

## **EPA Project: Mayagüez Bay Watershed Management Program (second year)**

During the second year of this project, three committees have been formed to help develop and give structure to the comprehensive plan. They consist of:

- (1) Administrative Committee - This committee will be in charge of administration, soliciting proposals and allocating the necessary funds for the research projects.
- (2) Technical Accessory Committee – This committee is made up of scientists and technical representatives of each constituent group. They will provide technical advice to the constituent committee (**FORO**) about which proposals to consider for the project.
- (3) Constituent Committee (**FORO**) – from a decision point of view, they represent the most important level. They determine the problems that are related to the basin and the order of priority. This group is composed of people from diverse groups in the community who are directly affected by these problems or those who can contribute by offering solutions.

During this second year, this established organizational process will be tested and evaluated in terms of effectiveness, coordination and communication.

During October 8, 1999, a group of 40 representatives from the community, academia, government and private industries made a panoramic visit to the Río Grande de Añasco basin. As a measure to involve the community, many strategies have been identified to describe and inform the community about the conditions of the Basin and the future plans to restore it back to normal. There have been many presentations to inform the public, including the Southwestern Industrial Association, the community of El Maní, the university community at the RUM, the Club de Leones at Mayagüez, the agricultural fair Cinco Días con Nuestra Tierra, and at various schools located within the basin area.

### **SUBMITTED PROPOSALS**

#### **➤ FEMA: Multidimensional Hydraulic Model for Mitigation of Flood Damages**

Flood hazard mitigation has been identified as a high priority task for Puerto Rico due to the loss of property and human risks during flood events occurred in the Island. There is a lack of updated regulatory documents used by engineers and professionals to design and construct appropriate infrastructure according to today's standard of practice. This proposal will develop an advanced computer model to delineate the flood zone of the Río Grande de Añasco valley and coastal flat zones. During floods, this river has significant multidimensional movement of water, and the use of existing one-dimensional models is questionable; therefore, a two-dimensional model is proposed. The suggested hydraulic model is included as part of the Surface Modeling System (SMS). The research project will also analyze mitigation measures from the hydrodynamic point of view, for the major communities located within the flood zone. From the experience with this project, it is expected to apply the same concept to other flood zones of Puerto Rico.

The Interagency hazard Mitigation Report, prepared after the Hurricane Georges affected Puerto Rico, was kept in mind during the preparation of this proposal. This report includes recommendations by a group of professionals assembled by FEMA. Among the most important issues raised in this report, there is a need for “*updates to topographic, bathymetric, and flood maps in order to update zoning maps and refine map data after disaster*”. The project will serve as a basis to *update and coordinate data needed for design and planning of watershed management programs: topographic maps, zoning*

*maps, floodplain maps, rainfall frequency, hydrologic atlas, and coastal data. It will also be useful to analyze data and determine cumulative impacts.* If this proposal is approved, the Federal Emergency Management Agency (FEMA) and the University of Puerto Rico will fund the project for a period of two years.

➤ **DEC Monitoring Program Project: Hydrologic Study for the Yalobusha River Tributaries**

Channel modification or channelization activities are listed among the top 10 sources for nonpoint pollution impacts to rivers. Activities such as straightening, widening, deepening, and clearing debris from channels are included as hydromodification activities. These activities can severely impact major river projects such as navigation and flood control, as well as alter or reduce the diversity of in-stream and riparian habitats. The Demonstration Erosion Control (DEC) project addresses three primary concerns: (1) provides for the development of a system for control of sediment, erosion, and flooding in the hill areas of the Yazoo Basin, Mississippi; (2) provides the ability for development of innovative stream rehabilitation and stabilization techniques to be developed and tested; and (3) provides for a significant research effort to monitor the effectiveness of constructed features to meet project goals. The research effort addresses fundamental topics related to the mission of the U.S Army Corps of Engineers. The knowledge gained through monitoring and analyzing the DEC project significantly increases the ability to define the contribution to nonpoint source sediment pollution caused by channelization and related hydromodification activities. The DEC monitoring program also defines the success of these activities in reducing nonpoint source pollution. Therefore, the research funding of the DEC monitoring program is providing: a) important performance data to identify alternative methodologies and benefits for control of nonpoint source sediment pollution; b) design and performance analyses of flood control, erosion prevention, and channel rehabilitation methodologies that are fundamental to the USACE mission; and c) technology transfer of these methodologies to the engineering profession. The DEC monitoring project is the first long-term monitoring project in the Yazoo Basin.

The Yalobusha River is a tributary of the Yazoo River. This research project proposes a preliminary hydrologic investigation for a series of 45 streams inside the Yalobusha watershed. Each of these streams is tributary to the Yalobusha River or Grenada Lake, and are located in Calhoun, Webster, Yalobusha and Grenada Counties, Mississippi. Hydrology development for each site will consist of determining the relevant hydrologic parameters for each catchment, these being drainage area, time of concentration, basin slope and length, and land use/soil type distribution. The parameters will be used in a hydrologic simulation model to generate runoff hydrographs for T-year storms. The proposed rainfall-runoff model is the Watershed Modeling System (WMS) package. The WMS model uses available digital elevation maps to compute catchment parameters, which are then coupled to a hydrologic model interface to compute runoff hydrographs. The U.S. Army Corps HEC-1 model is one of the available options, and is the one proposed for use in this study. The major benefit accruing from the proposed study is the creation of a basin hydrology data base that can be used in related river studies.

This project is scheduled to start in August, 2000. Dr. Jorge Rivera Santos is in charge of this project as principal investigator and, Dr. Rafael Segarra is co-principal investigator. A member of the U.S. Army Corps of Engineers will accompany the PI, Co-PI and one student during field reconnaissance and data acquisition.

➤ **Analysis and Recommendations for the Improvement to the Water Distribution System in the Western Area of Puerto Rico**



The management and control of water resources requires knowledge, planning and design of water systems to supply the demands of the present and future population. The population growth, as well as, industrial and commercial developments increase the water demand and require more efficient systems for the storage, treatment and distribution. The Puerto Rico Sewage and Sewerage Authority (PRASA), which is responsible for providing these services, and more recently, the Puerto Rico Water Company (PRWC), have not been able to provide an adequate service for the water distribution in the western part of the Island. The organization “Water for the West”, composed by citizens concerned about this problem, have taken initiative to find a solution to this problem and requested the PWRERI a proposal for the analysis and recommendations for improvement to the water distribution system in part of the west side of Puerto Rico. The study area includes the municipalities of Mayagüez, Añasco, Hormigueros and part of Las Marías, Maricao and Cabo Rojo.

To find an effective solution to the water supply problems it is vital to study the existing conditions of the system and evaluate the system to propose the required changes. Lack of maintenance, misuse, rust and corrosion, exposure to substances derived from the chemical composition of water, and the illegal use of the water services, produce an increase in the deterioration process of the pipes. Improvement, rehabilitation or total replacement might be necessary to meet the water demand in the present; as well as, in the future.

The hydraulic model is an important tool in the study of water distribution problems. This tool allows for the analysis and study of the system to determine the causes of improper or defective operation. It also allows for the analysis of alternatives providing information useful to solve the problems identified in a rational and efficient manner.

The main objectives of this investigation are: to develop and calibrate a hydraulic model of the water distribution system that supplies the western part of the Island. The model will be used to evaluate the capacity of the existing system and its ability to provide adequate service during changes in operation patterns; and to recommend improvements and expansions to the water distribution systems to satisfy the present and future demand. The project will be divided into three parts: (1) the data collection; (2) development of the hydraulic model; (3) evaluation of the alternatives for solving the water problems in the area. The project is scheduled to run for one year under the direction of the directors of the PWRERI, Dr. Jorge Rivera Santos and Dr. Walter Silva Araya.

### **APPROVED PROPOSALS:**

#### ✓ **Development of a novel Dual-Function Media Matrix for Protecting Water Resources from Noxious Wastes.**

Industrial growth in the Southeastern sun-belt coastal region of the United States including the Islands during the last three decades has adversely affected underground and surface water resources. Industrial effluents, especially injectable wastes such as sludge and other semi-solid wastes, which end-up in landfills, caves and wells/aquifers, interact in many ways with water resources. This has been identified as a serious problem in aquifers on the mainland United States; and also wells in Puerto Rico. Some injection sites are not too deep and are close to the water table. The wastes, especially leachates easily pollute water resources if the water table is too close to the surface. Injected sludge at sites in the Barceloneta area of Puerto Rico is already a source of pollution. The injected wastes interact with groundwater through flooding, rainfall infiltration and run-off, landfill saturation and the rising of the water table. Some landfills and injection sites in Puerto Rico have subsequently been closed, and as a result, untreated wastewater is ending up in bays and rivers.

The objective of this project is to develop and determine the effectiveness of a novel dual-function media matrix for the protecting water resources from injectable noxious wastes. This research will specifically address the handling problems associated with wastewater and sludge containing oils, grease and odorous biodegradable solids from the tuna industry. The specific research objectives include: (1) filtration and washing tests of dual-function media matrix with immobilized oily wastes; (2) in-situ biodegradation and biofiltration tests on media matrix; (3) washing and biofiltration tests on injection site material which injected wastes and optimization of dual-functionality properties. It will lead to the first step to design solid-liquid separators used in wastewater treatment that are not affected by the presence of fats, oils and grease, and fine particles in wastewater mixtures. The outcome of this project will lead to an economical method for injectable-waste disposal technology and for landfill cleanup operations. It will also provide a pedagogical methodology for the efficient education of undergraduates and graduate students new to the field.

Dr. Moses Bogeres is in charge of this project as the principal investigator. The proposed work schedule is from March 1, 2000 through February 28, 2001 because it is estimated that all objectives will be accomplished within the first year. In one year, enough data will have been collected to enable the PI's to optimize dual-functionality. It will then be possible to estimate the cost of this technology as compared to alternative technologies. The budget for this project is \$19,520.

#### ✓ **Sixth Caribbean Island Water Resources Congress**

The Sixth Caribbean Island Water Resources Congress will take place at the Mayaguez Resort and Casino in Mayaguez, Puerto Rico, on February 22 and 23, 2001. T

The water resources issues affecting the lives of the people living in the Caribbean and Tropic countries are as diverse as their culture, history and politics. A major concern in one little island may be the lack of surface and ground water, that forces

the people to use seawater desalination as the only source for satisfying potable water demands. Yet, a close neighbor might be interested in controlling flooding problems or the degradation of water quality produced by streams and rivers in steep watersheds. Additionally, some islands are of volcanic origin with mountainous terrain while others are of limestone origin with a low relief and constantly in danger of ocean swells. With all their diversity, the islands do have several similarities. They all have distinct rainy seasons often punctuated with hurricanes; have national objectives that include preservation of coastal waters from land based contamination; have a need for waste water disposal with minimal environment impact; and a need to better manage and conserve limited water resources. With all their particularities, how are the water resources policies in these countries responding to the accelerated changes taking place due to the globalization? How is the society preparing to deal with new water resources management that include conservation, reuse, rehabilitation of water systems and increased costs of preserving and creating new infrastructure? These are some of the important issues to be addressed in the Congress.

The Congress program will be organized to facilitate presentation of papers on the wide range of topics that are relevant to the continually growing needs of the islands. There will be concurrent technical sessions on areas of particular interest, plenary sessions on topics of more general interest, and a feature presentation by prominent persons well versed in subject of interest to all. The program will provide (1) an exchange of ideas and information for water resources investigators, educators, consultants, and management professionals; (2) an update on the current water resources situation in the Tropics and the Caribbean; and (3) sharing and transfer of data, technology, and management practices.

Abstracts can be submitted to be reviewed on the following topics:

- Watershed management
- Infrastructure and water distribution
- Erosion, sedimentation and geomorphology
- Data availability
- Extreme hydrologic events (floods/droughts, hurricanes)
- Sustainable development of water resources
- Desalination, water reuse, and other water-supply sources (Caribbean and Tropical Island experience)
- Climate change impact in the Tropics/Caribbean (global changes, El Niño, La Niña)
- Management of limited freshwater resources (conservation, reuse, availability)
- Water resources information and education
- Surface and ground water quality
- Social aspects and water issues: water price, water use, etc.
- Small community water systems: water supply and wastewater

A Call for Abstracts is available upon request at (787) 265-3826 or by e-mail at [WRRIRUM@rumac.upr.clu.edu](mailto:WRRIRUM@rumac.upr.clu.edu). August 4, 2000 is the Deadline.

**Cumulative and Secondary Impact Assessment Modeling Program for Jobos Bay  
Estuarine Research Reserve Watershed**

The Coastal Zone Management Program (CZMP) is approximately mid-way through a 3-year effort to integrate Cumulative and Secondary Impact Assessment (CSI) into management decision making for coastal resources. At the end of the 3-year period (Sept. 30, 2000) it is anticipated that the results of the work on CSI will begin to be integrated into the operational activities of the Puerto Rico's Department of Natural and Environment Resources (DNRA).

An initial step in the process will be a collaborative effort to adapt various existing models, beginning with EPA's Better Assessment Science Integrating Point and Nonpoint Source (BASINS) System, to the specific issues and conditions that exist within the Jobos Bay watershed.

The programmatic objectives for this fiscal year will focus on developing/adapting computerized simulation models that demonstrate cause and effect relationships within the watershed between: (1) specific land-based activities (i.e. agricultural practices) and resultant impacts on mangrove wetlands in the JBNERR; (2) Specific point source discharges (i.e. untreated sewage) affecting water quality in Jobos Bay.

The models will simulate the mechanism of pollutant generation and transport due to land use changes, land treatment (land grading/cut and fill) and other man activities within the Jobos Bay watershed. This modeling will produce the data necessary to determine pollutant loads and their effect on the quality of the waters of JBNERR and its habitat.

**PROFESSIONAL DEVELOPMENT CENTER:**

**SUCCESSFUL SHORT COURSE: HYDROLOGIC MODELING USING GIS  
AND THE WATERSHED MODELING SYSTEM**

A four days short course on HYDROLOGIC MODELING USING GIS AND THE WATERSHED MODELING SYSTEM (WMS) was offered from May 31 to June 3 at the Mayaguez Campus of the University of Puerto Rico. The course was designed as a hands-on application oriented training using the new version of WMS; as well as, an introduction to the Hydrologic Simulations Program – Fortran (HSPF) watershed water quality model. The course provided attendees with the knowledge and tools necessary to get the most out of GIS data developed specifically for watershed modeling, and examined how digital terrain data can be used for development of watershed parameters important in the common hydrologic analysis programs.

The course was coordinated by the PRWRERI and sponsored by the Department of Civil Engineering of the UPR-Mayaguez with collaboration from WES. Dr James Nelson, and Colby Manwaring from the Environmental Modeling Research Laboratory (EMRL) at Brigham Young University, Dr. Patrick Deliman and Dr. Carlos Ruiz from WES formed the team of instructors for this course. The course was attended by personnel from the Puerto Rico Department of Transportation and the University of Puerto Rico at Mayaguez. A description of the software introduced during the course follows.

## **WMS**

WMS is a comprehensive environment for hydrologic analysis. It was developed by the Environmental Modeling Research Laboratory (EMRL) at Brigham Young University in cooperation with the U.S. Army Corps of Engineers Waterways Experimental Station (WES) and the U.S. Federal Highway Administration (FHWA).

WMS merges information obtained from terrain models and GIS with industry standard lumped parameters hydrologic analysis models such as HEC-1 and HEC-HMS. Terrain models can be used to compute travel times for time of concentration or lag times using standard equations from TR-55, FHWA or used defined equations. Many display options are provided to aid in modeling and understanding the drainage characteristics of terrain surfaces.

A distinguishing difference between WMS and other applications designed for setting up hydrologic models like HEC-1 and TR-20 is its unique ability to take advantage of digital terrain data for hydrologic model development. WMS uses three primary data sources for model development: 1) Geographic Information Systems (GIS), 2) Digital Elevation Models (DEMs), 3) Triangulated Irregular Networks (TINs).

## **TMDL's and HSPF**

In the interest of maintaining or improving water quality, most environmental regulatory agencies are requiring watershed-based studies of water quality. This process is referred to as a Total Maximum Daily Load (TMDL). These TMDL studies generally require some numerical modeling to be performed as a predictive analysis of watershed behaviour. The Hydrological Simulation Program-FORTRAN (HSPF) is currently one of the best-suited watershed-based models in use for the development of TMDL's. The HSPF model is a powerful tool that allows the analysis of a wide range of variables in a watershed; however, the complexity of the model and the input required is prohibitive for wide use of model.

The HSPF is a continuous model which simulates the hydrologic and water quality processes on pervious and impervious land surfaces and in streams and well-mixed impoundments. Using meteorological inputs, HSPF can compute stream flow hydrographs for numerous sources of runoff and pollutographs for various water quality constituents.

**CONTACT THE PUERTO RICO WATER RESOURCES AND ENVIRONMENTAL RESEARCH CENTER FOR MORE INFORMATION ON WMS OR HSPF. The personnel of the Institute are qualified for developing research and applications of these state-of-the-art models to government agencies and private companies.**

## **CALENDAR OF EVENTS**

Sixth Caribbean Islands Water Resources Congress

Puerto Rico Water Resources Research Institute

Virgin Islands Water Resource Institute

U.S. Geological Survey

February 22 – 23, 2001 - Mayagüez Resort and Casino - Mayagüez, Puerto Rico

For more information contact: PR WRERI - Phone: (787) 265-3826 - Fax: (787) 832-0119 E-mail: [WRRI\\_RUM@rumac.upr.clu.edu](mailto:WRRI_RUM@rumac.upr.clu.edu)

Living Downstream in the Next Millennium: Reconciling Watershed Concerns with Basin Management

Universities Council on Water Resources (UCOWR)

Mississippi State University, Louisiana State University

August 1 – 4, 2000 - Hilton New Orleans Riverside - New Orleans, Louisiana

For more information contact: UCOWR - Phone: (618) 536-7571 - Fax: (618) 453-2671

E-mail:

AWRA 2000 Summer Specialty Conference: Riparian Ecology and Management in Multi-Land Use Watersheds

American Water Resources Association

August 29 – 31, 2000 - Double Tree Portland/Lloyd Center Hotel - Portland, Oregon

For more information contact: AWRA - Phone: (540) 687-8390 - Fax: (540) 687-8395

Web site: [www.awra.org](http://www.awra.org) E-mail: [info@awra.org](mailto:info@awra.org)

Ground Water, Source Water and Underground Injection Forum and Technical Exchange Exposition

Ground Water Protection Council 2000 Annual Forum

September 24 – 27, 2000 - Radisson Hotel - Ft. Walton Beach, Florida

For more information contact: Jeff Bryant - Phone: (405) 516-4972

E-mail: [jeff@gwpc.site.net](mailto:jeff@gwpc.site.net) Web site: <http://gwpc.site.net/meetings.htm>

Dam Safety 2000

Association of State Dam Safety Officials (ASDSO) 2000 Annual Conference

September 26 – 29, 2000 - Westin Hotel - Providence, Rhode Island

For more information contact: ASDSO - Phone: (606) 257-5140

Web site: [www.damsafety.org](http://www.damsafety.org)

AWRA's Annual Water Resources Conference

American Water Resources Association

November 6 – 9, 2000 - Hyatt Regency Miami Hotel - Miami, Florida

For more information contact: AWRA - Phone (540) 687-8390 - Fax: (540) 687-8395

Web site: [www.awra.org](http://www.awra.org)

Asking the Right Questions: Evaluating the Impact of Groundwater Education

2000 Groundwater Foundation Fall Conference and Groundwater Guardian Designation

November 13 – 15, 2000 - Lied Conference Center - Nebraska City, Nebraska

For more information contact: Cindy Kreifels, conference chair at the Groundwater Foundation - Phone: 1-800-858-4844 or (402) 434-2740

E-mail: [cindy@groundwater.org](mailto:cindy@groundwater.org) Web site: [www.groundwater.org](http://www.groundwater.org)