:	2006TN27B
Start Date:	3/1/2006
End Date:	2/28/2008
Funding Source:	104B
Congressional District:	Second
Research Category:	Water Quality
Focus Category:	Water Quality, Water Use, Models
Descriptors:	
Principal Investigators:	Paul R. Bienkowski, Robert M. Counce

Publication

1. Bagchi, Bratendu, 2007, Computer Modeling of Tennessee Valley Authority's Coal Based Power Plant at Kingston to Predict the Effluent to Emory River, "Ph.D. Dissertion," Department of Chemical Engineering, College of Engineering, University of Tennessee, Knoxville, TN., pp 206.

(6) Problem and Research Objectives:

This research is desired by TVA's Environmental Technologies Division and by the Plant Manager of TVA's Kingston Fossil Plant in order to reduce water consumption, water discharges, and to remain in compliance with EPA discharge regulations, both current and anticipated future restrictions (see attached letters of support). TVA has recently recognized that its substantial current and future efforts to reduce air pollution at all 11 fossil plants, through the gradual addition of SCR units and Scrubbers, is increasing water discharge concerns (1). Specifically discharges of ammonia/nitrates to the ash pond, potentially an alteration in the pH of the ash pond which might result in the release of selenium, arsenic and mercury from the ash, and a substantial increase of mercury oxides discharged to the ash pond. Task II of the proposed research will provide answers to how much of an increase in water quality problems TVA is facing and provide the tools for modeling the effects these changes will have on the ash pond discharges. Task I will at first provide a tool for the Kingston plant, and later for all 11 TVA plants, that can be used to reduce water consumption, reduce water discharges from the ash pond and provide a means of systematically evaluating remediation designs (Task 3).

TVA and UTK have an on-going research effort to reduce fresh water consumption at TVA Fossil Plants while maintaining compliance with all current and anticipated future emission regulations through development of a computer simulation of the Kingston Plant. This proposal expands on this research with a 2 year, more generalized effort, encompassing three major tasks; (1) developing a generalized computer simulation for plant wide water balance, including temperature and relevant pollutants (currently in progress) (2) a theoretical and experimental effort to develop models for the transport and kinetics of Hg and oxides of mercury, Se, As and ammonia in the ash ponds and the interaction of these substances with ammonia along with their distribution between the aqueous and ash phases, and (3) applying the simulation in the second year of the project to identify process modifications at Kingston to reduce fresh water consumption in an environmentally friendly manner. There are two main water streams; 40 MGD of very dirty water sent to the ash pond and 1,296 MGD of clean water used in the condensers. The ash pond is a major source of discharges and potentially a major resource. TVA's efforts to reduce air pollution through the addition of SCR units (for NO_x) and scrubbers (particulates and SO_x) have essentially converted air pollution problems into ash pond water pollution concerns with ammonia/nitrate and mercury discharges and possibly As and Se (desorption from the ash). Task 1 has been on-going for 15 months with the development in ChemCad of the entire water balance at Kingston including predictions of the quantities of pollutants produced based on coal type, boiler operation, and air pollution controls. Water recycle/reuse is the major source for reducing fresh water intake, it is essential to incorporate into the simulation thermal effects and the build up and interacts of pollutants to understand their effects on plant operation and maintain compliance with current and anticipated future emission standards. We are incorporating into the simulation models for phosphates, SO_x, NO_x, Hg, Se, As, ammonia and chlorine and the interactions of ammonia, chlorine and SO_x with these metals. This information will be derived from three sources, i) the literature, ii) experimental data from TVA's data base developed from its 11 fossil plants, specific plant wide tests at Kingston and future plant wide tests at other TVA plants, and iii) a theoretical and experimental program (Task 2) based at ORNL specifically directed at the fate of As, Hg, Se, mercury oxides and ammonia in the ash ponds and the interactions of these substances with ammonia. The deliverables will be models for the fate and transport of these substances in the ash ponds for incorporation into the

water balance simulation. Task 2 is essential because there is insufficient information in the literature to model the interactions of these substances in the ash ponds.

Second Year Objectives: Conduct a second plant wide test at Kingston to compare with the 2004 test conducted before all of the SCR units were in place and use this test as a further verification of the Kingston plant ChemCad model. Conduct a literature search and experimental program to develop simulations for the interactions of As, Se, ammonia and ash in the ash ponds and incorporate these simulations in the Kingston plant model. Incorporate the COMSOL simulation into the model to allow for a better representation of the ash pond by incorporating its fluid dynamics. Use of the ash pond as a remediation device is a very real possibility. In the Spring 2007 semester one ChE 490/488 design group (4 seniors) are using the ChemCad model to investigate remediation options for phosphates, mercury, SO_x and ammonia at the Kingston plant ash pond.

(7) Methodology and Accomplishments to Date:

2006 was a very productive year for this project due to the addition of a second graduate student (Mr. Ashwin) and a strong desire by Mr. Bagchi to graduate ahead of schedule in order to accept a very nice job offer. Mr. Bagchi defended his PhD dissertation on November 15, 2006, a copy of his dissertation is attached. The simulation was completed for the Kingston plant from a unit operations standpoint. This simulation will predict air pollutants based on the type of coal burned and boiler operating conditions and predict the quantities of pollutant removed from the flue gas based on the specific remediation units in use, (SCF, FGD, etc.). The fate of ammonia in the ash pond has been simulated using a biological model refined with experimental data. The simulation currently predicts sulfur, phosphorous, nitrates and mercury in the effluent. The interactions between ammonia, ash, and mercury was simulated through an experimental program which developed predictive thermodynamic models. The simulation is now operational and is capable of predicting a component material balance for all relevant plant streams. Simulations for arsenic and selenium are currently not available and will be developed in 2007 from experimental data.

(8) Principle Findings and Significance:

A working model of the TVA Kingston plant has been developed the model will produce a flow sheet and material and energy balances for the entire plant including the ash pond. The model is useful for predicting pollutant discharges and would be a useful tool for reducing water consumption.

(9) Future Research and Funding:

This research has been funded by a \$42,000 grant from TVA (3/31/06 – 12/31/07) and TVA has made a commitment of \$250,000 in matching in a 2006 proposal to DOE which was rejected. Potential future sponsors of this research are TVA, DOE, EPA and EPRI. If TVA chooses to use the Kingston model there is a high probability TVA would fund extension of the modeling work to the other 10 TVA plants.

Dr Handagama from TVA has met with the students on a weekly basis, either at the Kingston Plant, at SERF or via e-mail or phone conversations. Three plant tests were conducted at the Kingston plant site with assistance from plant personnel.

UTK supported Dr. Bienkowski and Dr. Counce (through EO1-1322) who met with the students on a daily basis.

ORNL While ORNL did not make a written commitment of support, ORNL ended up supporting this project with Dr. Southworth doing all of the mercury/ash analysis in his laboratory at ORNL.

Information Transfer Program

The major emphasis of the information transfer program during the FY 2006 grant period focused on technical publication support, conference planning/development, and improvement in the information transfer network. The primary purpose of the program was to support the objectives of the technical research performed under the FY 2006 Water Resources Research Institute Program.

The primary objectives, as in previous years, of the Information Transfer Activities are:

To provide technical and structural support to water researchers performing research under the WRRIP.

To deliver timely water-resources related information to water researchers, agency administrators, government officials, students and the general public.

To coordinate with various federal, state, and local agencies and other academic institutions on program objectives and research opportunities.

To increase the general public's awareness and appreciation of the water resources problems in the state.

To promote and develop conferences, seminars and workshops for local and state officials and the general public which address a wide range of issues relating to the protection and management of the state's water resources.

During the FY 2006 grant period, a major focus of the information transfer activities was on the participation of the Center staff in the planning and implementation of several statewide conferences and training workshops.

As co-sponsor, the Center was involved in the planning and implementation of the Sixteenth Tennessee Water Resources Symposium, which was held on April 19-21, 2006 at Montgomery State Park in Burns, Tennessee. The goals of the symposium are: (1) to provide a forum for practitioners, regulators, educators and researchers in water resources to exchange ideas and provide technology transfer activities, and (2) to encourage cooperation among the diverse range of water professionals in the state. As with previous symposia, the sixteenth symposium was very successful with over 320 attendees and approximately 62 papers and 17 posters being presented in the two-day period. The event received a good deal of publicity across the state.

The Center also participated in several meetings and workshops across the state that were held to address water related problems and issues such as stormwater management, water quality monitoring, non-point source pollution, water supply planning, TMDL development, watershed management and restoration, multiobjective river basin management and lake management issues and environmental education in Tennessee.

The following is a brief listing of formal meetings, seminars and workshops that the Center actively hosted, supported and participated in during FY 2006:

East Tennessee MS4 Stormwater Management Working Group, March 30, 2006, April 27, 2006, May 25, 2006, June 29, 2006, September 28, 2006 and October 26, 2006 at Ijams Nature center, Knoxville, TN. TNWRRRC and the Tennessee department of Environment and Conservation sponsored a monthly meeting

of local government officials responsible of implementing local stormwater programs under the MS4 Phase II permit. These meeting are designed to provide local officials with information that will add them in development of their local stormwater management programs.

Tennessee Department of Agriculture, Nonpoint Source 319 Program Workshop, Ellington Agriculture Center, Nashville, TN. March 28, 2006.

Tennessee Wetlands Technical Advisory Task Force meeting, April 17-18, 2006, Nashville, Tennessee. Meeting of government agency staff and technical experts to advise to the State on issues related to the Tennessee Wetlands Management Plan.

Kids-In the-Creek, April 27, 2006 Gibbs Middle School, Knoxville, TN. A watershed experience sponsored by Tennessee Valley Authority, TNWRRRC and the CAC AmeriCorps Water Quality Team. An all day event for approximately 70 5th grade students introducing them to watershed science including biological and chemical monitoring and land use impacts on water quality

WaterFest, May 5, 2006, Knoxville, TN. An annual community-wide event sponsored by the Water Quality Forum that highlights the importance of our water resources and the activities of the WQF partners to protect and manage those resources. Over 1,200 elementary school age students from the Knox County school systems and schools from the surrounding region attended.

Muddy Water Blues, Williamson County AgriCenter, Franklin, TN. May 10-11, 2006. This two day conference was sponsored by the Southeast Chapter of the International Erosion Control Association, TNWRRRC and the cities of Franklin, Brentwood, Clarksville and Metro Nashville-Davidson County and Williamson County, TN. The purpose of the conference is to promote state of the art technologies for erosion prevention and sediment control for construction activities. It included and field demonstration of EPSC best management practices. Over 350 persons from across the southeast U.S. attended.

Fundamentals of Erosion Prevention and Sediment Control Level I Training workshops, sponsored by the Tennessee Department of Environment and Conservation and the Tennessee Water Resources Research Center. A one day course for developers, contractors, road builders and others involved with construction activities across the State. The course was offered on the following dates in FY 2006: March 22, 2006, Jackson, TN.; March 23, 2006, Nashville, TN.; April 6, 2006, Knoxville, TN.; May 4, 2006, Knoxville, TN.; May 10, 2006, Franklin, TN. (Muddy Water Blues conf.); July 27, 2006, (MGLW) Memphis, TN.; August 15, 2006, Memphis, TN.; September 5, 2006, Knoxville, TN.; September 21, 2006, Nashville, TN.; September 26, 2006, Chattanooga, TN.; October 19, 2006, Johnson City, TN.; October 24, 2006, Murfreesboro, TN.; November 16, 2006, Knoxville, TN.; December 7, 2006, Nashville, TN.; February 9, 2007, (Associated General Contractors) Knoxville, TN.; February 15, 2007, Dyersburg, TN.; February, 21, 2007, (Cumberland River Compact) Lebanon, TN.; February, 28, 2007, Nashville, TN.

Design Principles for Erosion Prevention and Sediment Controls for Construction Sites Level II workshops sponsored by the Tennessee Department of Environment and Conservation and the Tennessee Water Resources Research Center. A two day training workshops for engineers and other design professionals responsible for the development of Storm Water Pollution Prevention Plans for construction activities. The course was offered on the following dates: April 12-13, 2006, Nashville, TN.; May 2-3, 2006, Knoxville, TN.; August 16-17, 2006, Memphis, TN.; November 29-30, 2006, Nashville, TN.; December 12-13, 2006, Knoxville, TN.

Adopt-A-Watershed teacher training workshop, June 27-29 2006, Knoxville, TN. This four day workshop sponsored by TNWRRC and partners of the Water Quality Forum trains middle and high school science teachers on how to work with their students to conduct watershed investigations and develop watershed improvement service projects and part of their classroom curriculum. Five new teachers completed the courses in 2006.

Southeast Watershed Roundtable Conference, August 2-4, 2006, Asheville, NC.

Southeast Stormwater Management Association Conference, November 1-3, 2006 Charlotte, NC.
TNWRRC is a charter member of SESWA.

Knoxville Water Quality Forum, Quarterly meetings, May, July and October 2006 and January 2007.
Meeting of government agencies and other organizations to share information and discuss water quality issues in the Tennessee River and it's tributaries in Knox County.

Little River, French Broad River, Bull Run Creek, Beaver Creek Stock Creek and Emory River Watershed Associations, monthly meetings. Agency staff and community leaders working towards protection of the Little River, Lower French Broad, the Emory/Obed and smaller tributaries watersheds.

Joint UT-TVA-ORNL Water resources Consortium Seminar Series on timely water resources topics, issues and projects of common interest to the three organizations.

Other principal information transfer activities which were carried out during the FY 2006 grant period focused on the dissemination of technical reports and other water resources related reports published by the Center as well as other types of information concerning water resources issues and problems. A majority of the requests for reports and information have come from federal and state government agencies, university faculty and students, and private citizens within the state. The Center also responded to numerous requests from across the nation and around the world.

Structuring of an Information Transfer and Outreach Strategy for TNWRRC Under a New Organizational Framework

Basic Information

Title:	Structuring of an Information Transfer and Outreach Strategy for TNWRRC Under a New Organizational Framework
Project Number:	2006TN29B
Start Date:	3/1/2006
End Date:	2/28/2008
Funding Source:	104B
Congressional District:	Second
Research Category:	Not Applicable
Focus Category:	Education, Management and Planning,
Descriptors:	
Principal Investigators:	Randall Wilson Gentry, Timothy Gangaware

Publication

1. Authur,Roy, Liz Bouldin,2006, The Beaver Creek Watershed Partnership Overview and Watershed Plan,"in" Proceedings of the Sixteenth Tennessee Water Resources Symposium, Tennessee Section of the American Water Resources Association, Nashville, TN. 2B-13.
2. Hanahan, Ruth Anne, 2006, The Beaver Creek Watershed Partnership: Education and Outreach,"in" Proceedings of the Sixteenth Tennessee Water Resources Symposium, Tennessee Section of the American Water Resources Association, Nashville,TN.,2B-14-17.
3. Authur,Roy, Jim Hagarman and Alice Layton,2006, The Stock Creek Watershed Restoration Plan,"in" Proceedings of the Sixteenth Tennessee Water Resources Symposium, Tennessee Section of the American Water Resources Association, Nashville, TN., 2B-20.

(13) STATEMENT OF CRITICAL REGIONAL OR STATE WATER PROBLEM(S):

The State of Tennessee (and the southeastern United States region) has many water resources researchers, who participate in a very active and robust research program. The need exists to offer a better coordinated forum for these researchers to interact. Currently, many water rights issues have been elevated in the regional federal district courts. These will be landmark cases, should they proceed, which will define the course of water rights laws in the southeast based upon their precedent. This is one example of the dynamic environment facing water resources decision makers regionally. A more robust forum for information exchange and education is proposed in order to address the multitude of needs in Tennessee.

(14) STATEMENT OF RESULTS OR BENEFITS

Over the past year, TNWRRC has been working within the ISSE framework to develop ties to other potential regional partners. These contacts have included regional watershed groups and other regional WRRIP funded centers within the southeast region. The progress has been slow due to transitional hurdles, but there has been moderate success. TNWRRC staff has worked with the ISSE communication staff to develop a communication outreach plan for TNWRRC. In addition, TNWRRC has been collecting electronic files of publications from previously funded WRRIP projects, report and studies from federal and State government agencies and other water resources studies of interest that will be used to populate the electronic database that will be part of the new website. We are exploring the possibility of converting past research projects technical reports from paper copy to electronic files, in order to post all project reports and publication into the new database.

Partnerships with a number of watershed stakeholder groups including the Cumberland River Compact, the Beaver Creek Watershed Task Force and the Harpeth River Watershed Association have been established and we are going to work with them to support their education and outreach activities.

The goal for the next year is to continue to develop and more robust outreach and information transfer tool for the TNWRRC.

(15) NATURE, SCOPE AND OBJECTIVES OF RESEARCH

As mentioned above, the nature of this research program is to develop better information transfer to state and regional stakeholders. The specific objectives are as follows:

1. Develop a new synergistic information transfer plan for statewide and possible regional stakeholders;
2. Implement a new management, strategy and planning framework for the TNWRRC program that will provide a stronger approach for the new information transfer plan; and
3. Incorporate an over all strategy that will enable more regional collaboration.

These objectives would be met through a series of activities or tasks summarized below:

1. TNWRRC will participate in watershed groups and planning efforts;
2. Formalize a partnership with the Cumberland River Compact group and facilitate a Targeted Watershed Initiative Grant;
3. Host a TN water resources stakeholder meeting to identify research priorities and facilitate focused dialogue;
4. Develop and new webpage for communication and outreach purposes; and
5. Develop a database for Tennessee Water Resources data and information for the public.

(16) METHODS, PROCEDURES AND FACILITIES

not applicable.

(17) RELATED RESEARCH

not applicable

(18) TRAINING POTENTIAL

A Graduate Research Assistant and one undergraduate student have worked with TNWRRC and ISSE staff on the IT project over the past year. It is anticipated that additional GRA and undergraduate students will work on it in FY 2007.

(19) INVESTIGATOR'S QUALIFICATIONS

Dr. Randy Gentry is an Assistant Professor in the Department of Civil and Environmental Engineering. Dr. Gentry's research has focused on the use of environmental tracers to determine aquifer vulnerability and the use of genetic algorithms coupled with traditional modeling techniques to determine spatial correlations for aquifer recharge. He has received funding from the Water Resources Research Center at UT, the American Water Works Association Research Foundation (AwwaRF), and NSF with a collaborative effort with Dr. McCarthy.

Student Support

Student Support					
Category	Section 104 Base Grant	Section 104 NCGP Award	NIWR-USGS Internship	Supplemental Awards	Total
Undergraduate	4	0	0	0	4
Masters	3	0	0	0	3
Ph.D.	1	0	0	0	1
Post-Doc.	0	0	0	0	0
Total	8	0	0	0	8

Notable Awards and Achievements

The Tennessee Water Resources Research Center (TN-WRRC) has been very active in providing training programs and materials in the area of erosion prevention & sediment control (EPSC) for the Tennessee Department of Environment and Conservation (TDEC), beginning with assistance to TDEC's Division of Water Pollution Control (WPC) in compiling and editing the March 2002 Tennessee Erosion and Sediment Control Handbook. TN-WRRC is also developing a construction site Field Guide of Erosion Prevention & Sediment Control for TDEC and field personnel responsible for inspecting and maintaining Best Management Practices (BMPs).

Over the 6-year period, (March 2001- December 2006), the Tennessee Water Resources Research Center (WRRC) has been very active in coordinating, developing, promoting and conducting construction site erosion prevention and sediment control workshop training courses throughout the State. These courses provide fundamentals and advanced design training to contractors, developers, inspection and enforcement personnel from all levels of government, plan reviewers, design engineers, and other professionals responsible for every aspect of preparation and implementation of the Storm Water Pollution Prevention Plans (SWPPP) associated with Tennessee's NPDES Construction General Permit requirements. Some special in-house classes have been conducted at the request of individual contractors, engineering firms, public agencies and utilities. TN-WRRC has worked closely with TDEC and TDOT over this period to update the course materials with changing EPSC technologies and periodic revisions to Tennessee's General NPDES Permit requirements for stormwater discharges associated with construction activities.

The TN-WRRC staff provides coordination and administration for establishing workshop schedule dates, venues, meals & breaks, handout materials, and registration. Two instructors, Dr. Bruce A. Tschantz, P.E., Professor Emeritus of the UT Civil & Environmental Engineering Department, and Dr. John R. Buchanan, P.E., Associate Professor of the UT Biosystems Engineering & Environmental Science Department, have provided continuous instruction for both courses since the workshop training program began. TDEC-WPC field office managers assist with introductory Level 1 instruction. Two additional instructors, Beth Chesson and Tom Lawrence, are scheduled to assist with teaching the fundamentals course, starting in 2007.

Detailed EPSC workshop course descriptions, schedules, information about instructors, and Frequently Asked Questions (FAQ) are summarized in TN-WRRC's EPSC website, <http://www.tnepsc.org/> and linked to TDEC-WPC's home page under Water Pollution Programs: Tennessee Erosion Prevention and Sediment Control Training and Certification Program, <http://state.tn.us/environment/wpc/programs/>.

The Tennessee WRRC staff has provided these courses to many Phase II communities to partially satisfy their MS4 training requirements. These courses also have been offered to TDOT and TDEC officials, utilities, federal agency officials, construction companies, Ft. Campbell base personnel and contractors, storm water and erosion & sediment management specialty conferences, and other organizations to introduce fundamentals and to sharpen advanced understanding of erosion prevention and sediment control practices. To date, 5,777 people have been certified by examination for the Level 1 Fundamentals course presented at 95 different times and locations. Over 1,050 engineers and other professionals have taken the Level 2 design course and earned 14,700 professional development credit hours (PDHs) at 28 places and times. Details of both courses and associated activities for Tennessee's Erosion Prevention and Sediment Control Training and Certification Program for Construction Sites can be viewed on the WRRC website at <http://www.tnepsc.org/>.

Publications from Prior Projects

1. 2005TN16B ("Macropores and Colloids: Their Influence on the Quantity and Quality of Recharge") - Articles in Refereed Scientific Journals - Zhuang,J., J.F.McCarthy, J.S.Tyner, E.Perfect, and M.Flury,2007, In-situ Colloid Mobilization of Hanford Sediments Under Unsaturated Transient Flow Conditions: Effect of Irrigation Pattern. *Envir. Sci & Technol.* 41(9) 3199-3204.
2. 2005TN17B ("Impacts of watershed urbanization on longitudinal fragmentation of stream habitat quality and fish habitat use") - Conference Proceedings - Sain,Robert,and John S, Schwartz,2006, Impacts of Urbanization on Habitat Quality and Fisheries in a Ridge and Valley Watershed: Implications for Stream Rehabilitation Planning,"in" Proceedings of the Sixteenth Tennessee Water Resources Symposium,Tennessee Section of the American Water Resources Association, Nashville, TN.,2B-9.
3. 2003TN7B ("Evaluation of Pathogen Occurrence and Causation withing the Stock Creek Watershed (Knox County) as a Model for Watershed Restoration") - Conference Proceedings - Layton,Alice, Dan Williams, Randy Gentry,and, Larry Mckay,2006,Bacteroides as an Alternative to E.Coli as a Fecal Indicator,"in" Proceedings of the Sixteenth Tennessee Water Resources Symposium, Tennessee Section of the American Water Resources Association, Nashville, TN., 3C-6.
4. 2003TN7B ("Evaluation of Pathogen Occurrence and Causation withing the Stock Creek Watershed (Knox County) as a Model for Watershed Restoration") - Articles in Refereed Scientific Journals - Gentry,R.W., J.McCarthy, A.Layton, L.McKay, D.Williams, S.R.Koirala, and G.S.Sayler,2007, Efficacy of Bacteriodes for Reducing the Statistaical Uncertainty with Hydrologic Flow and Fecal Loads in a Mixed Use Watershed, *Journal of Environmental Quality*, V36,n5, in press.
5. 2003TN7B ("Evaluation of Pathogen Occurrence and Causation withing the Stock Creek Watershed (Knox County) as a Model for Watershed Restoration") - Articles in Refereed Scientific Journals - Gentry,R.W., J. McCarthy, A. Layton, L. McKay, D. Williams, S.R. Koirala, and G.S. Sayler,2006, Esherichia coli Loading at or Near Baseflow in a Mixed-Use Watershed, *Journal of Environmmetal Quality*, v35,n6,pp2244-2249.
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