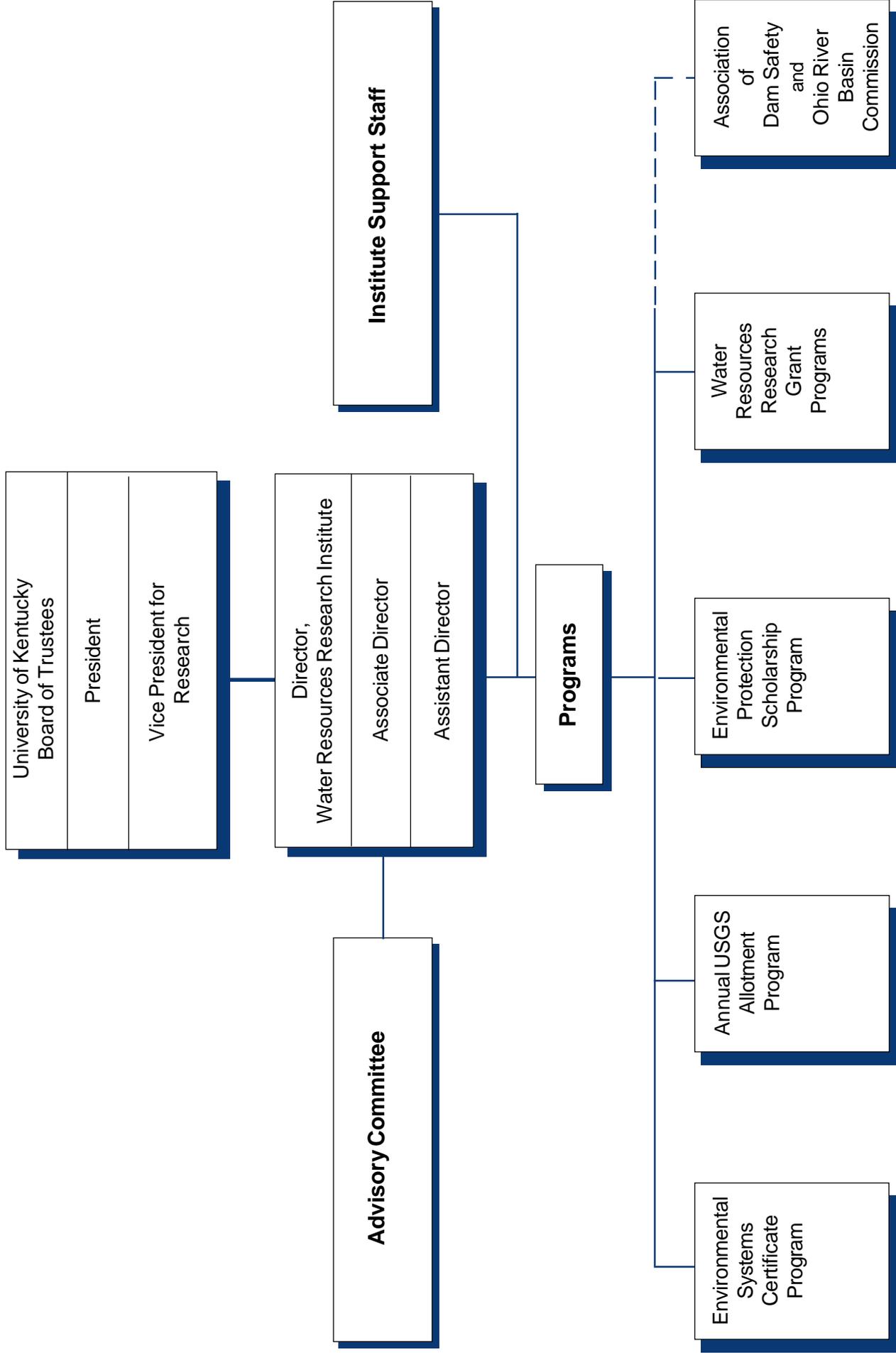


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Kentucky Water Resources Research Institute Organizational Chart



**KENTUCKY
WATER RESOURCES
RESEARCH INSTITUTE**

**2001
Annual Report**

James A. Kipp, Interim Director

233 Mining and Mineral Resources Bldg.
University of Kentucky
Lexington, Ky. 40506-0107

March 2002

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KWRRI Web Site

The KWRRI Web site is located at:

<http://www.uky.edu/WaterResources>

Visitors can access information about the Water Institute, including current and upcoming activities and copies of *Waterworks*, the institute's newsletter. Information about KWRRI programs, personnel and associated faculty members at the University of Kentucky are available as well.

Mission

The Institute's mission is to:

- ▶ Stimulate water resources and water-related environmental research
- ▶ Assist and stimulate academic units in the conduct of undergraduate and graduate education in water resources and water-related environmental issues
- ▶ Stimulate technology transfer on water resources and water-related environmental issues
- ▶ Develop statewide interactions between faculty and research staff and the private and public sectors

Significant Accomplishments

- KWRRI Associate Director, Dr. Lindell Ormsbee, is assisting the Kentucky Division of Water with the development of Total Maximum Daily Loads (TDMLs) for waterways. Protocols have been established to develop TDMLs for pH, nutrients and pathogens in streams across the Commonwealth
- KWRRI personnel participated in planning and staffing the award-winning *2001: A Water Odyssey*, an environmental education exhibition at the Kentucky State Fair. About 300,000 people visited the exhibit hall during the 10-day fair, including 8,000 students from area schools. Accompanying teachers were provided with a curriculum to use in their classrooms. The exhibition received a Spirit of the Land Award, which recognizes excellence in Environmental Education around the world. The award was presented at the 2002 Olympic Winter Games in Salt Lake City, Utah on February 18, 2002. (See pictures from the Kentucky State Fair on page 8.)
- During 2001, five new research projects were funded through the USGS Section 104(b) Annual Institute Program. The supported investigations are:

Dr. Gail M. Brion, and Dr. Srinivasa Lingireddy, Dept. of Civil Engineering, *Bacterial Ratios and Neural Networks for Modeling Kentucky River Water Quality*.

Dr. Randall K. Kolka and Dr. Mathew Smidt, Dept. of Forestry, *Retirement and Restoration of Forest Roads in Steep Terrain: Influence on Nonpoint Source Pollution and Hillslope Hydrology*

Dr. Christopher J. Matocha and Dr. Mark S. Coyne, Dept. of Agronomy, *Does Waste Amendment Affect Abiotic N Cycling in Soils by Naturally Occurring Reactive Fe(II)?*

Dr. Brian S. Shepherd, Dept. of Biology, UK, and Dr. Craig V. Sullivan, Dept. of Zoology, North Carolina State University, *Where Have all the Yellow Perch (*Perca flavescens*) Gone: Are Endocrine Disruptors (xenoestrogens) Involved?*

Dr. Howard H. Whiteman, Dept. of Biological Sciences, Murray State University, *Developmental Stability as an Indicator of Amphibian Population Health and Environmental Degradation*.

Significant Accomplishments, continued

- The Interim Director, James A. Kipp, chairs the Interagency Technical Advisory Committee for Groundwater. The duties and responsibilities of the committee include: 1) coordination of agencies in the overall characterization of the state's groundwater (occurrence, flow systems, water quality, and water quantity), 2) insuring data entry into the Kentucky Groundwater Data Repository, 3) establishing a long-term groundwater monitoring plan for the Commonwealth, 4) making recommendations for the prioritization of the state's groundwater research needs, and 5) reviewing data collection and analysis.

 - The Kentucky Water Resources Annual Symposium was held February 23, 2001 at the Four Points Barceló Hotel in Lexington, Ky. There were 181 individuals in attendance at the symposium, which featured 42 speakers and four poster presentations.

 - KWRRRI personnel led by Dr. Ormsbee and Dr. Greg Epp continue to implement the Kentucky Watershed Management Framework in the Kentucky River Basin on behalf of the Kentucky River Authority. In 2001, KWRRRI completed a series of regional meetings to gauge local interest and gain input. Watersheds (South Elkhorn Creek, Eagle Creek, and Red River) were identified where local task forces might take hold on the basis of the regional meetings, detailed assessments of 97 watersheds, and a ranked list of watersheds that integrate monitoring data with measures of potential impacts and protection factors.

 - At the Paducah Gaseous Diffusion Plant in McCracken County, KWRRRI scientific/technical staff continued to assist the Radiation Control Program of the Cabinet for Health Services in providing environmental oversight. KWRRRI represents the Cabinet on PGDP program management, project teams and working groups responsible for planning and executing environmental restoration program and projects.

 - Through KWRRRI scientific/technical staff, several UK faculty/staff are working on ongoing or special projects at the Paducah Gaseous Diffusion Plant, including:
 - Dr. Steve Fisher, Kentucky Geological Survey – Groundwater characterization and remediation planning and oversight.
 - Dr. Ed Woolery, Kentucky Geological Survey and Dept. of Geological Sciences – CERCLA Disposal Project seismic project planning and oversight.
 - Zhenming Wang, Kentucky Geological Survey – CERCLA Disposal Project seismic project planning and oversight.
 - Dr. Ed Woolery, Kentucky Geological Survey and Dept. of Geological Sciences – CERCLA Disposal Project seismic field investigation
 - Dr. Srini Lingireddy, Dept. of Civil Engineering – Groundwater flow model simulation and evaluation.
 - Dr. Mark Coyne & Dr. Elisa D'Angelo, Dept. of Agronomy – Study of Microbial Populations in Passive Iron Filings Column Utilized for 99Tc and TCE Removal from Groundwater.
 - Dr. Richard Warner, Dept. of Agricultural Engineering – Proposal for Passive Sediment Controls in PGDP Sub-watersheds.
-

- At the Maxey Flats Disposal Site in Fleming County, KWRRI scientific/technical staff compiled and evaluated historical sump and well data and provided recommendations to Cabinet for Health Services for abandonment and continued monitoring of trench sumps at the Maxey Flats site and for placement of new monitoring wells in the Maxey Flats restricted area.

Table 1

Advisory Committee

Research and Policy

Dwayne R. Edwards, Chair Biosystems and Ag Engineering University of Kentucky	Barbara A. Ramey Biological Sciences Eastern Kentucky University	Larry W. Robertson, Graduate Center for Toxicology University of Kentucky
Gail M. Brion Biosystems and Ag Engineering University of Kentucky	Glenn C. Blomquist Economics University of Kentucky	Scott A. Shearer Biosystems and Ag Engineering University of Kentucky
John Volpe Radiation Health and Toxics Agents Branch Cabinet for Health Services	Jean G. Watts Environmental Science Technology Lexington Community College	Richard J. Sweigard Mining Engineering University of Kentucky
Robert H. McKnight Preventive Medicine and Environmental Health University of Kentucky	Alan E. Fryar Geological Sciences University of Kentucky	Mark S. Coyne Agronomy University of Kentucky

Ex Officio

James A. Boling Vice President for Research University of Kentucky	Jack Wilson Director Kentucky Division of Water	James A. Kipp Interim Director KWRRI University of Kentucky
James C. Cobb State Geologist Kentucky Geological Survey University of Kentucky	Harry C. Rollins, Dist. Chief Water Resources Division U.S. Geological Survey Louisville, Ky.	

History of the Institute

The Kentucky Water Resources Research Institute is one of 54 Institutes in the United States established under Public Law 88-379, the Water Research Act of 1964. The intent of the program then and now is summarized in the Act as follows:

“To assist in assuring the Nation at all times of a supply of water sufficient in quantity and quality to meet the requirements of its expanding population, it is the Purpose of the Congress, by this Act, to stimulate, sponsor, provide for, and supplement present programs for the conduct of research, investigations, experiments, and training of scientists in the fields of water and of resources which affect water.”

The water resources institute program has been reauthorized several times since 1964. In 1997, the Water Resources Research Act (H.B. 1743) was reauthorized by the Congress for another five years.

Congressional support for the program has been strong throughout the years, but the level of funding has remained fixed since the early days of the program.

Since 1988, the Institute has developed new thrusts in Environmental Systems graduate education, undergraduate and graduate scholarships, and continuing education, and has developed strong ties to the Kentucky Natural Resources Environmental Protection Cabinet.

The Institute was established in 1964 by Dr. Robert A. Lauderdale, who was also a Civil Engineering professor. Since that time, eight other individuals have been responsible for the leadership of the Institute. In Spring 2001, Jim Kipp became the Interim Director of the Institute.

During its 37-year history, the Institute has sponsored short courses and conferences, supported 779 students in 32 departments in six colleges, and produced 204 research reports and numerous journal articles published by faculty and research staff associated with the Institute. The Institute plays a vital role in the coordination and stimulation of water research and education in the state.

Management of the Institute

An Institute organizational chart is shown on the inside of the front cover. The Institute Director reports to the Vice President for Research. The Committee on Research and Policy is a University Advisory Committee appointed by the President of the University of Kentucky that selects research projects and scholarship recipients and also helps set the agenda for the Institute. The Institute personnel during 2001 are listed on the inside back cover.

Programs of the Institute

Annual USGS Allotment Program

Objectives: The Annual Institute Allotment Program serves the needs of the state, region and nation by supporting and encouraging research and technology transfer in the area of water resources. Specifically, this includes:

- Identification of important water resources issues in the state and developing a list of priorities for research;
- Encouraging faculty to pursue this research agenda and develop viable research programs;
- Conducting a technology transfer program on water-resources-related issues in the state.

Program Description: The water resources research needs of the Commonwealth of Kentucky are assessed annually. A statement of the water resources research needs is prepared and a call for research proposals is sent to all Kentucky college and university water resources related faculty. The call for research proposals is an abbreviated statement of the currently perceived water resources research needs for the state.

The Institute's Committee on Research and Policy reviews and prioritizes the proposals. The Committee on Research and Policy is a multi-university committee appointed by the President of the University of Kentucky. After receiving the recommendations of the Committee, the Institute funds its top choices.

Water Resources Research Grant Program

Objectives: This program is designed to stimulate research and assist faculty and research staff in obtaining research support.

Program Description: This program stimulates research activities and, at the same time, increases research support for faculty and research staff. To accomplish these objectives, a statewide directory was compiled that included all of the faculty and research staff in Kentucky. The faculty and research staff identified in the directory are kept informed of potential research opportunities, ongoing research of interest to Kentucky, and policy changes that are important to the water resources of the State.

This program activity includes the assistance of faculty members in securing individual grants and contracts through proposal development. It also includes the development of special agreements with public- and private-sector organizations for team-type proposals that may result in contracts to conduct research and service activities. Examples include the MOAs signed with the Cabinet for Health Services and Environmental Protection and the Kentucky River Authority

Environmental Systems Certificate Program

Objectives: The overall objective of the Environmental Systems Certificate Program is to provide for graduate education in Environmental Systems. Specifically, this includes:

- Enhancing the graduate environmental-education program of the University of Kentucky and offering multi-disciplinary courses in Environmental Systems;
- Providing a certificate program in Environmental Systems for traditional and nontraditional students in all departments.

Program Description: The Environmental Systems Certificate Program is administered by a committee of faculty and private and public representatives (*see Table 2 on page 26*). The Environmental Systems Certificate Program Committee consists of representatives from the Colleges of Science, Medicine, Engineering, Agriculture, Law, and the Graduate School, the Kentucky Environmental Protection Cabinet and the private sector. Each Environmental Systems course is coordinated by a faculty member, and course instructors are representatives of their respective disciplines. The committee is the governing body of the program, and the chairman of the committee reports to the Dean of the Graduate School.

The Environmental Systems Certificate Program consists of a core of three survey courses and a seminar course. The content of the courses and seminars is the responsibility of the coordinator. Students integrate other environmentally related courses in their major program and generally have an environmental concept in their theses or dissertations. Nontraditional students must have significant experience in an environmentally related field.

A certificate is offered to all students specializing in environmental systems within their department. Individuals desiring a certificate must submit an application for admission to the program to the Environmental Systems Committee along with an outline of their graduate degree program or their experience. In 2001, three students received Environmental Systems certificates.

Environmental Protection Scholarship Program

Objectives: The Environmental Protection Scholarship Program is administered through the Kentucky Water Research Institute and funded by the Kentucky Department for Environmental Protection. The objectives of the program are to:

- Promote environmental education at the undergraduate and graduate level in the state universities;
- Assist the State's Environmental Protection agencies in their effort to hire the best graduates available for their professional staff.

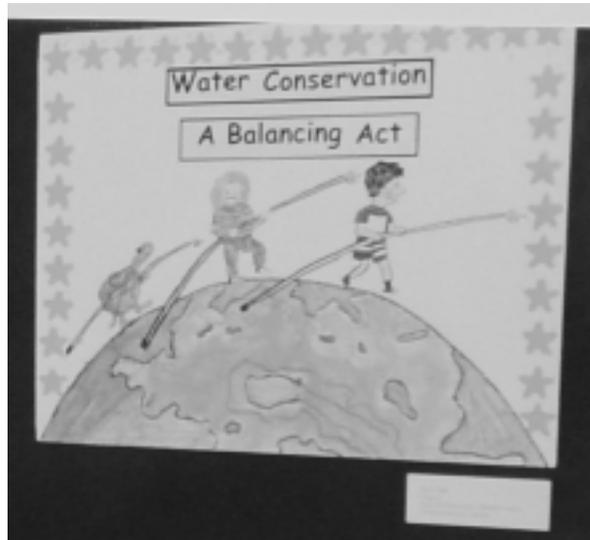
Program Description: Beginning in the fall of 1991, Environmental Protection Scholarships have been awarded to undergraduate juniors and seniors, and graduate students in environmental academic areas that are critical to the staffing needs of the state. Scholarship applications are received and evaluated by the Institute's Committee on Research and Policy. Selection of scholarship recipients is done in concert with the respective state departments. Individual scholarships cover the cost of tuition, room, board, books, and fees at the student's Kentucky university. Scholarship recipients are provided employment by the state agencies during the summer while in school. Following graduation each recipient is obligated to work for the Cabinet for one year for each year of scholarship support. To date, 38 students have been supported through this program.



Wesley Turner, a geologist with the Division of Waste Management's Underground Storage Tank program, is a former Environmental Protection Scholarship recipient.

"Receiving the scholarship gave me a tremendous sense of relief. I could concentrate on school and not worry about how I was going to pay for tuition, books and everything else," says Turner. "Also, I knew that I had a job waiting for me after graduation. So there was a double benefit for me," he adds.

2001: A Water Odyssey



The work of 295 Kentucky school children was on display at the Water Odyssey exhibit at the 2001 Kentucky State Fair.

Visitors to the Water Odyssey education exhibit at the 2001 Kentucky State Fair had the opportunity to find and stand on their local watersheds displayed on a large watershed map spread out on the floor.



Photos by James A. Kipp

Research and Service Activities

The Institute has had a strong research and service program throughout its history. Because of the long track record, it is possible to have some measure of impact. Since 1964, the Kentucky Water Resources Research Institute has:

- Funded research projects resulting in more than 200 research reports from the Institute, and contributing to the scientific education of about 800 graduate students;
- Sponsored numerous conferences and symposia, including the very successful Kentucky Water Resources Annual Symposium.

Many of the research projects have led to products that had a major impact on the nation's water resources. Examples include the KY PIPE program, the DEPOSITS reservoir sedimentation model, the Kentucky Watershed Model, the research results on chlorine and aquatic life, and the establishment of the first long-term monitoring of a spring in Kentucky.

Memorandum of Agreement Projects with the Kentucky Division of Water

James A. Kipp, Interim Director

The following research projects are included under this agreement:

- Continued Development of a Watershed-Based Water Quality Assessment and Management Methodology for the Kentucky River
 - Kentucky TMDL Development
 - Evaluation of the Impact of Gravel Dredging on Buck Creek
 - Graphic Design and Production of a Poster for Public Education to Protect Groundwater in Karst Areas of Kentucky
-

Continued development of a watershed-based water quality assessment and management methodology for the Kentucky River

Lindell E. Ormsbee, KWRRI and the Department of Civil Engineering, University of Kentucky

\$105,000--Kentucky Division of Water

In accordance with the new EPA emphasis on watershed-based environmental improvement, this study will investigate the feasibility of developing an environmental management methodology that could be used by the Kentucky Division of Water personnel in managing all water quantity and quality data at a watershed level. The methodology will provide a framework with which to integrate the various data sets and associated graphical coverages that have been developed and are continuing to be developed as part of the existing water-quality monitoring and management activities of the KDOW. This integration will be accomplished through the use of GIS technology with possible linkages to both statistical and deterministic analysis models.

The proposed environment will integrate modeling, GIS and data management components to provide a comprehensive environment for water quality analysis and assessment. By integrating both land use and facilities location data along with historical ambient water quality data, the system should provide a tool for use in identifying and estimating pollutant sources and impacts, along with a mechanism for investigating the potential impacts of various management strategies.

Kentucky TMDL Development

Lindell Ormsbee, KWRRI and the Department of Civil Engineering, University of Kentucky

\$ 107,500--Kentucky Division of Water

This project has been focusing on developing protocols for pH and total phosphorus Total Maximum Daily Loads (TMDLs) for watersheds in the state of Kentucky. This year, a protocol for pH TMDLs was developed which was then approved by the Kentucky Division of Water and EPA Region IV. The developed protocol was then used to develop a TMDL for Brier Creek watershed in Muhlenberg County as well as four other pH impaired watersheds in Hopkins County. Work is continuing on the development of a protocol for phosphorus TMDLs with Town Branch and Elkhorn Creek being used as case studies.

Evaluation of the impacts of gravel dredging on Buck Creek

James A. Kipp, KWRRI, University of Kentucky and
Jeffrey Jack, Dept. of Biology, University of Louisville

\$57,000--Kentucky Division of Water

This project will initiate a physical-chemical and bioassessment program to evaluate the impact of gravel dredging on Upper Cumberland drainage streams. Physical habitat assessments and transport modeling will be used to determine whether these operations have an effect on the physical structure of the stream bed. Biological parameters will be used to ascertain whether these physical influences negatively affect aquatic communities. Information obtained from this project will help the Kentucky Division of Water determine whether gravel dredging should be more closely regulated.

Graphic Design and Production of a Poster for Public Education to Protect Groundwater in Karst Areas of Kentucky

James A. Kipp, KWRRI, University of Kentucky

James Currens, Kentucky Geological Survey, University of Kentucky

\$57,100 — Kentucky Division of Water

The common attitude of the public toward the protection of the environment has perhaps the greatest influence on the effectiveness of mitigation programs of non-points source pollution. Non-point source pollution stems from daily activities, such as disposal of domestic garbage and trash, the use of pesticides, or selection of a domestic sewage disposal system for a new house. Without knowledge of what constitutes good and bad practices, and the justification for characterizing a practice as good or bad, individuals will lack the tools with which to act responsibly. Successfully providing individuals with such knowledge requires that the message be delivered with a cost-effective, novel, succinct and repetitive medium.

This project will produce, publish and distribute a poster illustrating groundwater flow in a karst aquifer. Further, the vulnerability of groundwater in this setting will be illustrated and discussed in the accompanying text. A poster was chosen as the medium to deliver the groundwater protection message, because a poster conveys the message succinctly and repeatedly as long as the poster is displayed, especially when an eye-catching design is used.

The final product was a 28-inch by 36-inch, four-color poster depicting karst topography and groundwater flow. Examples of non-point sources of pollution, as well as good examples of groundwater protection practices are illustrated.



Howard H. Whiteman, Ph.D., associate professor of biology at Murray State University, observes amphibian development as a way to monitor the health of ecosystems. (See page 16)

U.S. Geological Survey–University of Kentucky Funded Research

Ongoing Projects

Bacterial Ratios and Neural Networks for Modeling Kentucky River Water Quality

Gail M. Brion and **Dr. Srinivasa Lingireddy**

Dept. of Civil Engineering
University of Kentucky

\$14,000--U.S. Geological Survey

\$27,869--University of Kentucky

Our nation's rivers, including our local water supply, the Kentucky River, are overburdened with pathogen indicators, and presumably pathogens. However, we are unable to assess the true risk suggested by these bacterial indicators due to lack of knowledge about the original fecal source, and the amount of time the feces have been in contact with the environment. The new indicator systems must be able to work in a real-time manner so that peak pathogen loadings at water utilities can be avoided. Currently, real-time systems are not possible because of the nature of microbial tests, which provide results hours to days after the microbial peak has started. Adding to the difficulty of avoiding pathogens at the intake is the fact that a universal relationship between the bacterial pathogen indicators commonly measured and the multitude of suspected pathogens in surface water is difficult to define. However, aged fecal material generally contains fewer pathogens than fresh material, and it is agreed that fresh human wastes should be avoided in surface waters.

The overall objective of this research project is to compile a complete, multiparameter, multi-year database of water quality at the intake to the Kentucky-American Water Company's treatment plant on the Kentucky River for use in watershed modeling and management. This database will have crucial bacterial data that when analyzed by simple ratios, and more complicated neural network models, will indicate the freshness of fecal material at the river intake. Predictions from a combination of kinetic modeling data provided by laboratory survival experiments, new data from Kentucky American and neural network predictions after training with historical data will fill in missing peak values in the database.

The objectives of this research are:

- To assemble a multiparameter database of the raw water quality measurements at the Kentucky River intake from historical records kept at the laboratories of Kentucky American onto a computer at the University of Kentucky.
 - To obtain kinetic data on relationships between bacterial concentrations and ratios as fecal material ages in surface water and fit appropriate models to these results.
 - To predict missing bacterial data points in this database using a combination of neural network modeling from the historical database and kinetic models obtained from laboratory experiments.
-

Retirement and Restoration of Forest Roads in Steep Terrain: Influence on Nonpoint Source Pollution and Hillslope Hydrology

Randall K. Kolka and **Mathew Smidt**

Dept. of Forestry
University of Kentucky

\$10,000--U.S. Geological Survey
\$22,312--University of Kentucky

Forest roads constructed as a result of harvesting operations severely disturb soil, which leads to enhanced nonpoint source pollution, altered hillslope hydrology and lower productivity. Current best management practices (BMPs) for forest road retirement in Kentucky and many other states are effective at *reducing* nonpoint source pollution, but sediment fluxes can still be on the order of 10 to 40 times those in unharvested systems the first few years after harvest.

The USDA Forest Service has recently come under fire to protect roadless areas and to retire or possibly restore roads that receive little use. Unfortunately we know very little about environmental impacts of such closure techniques. The results of this study will directly influence Forest Service and other state and federal agencies as they consider techniques for road closure and watershed-level restoration.

The overall objective of this project is to examine the effects of restoration (i.e. recontouring the hillslope) and a new subsoiling retirement technique on forest roads on steep side slopes. Specific objectives include the following:

- Examine how hillslope restoration and deep subsoiling affect the transport of sediment and nutrients from forest roads;
- Examine how hillslope restoration and deep subsoiling affect hillslope hydrology and soil moisture;
- Identify amelioration techniques that efficiently and effectively improve soil properties and seedling growth on severely disturbed areas.

Does Waste Amendment Affect Abiotic N Cycling in Soils by Naturally Occurring Reactive Fe(II)?

Christopher J. Matocha and **Mark S. Coyne**

Dept. of Agronomy
University of Kentucky

\$ 7,500--U.S. Geological Survey
\$15,000--University of Kentucky

Nitrate loss from soil is typically attributed to leaching or denitrification. The former can lead to significant environmental problems and the latter represents a significant inefficiency in soil fertility. This research project will provide important and novel data on the effects of waste amendments on the mechanisms of NO_3^- reactivity on soils and important soil constituents using in situ spectroscopic

techniques to better simulate reactions in the natural environment. Such data will provide a better understanding of what happens, chemically, on a molecular level when reactive Fe and N species interact. Nitrate reduction by naturally occurring Fe(II)-reductants could represent a significant pathway of natural attenuation that could affect crop fertility, fertilizer use efficiency, and overall environmental quality in locations receiving animal wastes. The data generated from this proposed study could significantly assist in the sustainability of agriculture and industry.

Through combined macroscopic and in situ spectroscopic techniques, this research will generate baseline thermodynamic and kinetic data necessary to evaluate the role of naturally-occurring Fe(II)-bearing soil minerals on NO_3^- reduction as affected by applied animal wastes. The kinetic data will be invaluable in predicting abiotic reduction half-lives of NO_3^- and its environmental fate as affected by animal waste-amended soils. It is not known how waste-amended soils affect reactive Fe(II) species, thus, this information will be crucial because of the increasing number of acres amended with animal waste in Kentucky and throughout the southeast United States. By employing in situ spectroscopic techniques, we will better simulate redox reactions occurring between Fe(II) and N species and identify reaction mechanisms in natural field settings.

This research has a simple premise: mechanistic studies are needed to understand better the reactivity of naturally occurring Fe(II)-bearing minerals and Fe(II) in other coordination environments to more accurately predict the fate of NO_3^- in soils. This project will:

- Investigate the reactivity of NO_3^- with reference materials, soils, and soil components containing Fe(II)-bearing minerals as a function of animal waste treatment to identify reaction mechanisms and products; and
- Develop predictions about NO_3^- fate in natural soil environments based on the kinetic and spectroscopic studies.

Where Have all the Yellow Perch (*Perca flavescens*) Gone: Are Endocrine Disruptors (xenoestrogens) Involved?

Brian S. Shepherd
Dept. of Biology
University of Kentucky

Craig V. Sullivan
Dept. of Zoology
North Carolina State University

\$12,000--U.S. Geological Survey
\$25,191--University of Kentucky

Growth, development and reproduction, in all vertebrates, is regulated through the orderly release of hormones from the neuroendocrine system. Principal among these regulators is the pituitary hormone, growth hormone (GH), and its intermediaries, the insulin-like growth factors, IGF-I and IGF-II (1). In teleosts, and other vertebrates, the hypothalamo (brain)-pituitary-gonad (HPG) axis is the prevailing regulatory pathway important for reproduction. The principle endocrine factors responsible for maturation and reproduction include sex steroids (estradiol, testosterone and progesterone), neuroendocrine factors (e.g., the gonadotropin-releasing-hormones, GnRH and dopamine, DA) and the pituitary hormones, growth hormone (GH), prolactin (PRL), somatolactin (SL) and the gonadotropins (GtH I and II). Equally important, however, are the osmoregulatory and metabolic actions of GH, PRL and IGFs in teleosts.

Environmental, nutritional and social factors can also alter levels of pituitary hormones in fish. In addition, several agricultural (pesticides, surfactants and alkylphenols), industrial (chlorinated hydrocarbons-PCBs) and municipal (sewage) pollutants can mimic the biological actions of sex steroids, particularly estrogens. These pollutants, termed “xenobiotics” or “xenoestrogens”, are also referred to as “endocrine disrupting chemicals (EDCs)”, because they affect physiological processes that are controlled by endogenous hormones in many animals. These chemicals persist in the environment and accumulate in the tissues of all organisms in the food chain, often reaching magnified levels, and thus affecting the physiology of the contaminated organism (eg., fishes).

This project is developing the yellow perch as a model to study the endogenous endocrine pathways that are impacted/alterd by exposure to EDCs. The yellow perch was chosen to study because of its economic and ecological importance; however, while these two characteristics are important, there are other criteria that impart a greater sense of urgency and importance to the proposed studies on yellow perch:

- Yellow perch are economically and ecologically important teleosts with the widest distribution in North America. In addition, yellow perch have, historically, been one of the most important inland commercial fisheries in the United States. Further still, populations of yellow perch, in the Great Lakes Region, have been reduced to critically low levels and no single, underlying factor has, as yet, been identified for these declines.
- Physiologically, yellow perch display an estrogen-dependent, sexually dimorphic, growth rate, with females growing faster than males. A mechanistic understanding of hormonal pathways, responsible for this phenomenon, will provide unprecedented insights into how environmental stressors, such as estrogen-like EDCs, influence organismal traits (growth).
- Since yellow perch display this unusual, sexually dimorphic, growth rate, which is estrogen-dependent, this teleost can potentially represent an excellent model as an “estrogen sensitive” species. The development of new endocrine tools, to characterize the endocrine physiology of yellow perch, will allow us to examine the sub-lethal mechanisms by which EDCs influence vertebrate endocrine physiology.

Developmental Stability as an Indicator of Amphibian Population Health and Environmental Degradation (Year 2)

Howard H. Whiteman

Dept. of Biological Sciences
Murray State University

\$ 7,50--U.S. Geological Survey

\$18,23--Murray State University

One of the most important, yet most difficult, tasks associated with conservation of any organism is the identification of populations subject to stress before such stress has a detrimental effect. This is particularly true of amphibians; the global decline of amphibians is considered a disturbing indicator of environmental degradation because it may forebode of cascading ecological effects, as well as raising health concerns about human populations. Amphibians are ideal biological indicators, because their semi-permeable epidermis and complex life cycle expose them to multiple stressors in both aquatic and terrestrial environments. Because of this, amphibians should be among the first vertebrates affected by anthropogenic stressors in either of these environments. Furthermore, some of the same stressors affecting amphibians are known to have negative effects on other species, including humans (e.g., PCBs, UV light,

etc). Biologists thus need an early-warning system that could identify environmentally-stressed animals before the stressor causes population and/or regional harm. Such an indicator should be able to measure stress-induced effects before drastic changes in morphology take place which would subsequently decrease the organism's survival and reproductive abilities. One such indicator is obtained by measuring developmental stability, the ability of an organism to develop normally under a range of environmental conditions. One of the most widely used measures of developmental stability is fluctuating asymmetry (FA), nondirectional differences between the left and right sides of the body. Previous KWRRI-supported research by the principal investigator has shown that FA is correlated to human-induced stressors in one amphibian species (Whiteman unpubl. data). This project is a continuation of looking at developmental stability as a biological indicator of stress in amphibian populations, in an effort to improve the ability of biologists to evaluate the health of these populations, the surrounding aquatic and terrestrial ecosystems, and the possible environmental risks to humans.

The results of this study will provide the data necessary to evaluate the use of FA as an indicator of amphibian stress and environmental degradation. Development of FA analyses will provide researchers with a robust biological indicator of environmental health, which can potentially be used to monitor areas sensitive to ecological disturbance or where there are human health concerns. The research will thus be important to both species conservation and environmental monitoring.

Previous studies by the PI have shown that FA can be used as a biological indicator of anthropogenic stressors. Studies of bullfrog (*Rana catesbeiana*) tadpoles revealed that FA increased with increasing levels of agricultural disturbance and water quality degradation.

This research project will correlate amphibian FA with: 1. water chemistry parameters known to cause deformities and mortality in amphibians; 2. land use practices, i.e., undisturbed forested sites, moderately disturbed agricultural sites and highly disturbed industrial sites; 3. density of larvae, which at high levels can induce stress; and 4. population size of adults, which may affect FA via inbreeding depression in small populations. Population estimates will thus allow separation of natural stress levels from those that may be human induced (via water chemistry), which a recent NSF workshop identified as a critical goal of amphibian conservation. It is hypothesized that FA will increase with decreased water quality, increased human land use (disturbance), increased larval density, and decreased adult density. A significant relationships between water quality and land use is expected to be found.



*Amy Benson, Murray State University graduate student working with Dr. Howard Whiteman, analyzes digital images of bullfrog (*Rana catesbeiana*) tadpoles using morphometric software.*

In situ testing of integrated grass filter strip–permeable reactive barrier systems for groundwater protection

Elisa M. D’Angelo and **Mark S. Coyne**

Department of Agronomy

University of Kentucky

\$10,000--U.S. Geological Survey

\$20,000--University of Kentucky

Grass filter strips (GFS) are best management practices recommended to protect sensitive surface and groundwater supplies. However, studies with filter strips have demonstrated that phosphorus and fecal bacteria, significant agricultural contaminants affecting surface and groundwater quality, can circumvent treatment by filter strips because of rapid infiltration. An inexpensive, low maintenance strategy is required to address these problems.

This project will test the integration into a single design of GFS, tile drains and permeable reactive barriers (PRB) to treat surface- and subsurface-derived pollutants. The pilot design of integrated GFS-PRB systems can then be installed in situations where pollutant transport could impact water quality.

Fragipan influence on hillslope hydrology and solute transport

James Thompson

Department of Agronomy

University of Kentucky

\$ 7,500--U.S. Geological Survey

\$15,500--University of Kentucky

In western Kentucky, many soils contain fragipans—subsurface soil layers characterized by high density and high mechanical strength relative to overlying soil layers. The presence of a fragipan in a soil landscape controls water storage and discharge because the fragipan restricts downward water movement and promotes the development of perched water tables above the fragipan. In sloping landscapes, the fragipan encourages lateral subsurface water flow. The movement of dissolved and suspended species (e.g., carbon, nutrients, fertilizers, pesticides) to surface water and groundwater is enhanced through this lateral down slope flow above the fragipan.

A common animal waste disposal practice is to apply the waste to agricultural land. Once applied many factors control the fate of inorganic or organic nitrogen in the animal waste. The widespread occurrence of fragipans may affect the fate and transport of nitrogen and other dissolved or suspended species. To better understand the effects of different surface management operations on surface water and groundwater systems, it is necessary to examine the hydrological processes within the soil.

Data generated from this project will answer questions important to soil and water management in fragipan landscapes. The outcomes of this project will provide information on the management of soils in fragipan landscapes.

A growing season hydroclimatology, focusing on soil moisture deficits, for Kentucky and surrounding climate divisions

Mace L. Bentley

Kentucky Climate Center
Department of Geography & Geology
Western Kentucky University

\$ 9,035--U.S. Geological Survey

\$18,121--Western Kentucky University

Although mean monthly precipitation in Kentucky is adequate for agricultural productivity, moisture deficits due to interannual precipitation variability can cause major agricultural disruptions and economic losses. Planners, farmers and climatologists interested in soil moisture variability associated with climatic fluctuations will benefit from the data generated by this study.

A hydroclimatology will be developed for Kentucky and the 19 surrounding climate divisions, through a model which allows for the calculation of a long time series of soil moisture parameters. Expected results include identification of long-term trends in soil moisture conditions for the region, identification of spatial patterns of soil moisture deficit, and determination of causal mechanisms leading to soil moisture deficit conditions.

Developmental stability as an indicator of amphibian population health and environmental degradation

Howard H. Whiteman

Department of Biological Sciences
Murray State University

\$16,656--U.S. Geological Survey

\$33,378--Murray State University

With increasing global biodiversity loss, the decline of amphibian populations is an indicator of environmental degradation. Since amphibian life cycles occur in both water and land, amphibians are excellent indicators of ecosystem health. Population declines and morphological changes within amphibians may forewarn of impacts on humans. An early-warning system is needed which could identify environmental stressors on populations and regions. Stress-induced effects could be measured before changes in morphology occur which would decrease the organism's survival.

One indicator which can be measured is developmental stability, the ability of an organism to develop normally under a range of environmental conditions. A widely used measure of developmental stability is fluctuating asymmetry (FA) or nondirectional differences between the left and right sides of the body. It is proposed that FA be evaluated as an indicator mechanism in potentially stressed amphibian populations. FA in amphibians will be correlated with water chemistry variables known or hypothesized to cause deformities and mortality in amphibian species. The research will be significant to both species conservation and environmental monitoring.

Defining perennial, intermittent and ephemeral channels in eastern Kentucky

Randall Kolka and Jeff Stringer

Forestry Department
University of Kentucky

\$ 6,000--U.S. Geological Survey

\$12,621--University of Kentucky

Addressing non-point source pollution during silvicultural and timber harvesting operations requires that all parties be able to properly determine the types of streams and channels that are being impacted. The type of Best Management Practice (BMP) applied is dependent on whether a channel is classified as ephemeral, intermittent or perennial. For forestry BMPs, the presence and width of a streamside management zone (SMZ), the level of disturbance allowed within the SMZ, and the distance to major soil disturbances (e.g., roads) are dependent on the stream classification. Incorrect evaluation of stream channel class leads to either enhanced non-point source pollution in the form of sediment and nutrients when actual flow duration is longer than that assessed, or to costly, unneeded BMP implementation when flow duration is shorter than that assessed. The U.S. Geological Survey personnel monitors thousands of perennial streams, but they seldom monitor intermittent or ephemeral streams. This project is developing a field-based approach relating stream morphology to flow duration, because of the potential pollutant and economic impact.



Christopher J. Matocha, Ph.D., an Assistant Professor of Environmental Soil Chemistry in the College of Agriculture at the University of Kentucky uses an anaerobic chamber in his research project supported by KWRRI. Information about this research project is on page 14.

Other Funded Projects

Technical support for the Maxey Flats Disposal Site

James A. Kipp

KWRRI

University of Kentucky

\$196,641-- Cabinet for Health Services (2000-2001)

\$ 75,869-- Cabinet for Health Services (2001-2002)

Since 1995, the Kentucky Water Resources Research Institute has been assisting the Commonwealth by providing technical oversight of Superfund remedial activities at the Maxey Flats Nuclear Disposal Site. The Water Institute identifies the support needs and employs faculty and staff from various University of Kentucky departments as technical experts to fulfill the support needs. Faculty and staff from KWRRI, the Colleges of Engineering – Civil and Chemical Engineering Departments, and Agriculture, and the Kentucky Geological Survey have served as technical experts on Maxey Flats projects to date.

The Maxey Flats Nuclear Disposal Site is located in southern Fleming County, about 10 miles northwest of Morehead, Ky. Local topography consists of relatively flat upland plateaus, or “Flats,” bounded by steep hillsides with deeply incised surface drainage ways. The facility occupies a portion of Maxey Flats and includes 45 acres of fenced, restricted area containing 27 acres of disposal trenches.

Technical support for the Paducah Gaseous Diffusion Plant

James A. Kipp

KWRRI

University of Kentucky

\$238,912--Cabinet for Health Services (2000-2001)

\$199,662--Cabinet for Health Services (2001-2002)

The Kentucky Water Resources Research Instituted provides technical assistance to the Cabinet for Health Services for environmental sample collection, the review and evaluation of documents and activities related to environmental investigations, environmental monitoring, radiochemical evaluation, and remediation of the Paducah Gaseous Diffusion Plant. KWRRI provides scientific and technical expertise in such areas as radiochemistry, civil, chemical, and mechanical engineering, and hydrogeology

Technical support for environmental construction

Donn E. Hancher

Department of Civil Engineering
University of Kentucky

\$60,000--Kentucky Department of Military Affairs

The KWRRI is providing technical support to assist the Department of Military Affairs in meeting their obligations to execute federally-funded environmental projects at Kentucky National Guard locations. KWRRI is assisting with developing plans and specifications and overseeing contract work for environmental construction projects. Projects include installation of wash racks, closed-loop recycling wash rack systems, kitchen grease traps, above ground tanks, containment structures, removal of underground tanks, transfer of paper building plans to Intergraph/Microstation/CAD system and spill plan development.

Kentucky River basin watershed management coordination: Phase IV and Phase V

Lindell Ormsbee

Department of Civil Engineering
University of Kentucky

\$74,000--Kentucky River Authority (2000-2001)

\$81,500--Kentucky River Authority (2001-2002)

The primary goal of this project is to provide technical expertise and work plan coordination in support of the Kentucky River Authority in fulfillment of its role as Basin Coordinator as part of the Kentucky Watershed Management Framework. The initial focus is on fulfilling the goals and objectives associated with Phase IV of the Watershed Framework Basin Management Cycle. A secondary goal of the project is to identify and assess specific research needs as related to the Authority's planning, operation, and management responsibilities.

Phase IV focuses on the development of watershed action plans for priority watersheds and support of watershed task force activities in the basin. This was accomplished via development and distribution of a Watershed Action Planning Guide (in collaboration with the Division of Water), expansion of web-based information resources, and special workshops on watershed problems, solutions, and funding opportunities.

Superfund Outreach Program for Kentucky

Sandra S. Bastin, Cooperative Extension Service

James A. Kipp, KWRRRI

University of Kentucky

\$53,000--U.S. Environmental Protection Agency

The mission of the Outreach Program emphasizes partnerships with public and private sectors. Education outreach relating to Superfund issues will increase awareness and provide access to scientific knowledge; improve communication and network systems within a community; and promote informed decision-making by individuals, families and communities as it relates to nutritional intervention.

Using the results of the program project at the University of Kentucky and additional site information, the Outreach Program will lead to safer, cleaner water, food and air; enhance stewardship and management of natural resources; and promote healthier, more responsible and productive individuals, families and communities, especially as it relates to nutritional interventions.

Kentucky PRIDE Water Quality Assessment

Lindell Ormsbee

Department of Civil Engineering

University of Kentucky

Kentucky PRIDE--\$345,057 (2000-2001)

Kentucky PRIDE--\$199,400 (2001-2002)

The PRIDE (Personal Responsibility in a Desirable Environment) initiative was announced by U.S. Congressman Harold "Hal" Rogers and Natural Resources and Environmental Protection Cabinet Secretary James Bickford in 1997. PRIDE is the first comprehensive, region-wide, local/state/federal cooperative effort designed to address the serious challenge of cleaning up the region's rivers and streams. The initiative focuses on 40 separate counties located in the southeastern part of Kentucky that form the headwaters for the Big Sandy, Licking, Kentucky, Green and Cumberland river basins.

KWRRRI is developing a comprehensive water quality assessment program for PRIDE. The major goal of the project is to provide a means for assessing and evaluating the impacts of proposed and ongoing projects as well as to provide an objective mechanism for prioritizing the allocation of project funds. KWRRRI performed an initial assessment of all federal and state water quality programs operating within the PRIDE region along with an initial assessment the various PRIDE programs within each individual PRIDE county. The data from the program assessment were analyzed and presented in a report entitled: PRIDE Water Quality Assessment Report I: Problems and Programs.

KWRRI developed an assessment database of historical water quality data and associated GIS coverages which was assembled using data sets obtained from state and federal agencies as well Kentucky Watershed Watch. The data were subsequently analyzed and presented in a comprehensive baseline assessment for the 40-county PRIDE project area. Water quality assessments were summarized on the basis of both county and 8-digit HUC watersheds for the following constituents: pH, fecal coliform, habitat assessment, macro-invertebrate assessment, total nitrogen and total phosphorus, in a report entitled PRIDE Water Quality Assessment Report II: Chemical, Biological and Habitat Assessments.

Based on an evaluation of existing PRIDE programs and both historical and existing water quality monitoring stations throughout the region, a strategic water quality monitoring and assessment plan was then developed and summarized in the report: PRIDE Water Quality Assessment Report III: Existing and Proposed Monitoring Network. Results from this years sampling effort will then be used to develop comprehensive watershed models for use in predicting water quality impacts associated with both ongoing and proposed PRIDE projects. The results from the data and model assessments have been assembled in a Web site (<http://www.uky.edu/WaterResources/PRIDE/index.htm>) for electronic dissemination.

Educational Activities

Environmental Systems Certificate

The multi-disciplinary Environmental Systems Certificate curriculum provides graduate students with a broad understanding of the interactions of physical, social, biological, economic and legal parameters of environmental issues. Students can apply their understanding of environmental systems within their major academic fields. Students awarded an Environmental Systems Certificate will be able to compete for traditional employment as well as for positions that cross disciplinary lines.

Environmental Protection Scholarship Program

The students awarded Environmental Protection Program Scholarships during 2001 were:

Mathew A. Baker, Civil Engineering, University of Kentucky
Jolene M. Blanset, Geological Sciences, Eastern Kentucky University

Service and Technology

The service program of the Institute is accomplished by technology transfer and participation by Institute personnel, faculty members and research staff in various policy type committee activities.

Service Activities

The Institute's Director and the Assistant Director serve as active members of many committees, commissions and boards for the University, state and nation. A list of the advisory boards is given below.

- Kentucky Water Availability Task Force
 - Kentucky's Environmental Quality Commission--Water Section
 - Ohio River Basin Commission
 - Environmental Systems Program--University of Kentucky
 - Kentucky Nonpoint Source Pollution Advisory Committee
 - Kentucky Interagency Ground Water Monitoring Committee
-

Table 2

Environmental Systems Committee

Natural, Biological and Medical Sciences

Wesley J. Birge
Biological Sciences
University of Kentucky

Sanford Horstman
Preventive Medicine and Environmental Health
University of Kentucky

Ramesh C. Gupta
Graduate Center for Toxicology
University of Kentucky

James J. Krupa
Biological Sciences
University of Kentucky

Barbara A. Ramey
Biological Sciences
Eastern Ky. University

Larry W. Robertson
Graduate Center for Toxicology
University of Kentucky

Gabriele Ludwig
Nutrition and Food Science
University of Kentucky

Legal, Economic and Social Sciences

Glenn C. Blomquist
College of Business and Economics
University of Kentucky

Thomas R. Greider
Sociology
University of Kentucky

Edward T. Jennings
Martin School of Public Administration
University of Kentucky

Michael P. Healy
College of Law
University of Kentucky

Engineering and Physical Sciences

Dibaker Bhattacharyya
Chemical Engineering
University of Kentucky

James C. Cobb
Kentucky Geological Survey
University of Kentucky

Harry Enoch
Environmental Health and Safety
University of Kentucky

O.J. Hahn
Mechanical Engineering
University of Kentucky

John D. Kiefer
Kentucky Geological Survey
University of Kentucky

Lindell E. Ormsbee
Civil Engineering
University of Kentucky

James A. Kipp
Ky. Water Resources Research Institute
University of Kentucky

Yi-Tin (Ed) Wang
Civil Engineering
University of Kentucky

Jack Wilson
Kentucky Division of Water
Frankfort, Ky.

Environmental Systems Seminar

Gabriele Ludwig
Nutrition and Food Science
University of Kentucky

Technology Transfer Activities

A major focus of the technology transfer effort of the Institute is seminars. The Institute sponsored and/or participated in seminars, conferences and workshops during 2001. The objective of the Institute's Technology Transfer program is to serve the water-resources community of the state. To promote the application of funded research projects, the Institute sends out, by request, copies of its Research Reports to an international audience. The Institute sponsors the Kentucky Water Resources Annual Symposium, which is held to assess the water-resources activities in the state and to disseminate water-resources research information.

In addition to the Environmental Systems Seminar described under the Environmental System Program, the Institute sponsors water-resources seminars for professionals in the Bluegrass region.

Institute Symposiums and Seminars

Kentucky Water Resources Annual Symposium

Environmental Systems Seminars:

Spring 2001: Approaches to Solve Environmental Problems

Jan. 16 Introduction and Discussion: why training in environmental systems?

Jan. 23 Bluegrass Choices, Steve Austin, Bluegrass Tomorrow Inc.

Jan. 30 Environmental Health & Safety at UK: Past and Present, Harry Enoch, Director of the Office for Environmental Health & Safety

Feb. 6 Sustainable Cities from the Drawing Board to Reality, Richard Levine, UK Dept. of Architecture

Feb. 13 Sustainable Cities a Global Political & Cultural Goal, Ernest Yanarella, UK Dept. of Political Sciences

Feb. 20 Discussion with Drs. Levine & Yanarella

Feb. 27 Quality of Life - Compatible Goals for Economy and the Environment, Glenn Blomquist, UK Dept. of Economics

Mar. 6 Discussion with Dr. Blomquist

Mar. 20 Providing Help to Enhance Environmental Research/Training/Service Tracy Farmer

Mar. 27 Aluminum and the Environment: Problems and Solutions, Subodh Das, Director of the Center for Aluminum Technology, President of Secat

April 3 Discussion with Dr. Subodh Das

Institute Symposia and Seminars, continued

April 10 Aquaculture: a Solution for the Environment and Small Farmers, J. Tidwell, KSU, President of the World Aquaculture Society

April 17 Field Trip to KSU Aquacultures + Discussion

April 24 Environmental Health & Safety at UK: Discussion, Harry Enoch and students

The Kentucky River: Its important role in our lives – yesterday, today, and tomorrow

Aug. 28 The Kentucky River Basin: A river flows through it, Eric Christianson, UK History Dept.

Sept. 4 Physical landscapes of the Kentucky River Basin: Our geologic inheritance, James Dinger, Kentucky Geological Survey

Sept. 11 Aquatic organisms in the Kentucky River Basin: Habitats, ecology, and indicator species, Greg Pond, Kentucky Division Water

Sept. 18 Man-made impacts in the Kentucky River Basin: Our management responsibility, Lindell Ormsbee, UK Civil Engineering

Sept. 25 Public Discussion

Water quality policy

Oct. 2 The Clean Water Act: How it's supposed to work, Hank Graddy, Kentucky Watershed Watch

Oct. 9 TMDLs: An agricultural perspective, Rebeckah Freeman, Director of Natural Resources, Kentucky Farm Bureau

Oct. 16 TMDLs: A scientific perspective, Ken Reckhow, Water Resources Research Institute of North Carolina

Oct. 23 The Clean Water Act: The role of the state government, Bob Ware, Kentucky Div. of Water

Water quality management

Nov. 6 The impact of water quality on regional water supply: The central Kentucky experience, Lindell Ormsbee, Tracy Farmer Center for the Environment

Nov. 13 Urban water quality: The Lexington experience, David Gabbard, Lexington-Fayette Urban County Government

Nov. 20 Tour of the Kentucky-American water treatment plants, Rick Buchanan, Kentucky-American Water Company

Nov. 27 Rural water quality, Dave Harmon, Kentucky Division of Water

Dec. 4 Public Discussion

Institute Symposiums and Seminars, continued

Forum on Public Participation in the Environment

October 12, 2001 Worsham Theater, Student Center, University of Kentucky,
Sponsored by the Tracy Farmer Center for the Environment

8:30 - 9:00 Welcome and Introduction

9:00 - 9:30 Kentucky Division of Water

Jack Wilson, Director

9:30 - 10:00 Kentucky Watershed Management Initiative

Greg Epp, Kentucky River Basin Coordinator

10:00 -10:30 Eastern Kentucky PRIDE

Karen Engle, Executive Director

11 :00 - 11 :30 Kentucky Resources Council

Tom Fitzgerald; Director

11 :30 - 12:00 Kentucky River Watershed Watch

Hank Graddy, Project Director

12:00 - 1 :00 Speakers' Lunch

1 :00 - 1 :30 EP A Region IV

Bill Cox, Chief of the Watershed and Non-point Source Section

1 :30 - 2:00 Louisville MSD

Gordon Gamer, Executive Director

2:30 - 3:00 Kentucky Cooperative Extension Service

Curtis Absher, Assist. Director for Agriculture and Natural Resources

3:00 -3:30 Kentucky Farm Bureau

Rebeckah Freeman, Director of Natural Resources

3 :30 - 4:00 East Kentucky Power

Jeff Holman, Manager of Natural Resources and Environmental Communication

4:00 - 4:30 Panel Discussion

Audrey Lee, Editorial Writer Lexington Herald Leader

Publications and Presentations

Publications

Waterworks: The Water Institute's newsletter featuring articles and information on water resource-related topics

Journal Articles

Fryar, Alan, and Christofer Sweat, 2000, *Similar Sorption of Trichloroethene to Alluvial Soils and Cretaceous Sediments from the Lower Ohio Valley*, in *Geological Society of America Abstracts with Programs*, 32(7), A-484.

Brion, Gail M., H.H. Mao, and S. Lingireddy, 2000, *New Approaches to Use of Total Coliform Test for Watershed Management, Water, Science, and Technology*, 42(1-2), 65-69.

Brion, Gail, and H.H. Mao, 2000, *Use of Total Coliform Test for Watershed Monitoring with Respect to Atypicals*, *Journal of Environmental Engineering*, American Society of Civil Engineering, 126(2), 175-181.

Brion, Gail M. and Srinivasa Lingireddy, 2000, *Identification of Pollution Sources via Neural Networks*, in R.S. Govindaraju and A.R. Rao ed., *Artificial Networks in Hydrology*, Kluwer Academic Publishers, ISBN 0-7923-6226-8.

Brion, Gail M., J.S. Meschke, and M.D. Sobsey, 2000, *Male-specific Coliphage: Prevalence, Types, and Survival in Natural Waters*, in *Proceedings 1st World Congress of International Water Association, Health-Related Water Microbiology Symposium*, Paris, France, July 2000.

Brion, Gail, T.R. Neelakantan, and S. Lingireddy, 2000, *Using Neural Networks to Predict Peak Cryptosporidium Concentrations*, *Journal of the American Water Works Association*, 93(1), 99-105.

Bentley, Mace and Andrew Grundstein, 2000, *A Growing Season Hydroclimatology Focusing on Soil Moisture Deficits for the Ohio Valley Region*, in *EOS Transactions of the American Geophysical Union*, 81(48), Fall Meeting Supplement, Abstract H52A-18.

Perfect, E., 2000, *Estimating Soil Mass Fractal Dimensions from Water Retention Curves*, in Y.A. Pachepsky, J.W. Crawford, and W.J. Rawls eds., *Fractals in Soil Science, Developments in Soil Science 27*, Elsevier, Amsterdam, the Netherlands, 131-141.

Neelakantan, T., Gail M. Brion and Srinivasa Lingireddy, 2000, *Neural Network Modeling of Cryptosporidium and Giardia Concentrations in the Delaware River*, in *Proceedings 1st World Congress of the International Water Association, Health-Related Water Microbiology Symposium*, Paris, France, July 2000.

Bejat, E., E. Perfect, V.L. Quisenberry, M.S. Coyne, and G.R. Haszler, 2000, *Solute Transport as Related to Soil Structure in Unsaturated Intact Soil Blocks*, *Soil Science Society of America Journal*, 64, 881-826.

Etienne, Nadege, David Butler, Alan Fryar, and Mark Coyne, 2001, *Trichloroethene Biodegradation Potential in Wetland Soils and Paleowetland Sediments*, *Bioremediation Journal*, 5(1), 27-50.

Neelakantan, T.R., Gail Brion, and Srinivasa Lingireddy, 2001, *Neural Network Modeling of Cryptosporidium and Giardia Concentrations in the Delaware River*, *Water Science and Technology*.

Perfect, E., and M.C. Sukop, 2001, *Models Relating Solute Dispersion to Pore Space Geometry in Saturated Media: A review*, in H.M. Selim and D.L. Sparks ed., *Physical and Chemical Processes of Water and Solute Transport/Retention in Soil*, Special Publ. 56, Soil Science Society of America, Madison, Wisconsin, 77-146.

Perfect, Edmund, Michael C. Sukop, Gerald R. Haszler, and Riley J. Walton, 2001, *Measurement and Prediction of Solute Transport Parameters for Kentucky Soils*, *Kentucky Water Resources Research Institute, University of Kentucky, Lexington, Kentucky*, 28.

Bentley, Mace L., Andrew J. Grundstein, 2001, *A Growing Season Hydroclimatology Focusing on Soil Moisture Deficits for the Ohio Valley Region*, *Kentucky Water Resources Research Institute, University of Kentucky, Lexington, Kentucky*, 24.

D'Angelo, Elisa M., J. Crutchfield, and M. Vandiviere, 2001, *Rapid, Sensitive, Microscale Determination of Phosphorus in Water and Soil*, *Journal of Environmental Quality*.

Dissertations and Theses

Sweat, Christofer, 2000, *The Role of Organic Carbon in Natural Attenuation of a Trichloroethene-Contaminated Aquifer System*, Paducah, Kentucky, MS Thesis, Department of Geological Sciences, College of Arts and Sciences, University of Kentucky, Lexington, Kentucky, 132 p.

Houglund, Sarah, 2000, *A New Microbial Indicator to Predict Fecal Age*, MS Thesis, Department of Civil Engineering, Engineering College, University of Kentucky, Lexington, Kentucky.

Sukop, M.C., 2001, *Porosity, Percolation Thresholds, and Water Retention Behavior of Random Fractal Porous Media*, Ph.D. Dissertation, Department of Agronomy, College of Agriculture, University of Kentucky, Lexington, Kentucky. <http://lib.uky.edu/ETD/ukysosc2001d00009/Sukopdis.pdf>

KWRRRI Reports

Kentucky Water Resources Research Institute Annual Report, March 2001, 28 p.

PRIDE Water Quality Assessment Reports:

I. Problems and Programs, September 2000, 76 p.

II. Chemical, Biological and Habitat Assessments

III. Existing and Proposed Monitoring Network, September 2000, 43 p.

Perfect, Edmund, Michael C. Sukop, Gerald R. Haszler, and Riley J. Walton, 2001, *Measurement and Prediction of Solute Transport Parameters for Kentucky Soils*, Kentucky Water Resources Research Institute, University of Kentucky, Lexington, Kentucky, 28.

Bentley, Mace L., Andrew J. Grundstein, 2001, *A Growing Season Hydroclimatology Focusing on*

Soil Moisture Deficits for the Ohio Valley Region, Kentucky Water Resources Research Institute, University of Kentucky, Lexington, Kentucky, 24.

Conference Proceedings

Westrick, Judy, Miriam Steinitz-Kannan, Brian Bertsch, and Heather Millson, 2000, *Water Quality Differences between the Ohio River and the Storage Reservoir of the City of Newport Drinking Water Plant*, in *Proceedings American Water Works Association 2000 Water Quality Technology Conference*.

Proceedings Kentucky Water Resources Annual Symposium, February 25, 2001, 52 p.

Perfect, E. and M.C. Sukop, 2001, *Modeling Solute Dispersivity in Irregularly Shaped Soil Pores*, in *Proceedings 4th Eastern Canada Soil Structure/Carbon Workshop*, Leamington, Ontario, Canada, 107-116.

2001 Kentucky Water Resources Annual Symposium Presentations

Mapping and summarizing Kentucky ground-water chemistry, *R.S. Fisher, KGS; P.T. Goodmann, KY DOW*

Arsenic in Kentucky's groundwater and public water supplies and the impact of the new MCL of 10 mg/L, *P.T. Goodmann, James Webb, and Tracy Burgess, KY DOW; Jolene Blanset, Earth Sciences, EKU*

The Kentucky ground-water data repository, *Bart Davidson, KGS*

Radon levels in ground water and finished water at Kentucky ground-water-supplied public water systems in Kentucky and the impact of EPA's proposed radon rule, *P.T. Goodmann, D.P. Leo, and Jack Moody, KY DOW*

Devising a wellhead protection strategy for Georgetown: A report of the efforts to preserve the groundwater quality in a karst spring underlying Fayette

and Scott Counties, *R.L. Riddle and J.G. Long, Jr., Georgetown Municipal Water and Sewer Service*

Changes in ground-water quality in a conduit-flow-dominated karst aquifer following BMP implementation, *J.C. Currens, KGS*

Springs and springhouses in Kentucky's Inner Bluegrass Region: Form and function in an evolving landscape, *G.A. O'Dell, KYDOW*

Use of stable isotope data in a preliminary investigation of ground-water recharge, *C.J. Taylor, USGS, Louisville, KY*

Improving the performance and management of onsite waste water treatment systems, *Barry Tinning, Tetra Tech, Inc., Fairfax, VA*

Kentucky Watershed Watch Program

Four Rivers, *Mike Kemp, Murray State University*

Tradewater-Lower Green Rivers, *Rob Kingsolver, Kentucky Wesleyan University*

Upper Green River, *Ouida Meier, Western Kentucky University*

Upper Cumberland River, *Gary Sherman, Somerset Community College*

Salt River, *Jeff Jack, University of Louisville*

Kentucky River, *Lindell Ormsbee, University of Kentucky*

Licking River, *Marc Hult, Daniel Carter Beard Environmental Center, Covington, Ky.*

Big Sandy River, *Tom Vierheller, Paul Thompson, Prestonsburg*

Approaches to prioritizing watersheds within the Licking and Kentucky River Basins, *Pamla Wood, KY DOW; Greg Epp, KWRI*

A macroinvertebrate bioassessment index for headwater streams of the Eastern Coalfield Region, Kentucky, *Greg Pond and Steve McMurray, KYDOW*

Impact of gravel removal operations on stream physical and biological integrity in the Upper

Cumberland River Drainage, Kentucky, *Jeffrey Jack and Rich Schulze, Biology; Art Parola, Civil and Env. Engr, UL; and Bill Sampson, KYDOW*

Genetic analysis in microbial chromium (VI) reduction, *Noppadon Kowsuvon and Y.T. Wang, Civil Engr; C.L. Pickett, Microbiology and Immunology; Edward Demoll, Chemistry, UK*

The effect of iron chelates on the oxidation of organic groundwater contaminants by Fenton's Reagent, *Paul Rodgers and Dibakar Bhattacharyya, Chem and Materials Engr, UK*
Ohio River high-volume sampling, *K. F. Miller, USGS, Charleston, WV*

Yields of selected pesticides in the Lower Ohio River Basin, 1996-98, *A.S. Crain and T.O. Mesko, USGS, Louisville, KY*

Calibration and validation of a two-dimensional hydrodynamic model of the Ohio River, Jefferson County, Kentucky, *C.R. Wagner and D.S. Mueller, USGS, Louisville, KY*

Louisville KY/Ohio River wet weather demonstration project, *Lynn Jarrett and Lawrence Curry, J.E. Edinger Associates, Henryville, IN*

Introduction, Dwayne Edwards, Biosystems and Agricultural Engineering, UK

Educational programs on current and emerging issues in water quality, *W.O. Thom, L.M. Heaton, J. Cocanougher, K. Henken, and M.S. Coyne, UK*

Filter strips and fecal coliforms - does best management work? *M.S. Coyne, Agronomy, UK*

Diurnal variations and sample bias in a karst watershed in central Kentucky, *A.W. Fogle, KGS and J.L. Taraba, Biosys and Ag Engr, UK*

Opportunities for animal nutrient management using precision agriculture, *S.A. Shearer, Biosys and Ag Engr, UK*

Pesticides in runoff and infiltration water from plant production, *G.F. Antonious, Plant and Soil Science, KSU*

Nitrogen retention and release in soils of certified organic farms, *V.M. Bhavsar and M.S. Coyne, Agronomy, UK*

Bacteriological quality of three mixed land use watersheds in McLean County, Kentucky, *G. Henson, McLean County Cooperative Extension; M.V. Fernandez-Canigia and M.S. Coyne, Agronomy, UK*

Monitoring strategy and source assessment for TMDL development in karst geology, *J.L. Taraba, Biosys and Ag Engr, UK and A.W. Fogle, KGS*

Fractionation and biological availability of suspended phosphorus in agricultural surface waters, *M.E. Taylor, J. Crutchfield, and M.S. Coyne, Agronomy; J.L. Taraba, Biosys and Ag Engr, UK*

Phosphorus distribution and behavior in Kentucky watersheds, *Lynn Jarrett, J.E. Edinger Associates, Henryville, IN*

Continuous manure application without adverse environmental impact: Spatial analysis of crop phosphorous removal to improve the Kentucky Phosphorus Index, *J.H. Grove and E.M. Pena-Yewtukhiw, Agronomy, UK*

Effect of manure application rates on fecal bacteria infiltration through intact sod, *M.S. Coyne, M.V. Fernandez-Canigia, E. Perfect, J. Grove, Agronomy; D. Edwards, Biosys and Ag Engr, UK*

Herrington Lake-Dix River Watershed, *Lynn Jarrett and Lawrence Curry, J.E. Edinger Associates, Inc., Henryville, IN; John Overing, KY Heritage RC&D, Harrodsburg, KY*

Successful partnering of utility, regulatory authority, and citizens to resolve NPDES discharge permit limitation differences, *Jim Buckles, Commonwealth Technology; Gary Swanson, CH2M Hill; Marsha Jenkins, Louisville-Jefferson County MSD; Jeff Frank, Sierra Club*

Hydrologic modeling of the Chenoweth Run Basin, Jefferson County, Kentucky, *G.R. Martin, USGS, Louisville, KY*

Posters

Employing geographic information systems (GIS) and global positioning systems (GPS) in public works applications, Kevin Wente, LFUCG

Assessing the spatial probability of water-saturated subsoil and the remaining remediation area for a nitrate contaminated farmstead, *E.M. Pena-Yewtukhiw and J.H. Grove, Agriculture, UK; E.G. Beck, J.S. Dinger, and R.C. Counts, KGS, UK*

Big Sandy River Watershed Watch sampling results for 1999-2000, *P.D. Thompson, T.L. Virheller, and Chenzhao Vierheller, Prestonsburg Community College, Prestonsburn, Ky.*

The Kentucky agriculture water quality act: Computer program for assisting farmers in preparing agriculture water quality plans, *Henry Duncan, Ag Water Quality Liaison, Frankfort, Ky.*



A person attending the 2001 Water Resources Annual Symposium gets in close to check a detail on one of the posters.



Dr. Lindell Ormsbee, Interim Director of the Tracy Farmer Center for the Environment talks with Brian Stewart of the Hazard Community College during a break at the 2001 Water Resources Annual Symposium.



Jim Dinger, Kentucky Geological Survey, uses the break time to network with other attendees at the 2001 Water Resources Annual Symposium.

Associated Units

These are non-UK units that are associated with KWRRI.

Ohio River Basin Commission

The Commission's purposes are to: (1) Provide a forum for the Ohio River Basin States to study, discuss, and develop regional policies and positions on common interstate issues concerning water and related land resources.

(2) Coordinate, to the extent possible and appropriate, water and related land resources planning in the Ohio River Basin and to encourage coordinated and cooperative action by the Ohio River Basin states, the federal government, and other agencies in the planning, development, and management of the water resources of the Basin.

(3) Provide representation of the regional interests of the Basin before the Congress and federal agencies responsible for the planning, development, and management of water and related land resources in the Basin.

(4) Investigate, study, and review water-related problems and issues of interest to the member states.

More information is available at: <http://www.orbcinterstate.org/>.

Association of State Dam Safety Officials

The Association of State Dam Safety Officials (ASDSO) is a not-for-profit organization formed in 1984 in response to several major dam failures across the United States during the previous decade. It was recognized at the time that the need for stronger regulatory programs was great. In order to encourage and assist states in setting up or upgrading their dam safety programs, the Association was formed.

ASDSO is located in Lexington, Kentucky. At the headquarters is a four-person staff, a computerized network of over 11,000 members and contacts within the dam safety community, a centralized library of books and media products on dam safety and related fields and a vast electronic bibliography of dam safety materials.

More information is available at : <http://www.damsafety.org> .

KWRRI Personnel

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