AMERICAN INSTITUTE OF HYDROLOGY
2004 ANNUAL CONFERENCE

INTEGRATED WATER RESOURCES MANAGEMENT

CONFERENCE PROGRAM

IN COOPERATION WITH:

THE UNITED STATES GEOLOGICAL SURVEY

ALEXIS PARK RESORT & SPA
LAS VEGAS, NEVADA
OCTOBER 17 - 21, 2004

TABLE OF CONTENTS

2004 AIH Conference Information 4

2004 Organizing Committee 5

Floor Plan of Alexis Park Resort & Spa 6

Schedule of Events 6-9

Session 1 Abstracts 10-11

Session 2 Abstracts 12-13

Session 3 Abstracts 14-15

Session 4 Abstracts 16

Session 5 Abstracts 17

Session 6 Abstracts 18-19

Session 7 Abstracts 20-21

Session 8 Abstracts 22

Session 9 Abstracts 23

Session 10 Abstracts 24

Session 11 Abstracts 25-26

Session 12 Abstracts 27

Guest Speakers 28

Short Courses 29

Poster Presentations 30

Exhibitors/Sponsors 31

2006 AIH 25th Anniversary Meeting, Baton Rouge, Louisiana 32

2004 AIH CONFERENCE INFORMATION

INTRODUCTION

The conference intent is to convene scientists, government officials, business personnel, and students of hydrology to share scientific and technical information on activities and developments within all disciplines of hydrology throughout the United States as well as other countries. Technical presentations and poster sessions will be used to document and transfer information throughout the conference. The program will also include keynote speakers, plenary sessions, short courses, field trips and the AIH Annual Business Meeting.

Three major awards will be presented: the Ray K. Linsley Award, the C.V. Theis Award and the AIH Founders Award. Awards will also be given to students participating in the conference who have been judged for best poster and oral presentation.

TECHNICAL PROGRAM

The technical program for the 2004 Conference will cover all disciplines of hydrology with emphasis on the combined application of these disciplines to address complex water resource management issues. Integrated hydrology themes that should be considered by potential speakers include:

" Multi-disciplinary hydrologic approaches to watershed management
" Hydrologic approaches to the development of Total Maximum Daily Loads
" Successful use of hydrologic models for managing storm water in growing urban areas
" Surface-/Ground- water relationships during storm events
" Use of geospatial data in hydrology
" Water quality in urban watersheds
" Challenges to maintaining dissolved oxygen levels in tail race reaches below dams
" Multi-disciplinary hydrologic approach to managing Corps of Engineer lakes for recreation and electrical generation
" Conjunctive surface water-ground water management

CONFERENCE INFORMATION

REGISTRATION

All conference participants are required to register. Full registration includes admission to all conference sessions, final program, proceedings copy, breaks, planned luncheons, and awards banquet. One-day registration is also available, which includes admission to all conference sessions, final program, and breaks on the day for which the participant is registered. Separate registration is needed for the short courses; and any participant's invited guests to a lunch or the Awards Luncheon.

MEETING

The general sessions and concurrent sessions will be held at the Alexis Park Resort & Spa, Las Vegas, Nevada. All break refreshments can be found in the Exhibit Area (Parthenon 4). The Luncheons and the Awards Banquet will be held in the Parthenon 2 Area.

PAPERS

The technical papers are listed chronologically in the Program.

EXHIBITS

One of the highlights of the conference is the exhibits. The exhibits are located in the Parthenon 4 Area, where you will also find the break refreshments. The exhibits will open Sunday, October 17, at 6:00 pm to 7:00 pm and between 8:00 am to 7:00 pm, Monday and Tuesday. The exhibits will close at 10:30 am on Wednesday, October 20, 2004.

AIH BOOTH

Visit the AIH booth for the opportunity to look at various publications available for sale.

CONFERENCE PROCEEDINGS

The American Institute of Hydrology will publish the meeting proceedings. The proceedings include all of the meeting abstracts and are included with full registration. The full manuscript of papers may submitted for publication and will undergo the regular peer review process for publication in the *Hydrological Science and Technology* Journal at a later date. The Journal may be purchased separately and will be available at a date to be announced following the meeting.

2004 ORGANIZING COMMITTEE

Chairman of the Organizing Committee

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U.S. Geological Survey

Chairman of the Technical Program

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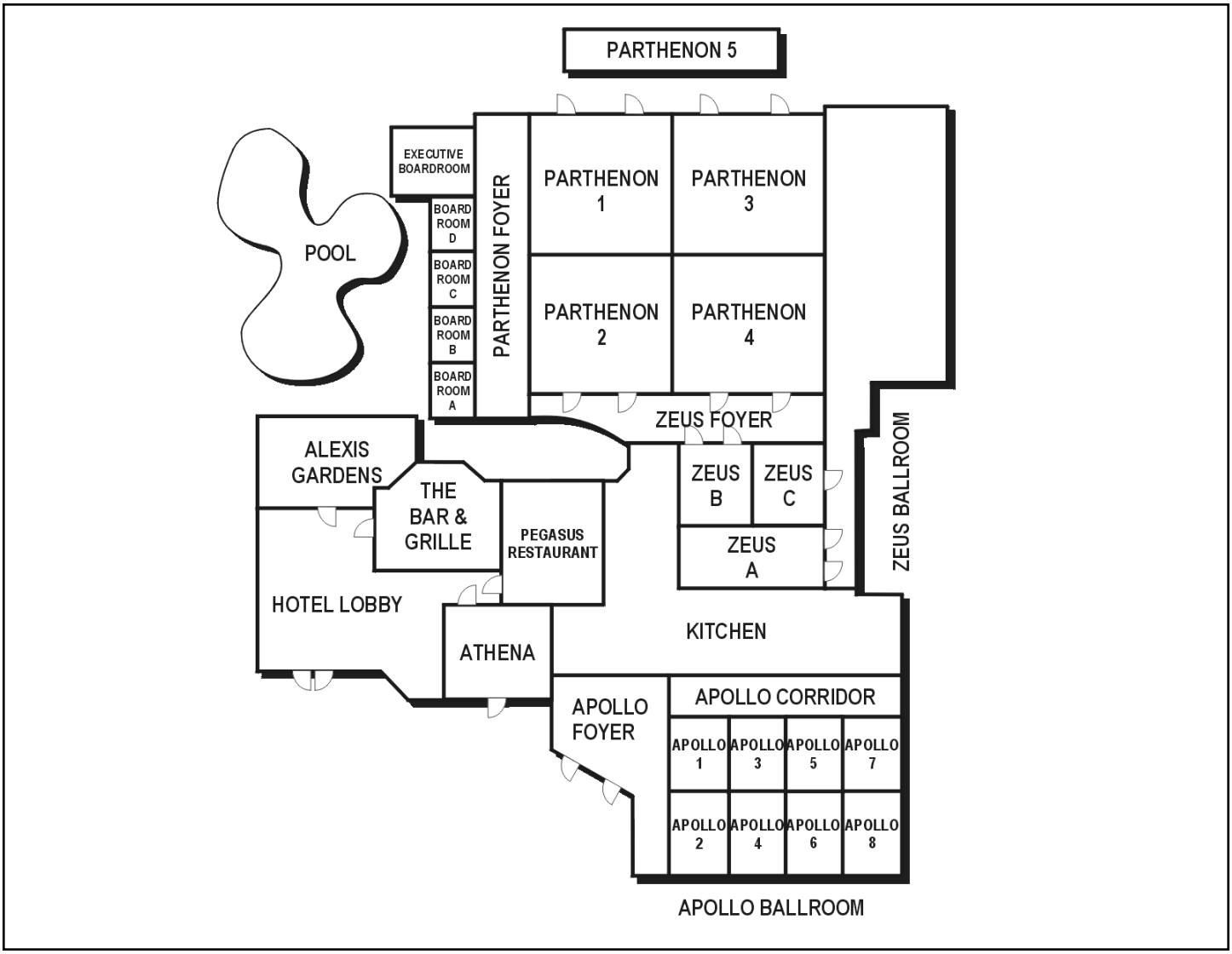
U. S. Geological Survey

Robert Annear
Department of Civil and Environmental Engineering, Portland State University

Alex Cheng
University of Mississippi

FLOOR PLAN OF ALEXIS PARK RESORT & SPA



SCHEDULE OF EVENTS

SUNDAY, OCTOBER 17, 2004

8:00 am - 5:00 pm	**Short Courses**	
	"Hydrologic Field Methods" ..... John Moore	Zeus C
	"Introduction to HEC-RAS" ..... Tom Piechota, Glenn Tootle	UNLV
2:00 pm - 4:00 pm	Registration Desk Set-up	Parthenon Foyer
2:00 pm - 5:00 pm	Exhibitors Set-up	Parthenon 4
	Poster Presentation Set-up	Parthenon 4
2:00 pm - 6:00 pm	**Executive Committee Meeting**	Zeus B
4:00 pm - 6:00 pm	**Registration Desk Open**	Parthenon Foyer
6:00 pm - 7:00 pm	**Icebreaker Reception**	Parthenon 4

SCHEDULE OF EVENTS

MONDAY, OCTOBER 18, 2004

8:00 am - 5:00 pm	**Registration Desk Open**	Parthenon Foyer
8:30 am - 9:45 am	**Opening Plenary Session:**	
	"Integrated Water Resources Management" — Moderator: Emitt Witt	Athena
8:30	Welcoming Remarks — Emitt Witt, Conference Chairperson; P. Leahy, AIH President	
9:00	Keynote Speech: "The History of the Colorado River" — Ms. Kay Brothers, SNWA	
9:45 am - 10:15 am	**Break**	Parthenon 4
10:15 am - 12:15 pm	**Session 1**	
Session 1:	"Water Resources Management Strategies" — Moderator: Miguel Marino	Athena
10:15	"The Role of International Water Cycle Research Programs in Developing Integrated Water Resource Management Strategies" — S. Sorooshian	
10:45	"Modeling of the World Water Dynamics at Continental Scope with Water Resources Limitations" — T. Kojiri, C. Sheng, J. Natasuka and T. Hori	
11:15	"Interdisciplinary Hydrologic Approaches to Watershed Management and Decision Making in the Upper San Pedro Basin, Arizona" — D. Goodrich, B. Strain, H. Richter, R. Varandy and A. Browning-Aiken	
11:45	"Decision Support Systems for Demand Management of Lower Rio Bravo/ Rio Grande" — J. Valdes, S. Stewart, J. Aparicio and H. Passell	
12:15 pm - 1:30 pm	**Luncheon** — Moderator: Emitt Witt	Parthenon 2
	Keynote Speech: "The National Map" — Keven Roth, USGS	
1:30 pm - 3:00 pm	**Session 2 and Session 3**	
Session 2:	"Water Management Planning" — Moderator: Robert Hordon	Athena
1:30	"Lower Colorado River Basin Water Management Plan and Water Availability Model" — N. Kabir, B. Brandes and K. Kennedy	
2:00	"Evaluating Management Scenarios in the Croton Watershed GIS-based Risk Modeling and Decision Support" — A. Atamian, C. How, L. Wordsman and K. Kane	
2:30	"Analytical Framework for the Planning of Integrated Water Resources Management" — S. H. M. Fakhruddin	
Session 3:	"Hydrologic Model Considerations" — Moderator: Alex Cheng	Zeus B
1:30	"Good Practices for Physically-based Models' Calibration" — P. Gourbesville	
2:00	"Evapotranspiration Conceptualization in the HSPF-MODFLOW Integrated Models" — M. Ross, P. Tara, J. Geurink and A. Said	
2:30	"Unification of Surface Water Hydrology Modeling Algorithms" — T. Hromadka	
3:00 pm - 3:30 pm	**Break**	Parthenon 4
3:30 pm - 5:00 pm	**Session 4 and Session 5**	
Session 4:	"Conjunctive Surface Water-Ground Water Management" — Moderator: Robert Millette	Athena
3:30	"Conceptualization and Discretization for Integrated Surface Water/ Groundwater Modeling" — P. Tara, M. Ross, K. Trout and J. Geurink	
4:00	"Groundwater Management Issues of a Fractured Aquifer in Oklahoma" — A. K. Tyagi and P. Kumar	
4:30	"The Integrated Hydrologic Model: A Fully-Coupled Surface Water/ Valdose Zone/Groundwater Model" — A. Aly and P. Tara	
Session 5:	"Urban Water Quality Modeling" — Moderator: Rolando Bravo	Zeus B
3:30	"Maximum Extent Practical Stormwater Treatment Utilizing ASCE Water Quality Capture Volume Methodology" — S. C. Phelps	
4:00	"Storm water Quality Model with BMP Module" — N. Rashedi	
4:30	"Detention Pond Design Using Volume Time Method and Geospatial Data" — M. Yeboah, E. Loucks, E. Grimison and J. Saarinen	
6:00 pm - 7:00 pm	**Reception: Hospitality Networking Session**	Parthenon 4
	Entertainment by Gary Norsigian, Magician	

TUESDAY, OCTOBER 19, 2004

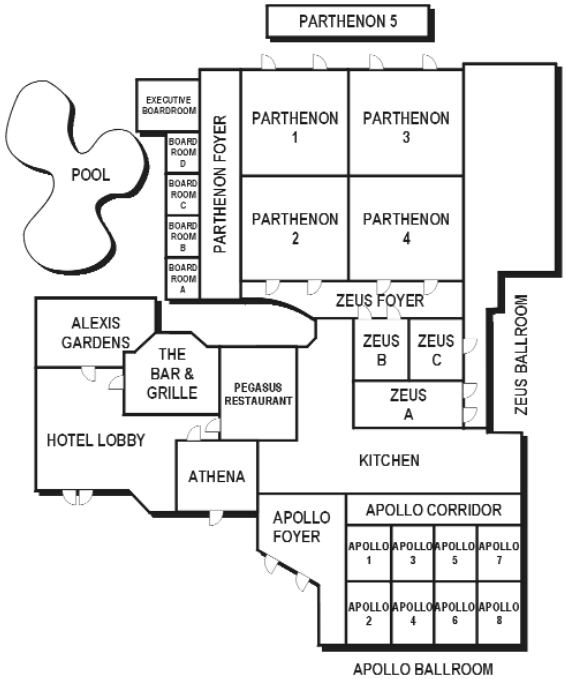
8:00 am - 5:00 pm	**Registration Desk Open**	Parthenon Foyer
8:00 am - 10:00 am	**Session 6**	
Session 6:	"Effects of Management Practices on Water Quality"	Moderator: G. E. Seaburn — Athena
8:00	"The National Ramifications of the Miccosukee Case"	D. Miller, General Counsel, CAWCD
8:30	"Evaporation, Precipitation, and Associated Salinity Changes at Indian River Lagoon, Florida"	D. M. Sumner and G. Belaineh
9:00	"Spatial and Temporal Variation of Water Quality for Integrated Water Resources System at a Citrus Grove in South Florida"	A. N. Shahane
9:30	"Groundwater Recharge from the Gila River in Safford Valley Arizona"	T. A. Gookin
10:00 am - 10:30 am	**Break**	Parthenon 4
10:30 am - 12:00 am	**Session 7**	
Session 7:	"Surface Water Management"	Moderator: A. Laenen — Athena
10:30	"Western Washington Hydrology Model"	D. Beyerlein, J. Brascer and S. White
11:00	"Near-Term Forecasting of Surface Water Supplies for Regional Water Quality"	J. Lantrip, M. Griffin and A. Aly
11:30	"Cumulative Environmental Effects of Contemporary Forest Management Activities in Headwater Basins of Western Oregon"	A. Skaugset, R. Gresswell J. Li , M. Adams and K. Cromack
12:00	"Use of Unsteady Techniques to Evaluate Flood Storage Reservoirs on Indian Creek"	C. Smith
12:30 pm - 1:45 pm	**Awards Luncheon**	Moderator: P. Leahy — Parthenon 2
	Recipient of R. K. Linsley Award	C. T. Tom Haan
	Recipient of C. V. Theis Award	J. Toth
	Recipient of AIH Founder's Award	H. Klose
1:45 pm - 3:15 pm	**Session 8**	
Session 8:	"Data Assessment in Hydrologic Modeling"	Moderator: Doug Glysson — Athena
1:45	"Intensive Hydrologic Data Collection in a Small Watershed West-Central Florida"	K. Trout and M. Ross
2:15	"Gridded Hydrologic Data in HEC-HMS"	L. R. Kreymborg
2:45	"Assessing Best Management Practice Effectiveness in Multiple Dimensions and Scales"	G. Ice
3:15 pm - 3:30 pm	**Break**	Parthenon 4
3:30 pm - 5:00 pm	**Session 9 and Session 10**	
Session 9:	"Water Resources Management I"	Moderator: Robert Annear — Athena
3:30	"The Integrated North Tampa Bay Hydrologic Model"	G. Ruskauff, P. Tara and A. Aly
4:00	"Simulation Models for Assessment of Pathogens at a Watershed Scale"	L. Ormsbee, R. Teegavarapu, and A. Tangirala
4:30	"Development of Nutrient Susceptibility Index in Support of Establishing Nutrient Criteria for Streams and Rivers"	L. S. Lin, M. Markus and A. Russell
Session 10:	"Effects of Snowmelt Runoff, River Fluxes and Water Management Quality on Water Resources Management"	Moderator: Emitt Witt — Zeus B & C
3:30	"Estimation of Snowmelt Runoff in a Watershed by Using Satellite Images Processing and GIS"	A. Shahabfar and M. Sharifi
4:00	"Decision Support System and Water Quality of Amdary River for Ecosystem Restoration"	A. B. Nasrulin
4:30	"Content of Radionuclides in Natural Waters Surrounding Armenian APS"	L. Ghalachyan, K. Kocharian. M. Avetisyan and L. Tatevosyan
5:00 pm - 6:00 pm	AIH Business Meeting	Athena
5:00 pm - 7:00 pm	**Reception:** Hospitality Networking Session	Parthenon 4

WEDNESDAY, OCTOBER 20, 2004

8:00 am - 10:00 am	**Registration Desk Open**	Parthenon Foyer
8:00 am - 10:00 am	**Session 11**	
Session 11:	"Water Resources Management II" — Moderator: Suzanne Pierce	Athena
8:00	"National Water Master Planning in Jordan: The Use of Interactive Digital Planning Tools" — H. El-Naser and S. Taha	
8:30	"Drought and Flood Management Based on Real-time Monitoring Groundwater-Surface Water Interaction and Forecasting of Groundwater Levels and Soil Moisture" — R. Sturman, A. Visser, R. van Montfoort, Y. van der Velde and M. Bierkens	
9:00	"Identification of Groundwater Discharge and Recharge Site through Temperature Time Series Analysis" — R. Ghanbari and H. Bravo	
9:30	"How Much Complexity is Warranted in Regional Flood Frequency Analysis?" — S. Perica and M. Stayner	
10:00 am - 10:30 am	**Break**	Parthenon 4
10:30 am - 12:15 pm	**Session 12**	
Session 12:	"Water Resources Management III" — Moderator: P. Leahy	Athena
10:30	"Application of Hydrograph-Derived Streamflow Indices in Hydrologic Studies" — B. Imam, E. Shamir and S. Sorooshian	
11:00	"Estimation of Evaporation and Hydrologic Parameter Using Continuous Soil Moisture and Water Table Monitoring" — M. Rahgozar and M. Ross	
11:30	"Water Quality in Cattaraugus Creek, Northwestern New York State" — G. Basto Salgado, T. Diggins and C. Johnston	
12:00	Closing Remarks — P. Leahy, AIH President	

THURSDAY, OCTOBER 21, 2004

8:00 am - 5:00 pm	**Short Course:** "Integrated Surface Water/Groundwater Modeling with the Integrated Hydrologic Models (IHM)" — P. Tara	Apollo 5
9:00 am - 4:00 pm	**Short Course:** "Using Concepts of Watershed Hydrology" — P. Black	Apollo 2



Session 1 — MONDAY, OCTOBER 18, 2004

MODERATOR: Miguel Marino **LOCATION: Athena**

10:15 "The Role of International Water Cycle Research Programs in Developing Integrated Water Resources Management Strategies"

-SOROOSH SOROOSHIAN, Director, Department of CEE Center for Hydrometeorology & Remote Sensing, University of California, Irvine, CA

Effective management of water resources in the 21st century will require that water resources managers: (a) understand the interconnection between global change induced intensification of the hydrologic cycle, climate variability, and the availability of water at various scales, (b) deploy monitoring strategies across local-regional-continental scales that allow for reasonable assessment of basin condition, and (c) utilize sophisticated hydrologic prediction tools, depending on the issues to be addressed. The hydrologic information needed may require hourly, seasonal, interannual, decadal, or century forecasts. A few examples of the use of these forecasts include flash floods, snow-cover, reservoir operation, and water supply structural design, respectively. Similarly, the type of hydrologic models used also depends on the scale of the issues at hand.

Clearly, further research and data-collection activities are needed in order to quantify the impact of the intensification of the hydrologic cycle on the magnitude, direction, and frequency of floods, droughts, and other weather hazards which impact water resources management. This presentation addresses a number of international projects that have been initiated for this purpose. These projects include the Global Energy and Water Cycle Experiment (GEWEX) of the World Climate Research Program (WCRP), and the Earth Observing System (EOS) of NASA in the United States. These projects have a strong emphasis on state-of-the-art remote-sensing satellites which are capable of providing useful information for a variety of purposes related to hydrology and water resources. A review of these projects and their potential role in developing integrated water resource management strategies will be presented.

KEYWORDS: International Water Cycle, hydrologic models, floods, droughts, weather hazards.

10:45 "Modeling of the World Water Dynamics at Continental Scope with Water Resources Limitations"

-TOSHIHARU KOJIRI, Water Resources Research Center, DPRI, Kyoto University, Gokasho, Uji, Kyoto, Japan,
-CHONG TENG SHENG, Water Resources Research Center, DPRI, Kyoto University, Gokasho, Uji, Kyoto, Japan,
-JUNPEI NAKATSUKA, Water Resources Research Center, DPRI, Kyoto University, Gokasho, Uji, Kyoto, Japan,
-TOMOHARU HORI,Water Resources Research Center, DPRI, Kyoto University, Gokasho, Uji, Kyoto, Japan,

Freshwater withdrawals by human activities have increased dramatically over the years. Already, at the beginning of the 21st century, one-sixth of the worlds population was without access to improved water supply while two-fifths lacked access to improved sanitation. Problems of water resources have also become much discussed issues in international conferences and multinational organizations.

This research addresses the problem of growing shortage of water resources by modeling of the socio-environmental changes. There are two main objects; namely (i) to simulate and predict trends in the development of human civilization in different continents taking into account the effects of limited water resources through feedback links between water availability and the human society, and (ii) to identify the important roles and effects of water resources that have on the growth of the world so as to aid in the planning of scenarios and policies for sustainable development. A model exploring water needs of the various continents is developed using System Dynamics. Identification of continents with acute water shortage and development limitations will also be possible with this model. Besides focusing on the effects of water on each continent, the model is characterized by its treatment on the various continents as inter-dependent blocks.

KEYWORDS: World Water Distribution, System Dynamics, Continental Scope, Economical Activities, Water Utilization, Global Warming.

11:15 "Interdisciplinary Hydrologic Approaches to Watershed Management and Decision Making in the Upper San Pedro Basin, Arizona"

-D. GOODRICH, USDA-ARS, Tucson, AZ
-B.STRAIN, City Council, Sierra Vista, AZ
-H. RICHTER, The Nature Conservancy, Bisbee, AZ
-R. VARADY, The University of Arizona, Tucson, AZ
-A. BROWNING-AIKEN, The University of Arizona, Tucson, AZ

This presentation will provide an overview of our experience with the evolution of natural resources research in the San Pedro Basin into a mature example of integrated science and decision-making embodied in the Upper San Pedro Partnership. It will discuss the transition through science and research for understanding; to science for addressing a need; to integrated policy development and science. At each stage the research conducted becomes more multi- and interdisciplinary, first across abiotic disciplines (hydrology, remote sensing, atmospheric science), then a merging of abiotic and biotic disciplines (adding ecology and plant physiology), and finally a further merging with the social sciences and policy and decision making for resource management that has been recently recognized by Congress. Lessons learned from this experience will be reviewed with the intent of providing guidance to ensure that hydrologic and watershed research is socially and scientifically relevant and will directly address the needs of policy makers and resource managers.

KEYWORDS: San Pedro Basin, Integrated policy development and science, decision making for research management.

Session 1 *(continued)* MONDAY, OCTOBER 18, 2004

11:45 “"Decision Support Systems for Demand Management of Lower Rio Bravo/Rio Grande"”

-JUAN VALDES (SAHRA-UA)
-STEVE STEWART (SAHRA-UA)
-JAVIER APARICIO (IMTA)
-HOWARD PASSELL (Sandia Labs)

There is a need for integrated models of transboundary watersheds such as that of the Rio Grande/Rio Bravo (RGRB) along the US/Mexico border. We present the first stage an interdisciplinary effort to develop a semi-distributed regional dynamic simulation model (DSM) for examining water issues in the Lower RGRB basin. The RGRB serves as the border between the U.S. and Mexico. Two DSS are discussed, first the Conchos River basin, which contributes approximately 70-80% of the surface flow in the lower RGRB basin. Irrigated agriculture has historically been the major user of water and irrigated acreage continues to expand, but it faces increasing competition from industrial development, maquiladoras, and increasing residential water demand. The second DSS deals with the entire basin and is currently being developed by a multi-disciplinary multi-institutional team of researchers at Sandia National Laboratories, Mexican Institute of Water Technology (IMTA) and SAHRA-UA

International agreements such as the Treaty of 1944 between the US and Mexico stipulate that the flows in the RGRB are equally split. Yet uncertainties remain due to vagaries in the legislation. For example, Mexico is required to provide an average of 350,000 AF/yr over a five-year cycle, unless "extraordinary drought" occurs, although the Treaty does not define extraordinary. The characterization of droughts poses a significant problem for hydrometeorologists and water resource engineers. Our simulation model incorporates drought indices developed to characterize droughts in semi-arid and arid regions and statistical approaches to examine the spatial influence of droughts.

To examine the effects of various structural and institutional changes to water use in the basin to meet the requirements of the Treaty and simulate climactic issues, we model agricultural, municipal, and industrial water demands that are directly linked to sectors of the regional economy using input output (IO) models. IO models can be used to examine how changes in water deliveries to the agricultural or manufacturing sectors affect the level of output, employment, and wages in the regional economy. All model outputs will be incorporated into a decision support system that will provide a tool to simulate hydrological profiles, ecosystem variability, changes in irrigation technology, and changes in management regimes within the basin and will serve to inform decision-makers of the water demand and supply changes necessary to meet the needs of international obligations and growing populations in the short and long term. The initial set of available management options include water banking and water trading within each country as well as irrigation standards, application efficiency, and water banking across borders.

KEYWORDS: Transboundary watersheds, Rio Bravo, Rio Grande, drought, hydrometeorology, IO models.

Session 2 — MONDAY, OCTOBER 18, 2004

MODERATOR: Robert Hordon **LOCATION: Athena**

1:30 "Lower Colorado River Basin Water Management Plan and Water Availability Model"

-NADIRA KABIR, Senior Engineer, Lower Colorado River Authority, Austin, TX
-BOB BRANDES, Principal Engineer, RJBCO, Austin, TX
-KIRK KENNEDY, Senior Scientist, RJBCO, Austin, TX

Since 1989, Lower Colorado River Authority (LCRA) has employed a stakeholder process to establish operating rules for the allocation of water stored in the Highland Lakes. The resulting Water Management Plan (WMP) complies with legal requirements governing water rights in Texas and LCRA enabling legislation, while outlining different approaches for satisfying the needs of the stakeholders.

Pursuant to the requirements of Senate Bill 1 of the 75th Texas Legislature in 1997, the Texas Commission on Environmental Quality (TCEQ) developed simulation models for determining water availability for individual water rights under Texas Water Code. R. J. Brandes Company (RJBCO) assisted the TCEQ in developing a Water Availability Model (WAM) for the Colorado River Basin in accordance with the Texas Water Code (prior appropriation doctrine).

In 2003, LCRA undertook a study to develop recommendations for incorporating significant features of the WMP into the Colorado WAM. This study offered significant improvements to the Colorado WAM, which was later accepted by the TCEQ. As water demand and supply conditions within the area change in the future, various provisions of the WMP will be amended, which will then be incorporated in the WAM. This paper discusses the incorporation of LCRA's WMP in the Colorado WAM and its potential use in analyzing various changes to the WMP in the context of the entire basin.

KEYWORDS: Lower Colorado River Authority, water availability model, operating rules, allocation of water, Highland Lakes, water management plan, Senate Bill 1 of the 75th Texas Legislature, TCEQ.

2:00 "Evaluating Management Scenarios in the Croton Watershed GIS-based Risk Modeling and Decision Support"

-AMY ATAMIAN, Malcolm Pirnie, Inc., White Plains, NY
-CINDY HOW, Malcolm Pirnie, Inc., White Plains, NY
-LEE WORDSMAN, Malcolm Pirnie, Inc., White Plains, NY
-KIMBERLEE KANE, New York City Department of Environmental Protection, Valhalla, NY

The Croton Watershed is the oldest portion of New York City's drinking water supply system, and is already heavily developed. To achieve water quality goals, a GIS-based risk assessment methodology was developed to help the NYCDEP optimize watershed management efforts, and focus limited resources on critical areas to achieve maximum water quality benefits.

Specific methodologies were developed for each of several water quality variables, which are dependent upon both the characteristics of the variable and the data available. In addition, watershed characteristics that may enhance or mitigate transport from a source, such as slope or soil type, are considered along with zoning, socio-economic data, and other indicators of development under "fully-developed" conditions. While the analysis was intended to compare risks between subbasins, use of the GIS provides sufficient detail to identify localized areas of concern at the parcel level, and the ability to prioritize areas based on additional user-defined objectives.

A decision support and project tracking application was developed to support the NYCDEP's on-going watershed management activities. With this tool, NYCDEP will be able to prioritize its watershed monitoring, protection and restoration efforts and provide local stakeholders with technical information for their own watershed programs.

KEYWORDS: Watershed management, decision support, risk ranking, GIS.

Session 2 *(continued)* MONDAY, OCTOBER 18, 2004

2:30 "Analytical Framework for the Planning of Integrated Water Resources Management"

-S.H.M.FAKHRUDDIN, Water Resources Engineer, CEGIS, Bangladesh

Located in the world's largest delta, Bangladesh is dominated by its water resource system. The Ganges, the Brahmaputra and the Meghna all flow through Bangladesh. The combined flow of the rivers ranks it among the largest river systems of the world. Yet Bangladesh covers only 8% of the total catchment area. This raises difficult challenges for planning and management of the water resources (WR).

In the recent year, there has been an increase in demand in the macro-level planning for analysis and assessment based on an integrated approach. This requires that the availability of and demand for resources be analyzed within a framework that includes environmental, ecological and socio-economic issues and concerns. CEGIS together with WARPO developed computational framework for IWRM which will supports the formulation, analysis and evaluation of alternative water management strategies of IWRM. The analytical framework will provide information to planning agencies enabling them to assess and compare alternative courses of action in preparation for decision making. An important aim of the IWRM framework is to provide structured approach based on consensus on the required information and connects three important parties or stakeholders in the planning process: resources analysts, planners and decision makers. This framework will reflect the changes in the utilization and availability of the water resources and in the water resources system itself. The computational framework will predict the relevant impacts on ecosystems and on the social and economic conditions of the different users of the resources and the society as a whole. The concept and its computational assumptions will be shared with other agencies involved in water management. Under this programme based on conceptual framework, the design of the computational framework has been developed together with local and international agencies to develop different components of computational framework. This activity ultimately may result in Bangladesh' guidelines for WRS planning, which describe, e.g., how cost estimates are made; which discount rates to use; and how to "value" water and water using activities. Such guidelines would also specify the criteria used for planning decisions and would identify the possible use of MCA techniques to compare alternative options or strategies.

The analytical framework is not only a structured set of components and their interrelations but when visualized through a systems diagram, it also creates a structured process for its development and implementation. Analytical frameworks are situations and are problem specific and thus have to be developed to meet the requirements of specific decision making contexts. Through a generic approach, called the "steps of analysis", these specific frameworks can be developed.

KEYWORDS: Integrated water Resources Management, Computational Frame work, planning for future, water security, sustainable use.

Session 3 — MONDAY, OCTOBER 18, 2004

MODERATOR: Alex Cheng **LOCATION: Zeus B**

1:30 "Good Practices for Physically-based Models' Calibration"

-PHILIPPE GOURBESVILLE, Associate Professor, University of Nice-Sophia Antipolis - UMR 6012 of CNRS, Nice, France

Growing interest for physically-based models in hydrology and systematic acquisition of hydrological data associated to geographical information offer new possibilities for development and application. However, this new approach must be carefully applied with a good knowledge about physical processes, modeling concepts, data quality and sensitivity of parameters. This paper underlines the potentialities of physically-based models and in a second time, describes the associated methodologies to develop for the calibration phase.

Extreme hydrological events are characterized by the scarcity of data (in terms of spatial and temporal frequency). This problem becomes more acute when it comes to modeling the response of large catchments with small concentration times due to particular morphology or .rainfall intensities. The classical approach to modeling, (that consists of trying of tuning the model parameters so as to bring the calculations as close as possible to the measurements) becomes highly questionable because it may turn out to be extremely harmful to the predictive power of the model.

The present paper addresses uncertainty in modeling the flash flood of 05.11.1994 on the Var watershed (France, 2820 km2). This watershed, located in the French riviera, is characterized by steep slopes, narrow valleys and large topography curvatures, making the flow pattern extremely complex. Seven models of the catchment were built using the Mike She hydrological modeling system. These models have different structures, geometries, or parameter values.

The analysis of the model results on the flash flood of 05.11.1994 leads to the following conclusion: the main sources for uncertainty in model results are, by decreasing order of importance:

the model structure, i.e. the assumptions concerning the dominant phenomena and how they are modeled, the model geometry, the value of the model parameters.

This shows that, for this particular case at least, it is much more important to have a good knowledge of the phenomena occurring on the catchment, as well as of the particular geometrical feature, than to try to calibrate the parameters of the model. On the contrary, blind calibration of the model may jeopardize its predictive capabilities.

KEYWORDS: Physically-based models, systematic acquisition, Var watershed, French Riviera, Mike She hydrological modeling system.

2:00 "Evapotranspiration Conceptualization in the HSPF-MODFLOW Integrated Models"

-MARK ROSS, Department of Civil and Environmental Engineering, University of South Florida, Tampa, FL
-PATRICK TARA, INTERA, Inc., Tampa, FL
-JEFFREY GEURINK, Tampa Bay Water, Clearwater, FL
-AHMED SAID , Department of Civil and Environmental Engineering, University of South Florida, Tampa, FL

In 1988, the Florida Institute of Phosphate Research (FIPR) funded a project to develop an advanced hydrologic model. The FIPR hydrologic model (FHM) was developed to provide an advanced predictive capability of the interactions of surface water and ground water features using its component models, HSPF and MODFLOW. The hydrologic processes including precipitation, interception, evapotranspiration, runoff, recharge, streamflow, base flow are explicitly accounted for in the integrated model. Considerable review of that model and applications occurred through a series of projects. The model has evolved to Integrated Hydrological Model, IHM to more accurately estimate flow within the entire land based part of the hydrological cycle. There is a significant departure of IHM algorithms from FHM, especially for soil water and evapotranspiration (ET). In this paper, the ET concepts in both FHM and IHM will be presented. The paper also demonstrates the advantages and disadvantages of these methods. In FHM and IHM, groundwater ET algorithms of the MODFLOW ET package (EVT) replace those of HSPF. However, IHM partitions ET between surface storages, vadose zone storage and saturated ground water storage by considering evaporative flux from surface sources, proximity of the water table to land surface, relative moisture condition of the unsaturated zone, thickness of the capillary zone, thickness of the root zone and relative plant cover density. This concept provides a smooth transition to satisfy ET demand between the vadose zone and groundwater. While this approach provides sound representation of the actual soil profile, it may need more model applications to be verified.

KEYWORDS: Surface water models, ground water models, surface and ground water interaction, West-Central Florida.

Session 3 *(continued)* MONDAY, OCTOBER 18, 2004

2:30 "Unification of Surface Water Hydrology Modeling Algorithms"

-TED V. HROMADKA, II, , Principal, Hromadka & Associates, Costa Mesa, CA

A frequently used computer modeling strategy is to subdivide the study watershed into subareas where each subarea is represented by a runoff algorithm, and to link these subareas together by means of links where each link is represented by a flow routing algorithm. The assemblage of these subarea runoff hydrograph algorithms with link flow routing algorithms results in the hydrologic surface runoff model that represents the entire watershed. Frequently, the subarea runoff hydrograph algorithm selected can be closely approximated by a standard unit hydrograph model where runoff excess (rainfall less losses) is estimated by means of a loss rate function such as the well-known phi-index (constant loss function), or a runoff coefficient (constant percentage of rainfall loss function), and the selected linkage flow routing algorithm can be closely approximated by a standard hydrologic routing method such as convex, Muskingum, or similar type algorithm. In this paper, it is shown that these various algorithms can be written as matrix equations which, in turn, can be manipulate and combined into a single global matrix system where total watershed runoff is equated to a global system matrix multiplied by the vector of unit excess rainfalls. This final result directly compares to the standard single-area unit hydrograph method matrix system, and therefore draws a direct linkage between use of such algorithms in a runoff modeling network and the classic unit hydrograph method. This result may provide a better understand between modeling component algorithm calibration and global model calibration to rainfall-runoff data.

KEYWORDS: Matrix equations, convex, Muskingum, algorithm, runoff hydrograph, computer modeling strategy, runoff algorithm.

Session 4 — MONDAY, OCTOBER 18, 2004

MODERATOR: Pat Leahy **LOCATION: Athena**

3:30 "Conceptualization and Discretization for Integrated Surface Water/Groundwater Modeling"

-PATRICK TARA, INTERA, Inc., Tampa, FL
-MARK ROSS, Department of Civil and Environmental Engineering, University of South Florida, Tampa, FL
-KEN TROUT, Research Hydrogeologist, Center for Modeling Hydrologic and Aquatic Systems, University of South Florida, Tampa, FL
-JEFFREY GEURINK, Tampa Bay Water, Clearwater, FL

The land-use/land cover within a watershed play a significant role in controlling the hydrologic processes that influence ET, runoff, baseflow and surface storage attenuation. In order to appropriately simulate these processes, it is desirable to explicitly utilize the land-use information in the conceptualization and discretization of hydrologic models as well as the assignment of the model parameters. Integrated surface water/groundwater hydrologic modeling adds complexities because the land-use data and their unique hydrologic properties must be conceptualized and discretized into both the surface water and groundwater domains. Using GIS, basins can be subdivided by land-use categories into computational elements called hydrologic response units or HRU's. Utilizing HRU's in model discretization allows the discrete representation of the various hydrologic responses for each land form. This approach lumps areas of similar hydrologic response while avoiding the lumping of contrasting parameters (i.e., "lumped parameter modeling"). As opposed to grid-based models which may inadvertently introduce arbitrary boundaries, land-use discretization maintains physical basin and landform characteristics. In order to properly capture the full storage capacity found within a basin, all lakes and wetlands can be conceptualized and simulated as hydrography elements. The aerial extent of the hydrography can be obtained from detailed land use mapping. Model parameters for the reaches can be defined with land use and soils designations to correctly represent the storage and attenuation characteristics of the hydrography included in the model. Assigning model parameters with the original land-use data assures consistent parameterization throughout the model domain.

KEYWORDS: Land use, GIS, surface and groundwater model, discretization, distributed parameter modeling.

4:00 "Groundwater Management Issues of a Fractured Aquifer in Oklahoma"

-A. K. TYAGI, Oklahoma Infrastructure Consortium, School of Civil and Environmental Engineering, Oklahoma State University, OK
-P. KUMAR, Oklahoma Infrastructure Consortium, School of Civil and Environmental Engineering, Oklahoma State University OK

The legislature of Oklahoma imposed a moratorium on pumping groundwater from the Arbuckle-Simpson Aquifer. This Aquifer is located in south-central Oklahoma near the border of Texas and Oklahoma. Proposals to develop this aquifer and supply groundwater to Dallas and Oklahoma City areas have been developed. Due to the lack of understanding of the existing groundwater supply in this aquifer and its interaction with natural springs, the legislature stopped any plans to further develop groundwater. The purpose of this paper is to evaluate the potential groundwater supply in the aquifer and its relationship with existing natural springs in the aquifer area using a finite element model.

The Arbuckle-Simpson Aquifer is vast source of fresh water, which is vital to the future of south-central Oklahoma. This study describes the development and application of groundwater model to evaluate the options for efficiently using groundwater resources without affecting the natural flow in springs and streams. The rate of recharge, which is approximately 4.7 inches per year, limits the amount of water that can be pumped from the basin without affecting existing springs and streams and hydrologic system. This paper presents a better understanding of groundwater flow system, providing a detailed knowledge of geohydrologic characteristics and management of the aquifer.

KEYWORDS: Oklahoma legislature moratorium, Arbuckle-Simpson Aquifer, groundwater flow system, geohydrologic characteristics.

4:30 "The Integrated Hydrologic Model: A Fully-Coupled Surface Water/Valdose Zone/Groundwater Model"

-ALAA ALY, INTERA Incorporated, Niwot, CO
-PATRICK TARA, INTERA Incorporated, Tampa, Florida

The Integrated Hydrologic Model (IHM) integrates the significant surface and subsurface hydrologic processes for the land based portion of the hydrologic cycle into a single software package. Through the coupling of surface water and ground water process models and the explicit representation of the vadose zone, IHM provides a state-of-the-art public domain windows-based capability to simulate the interaction between surface water and ground water. IHM uses physically-based delineations of land forms into land segments. Each land segment represents a homogeneous hydrologic response unit (HRU) within a drainage basin. A unique land segment is created by intersecting the drainage basins, land use, and soils coverage. IHM parameters are directly derived from land cover and soil data.

A small-scale application to a 450-acre heavily instrumented site demonstrated the model's capability to represent detailed hydrography, while being able to closely represent vadose zone moisture conditions. Application results indicate that IHM conceptual framework is well suited for simulating the short-term fluctuations in water table depth, soil moisture conditions, and evapotranspiration fluxes from the vadose zone and the water table, in humid and shallow water table conditions.

KEYWORDS: Hydrography, momogeneous hydrologic response, vados zone, IHM simulation.

Session 5 MONDAY, OCTOBER 18, 2004

MODERATOR: Rolando Bravo **LOCATION: Zeus B**

3:30 "Maximum Extent Practical Stormwater Treatment Utilizing ASCE Water Quality Capture Volume Methodology"

-STEVEN C. PHELPS, Stormwater Product Manager, Jensen Precast, Sparks, NV

Development of a vault type stormwater treatment system that would achieve pollutant reduction to the Maximum Extent Practical (MEP) was initiated by Jensen Precast in 1999. The Stormvault™ Mitigation System has met that goal, utilizing the "Water Quality Capture Volume" sizing criteria as documented in "Urban Runoff Quality Management", WEF Manual of Practice No. 23 and ASCE Manual and Report on Engineering Practice No. 87. The mean water quality capture volume based on (Driscoll, E.D., et al 1989) and detention time based on (Guo and Urbonas, 1995) is optimized to promote removal of approximately 86 percent of the average annual total suspended sediments in normal urban stormwater. Third party monitoring data of over 60 individual storm events confirms how the Stormvault's ASCE sizing methods provide TSS pollutant discharge values superior to the listed removals comparable to traditional stormwater BMPs, as listed on the ASCE Database.

By employing the "Hazen's surface area loading" criteria, that based on (Grizzard, at el 1986 Urban Runoff Quality-Impact and Quality Enhancement Technology) the capture of TSS particles less than 70 microns in size will remove additional pollutants of concern such as heavy metals, nutrients and chemical oxygen demand. The ASCE "mean" Water Quality Capture Volume criteria utilizing the Stormvault's innovative patented baffle configuration completely captures and treats up to 77% of the runoff hydrograph events for each design locale, including the "first flush" of larger events significantly reduce erosion and stream degradation from increased flows due to urbanization and help restore pre-development runoff rates.

KEYWORDS: Stormwater treatment, Stormvault Mitigation System, TSS pollutant, first flush.

4:00 "Storm water Quality Model with BMP Module"

-NOVIN RASHEDI, Senior Consultant, Psomas, Costa Mesa, Ca
-PATTY LAKE, Project Manager, Psomas, West Los Angeles, CA

Previously, a planning level storm water pollutant loading model was created for the City of Los Angeles. The main purpose of the study presented here was to augment this model with a Best Management Practice (BMP) module which enables the users to evaluate urban runoff loads post application of various treatment control systems, as well as provides a planning level tool for comparison of relevant structural BMPs. Data from about 22 different types of structural BMPs and constituents including PAH, TPH, Oil & Grease, Bacteria, TSS, Metals and Nutrients were evaluated. The data included both BMP effluent concentrations and percent removals. The overall model was developed using ESRI's (Environmental Systems Research Institute) ArcView version 3.2 and Spatial Analyst. Flexibility in the program was designed in to allow users to modify and update the core data used for analysis, including BMP's, rainfall data, and constituents. This module was created as a planning level tool to help municipalities and other operators with the initial and early planning of resources in order to achieve storm water objectives and targets.

KEYWORDS: Urban runoff modeling, pollutant loading, BMP, GIS.

4:30 "Detention Pond Design Using Volume Time Method and Geospatial Data"

-MARK YEBOAH, CDM, Inc., Cambridge, MA
-ERIC LOUCKS, CDM, Inc, Austin, TX
-ERIC GRIMISON, CDM, Inc., Maitland, FL
-JUSTIN SAARINEN,CDM, Inc., Maitland, FL

The increased availability of geospatial data for geographic information systems (GIS) has allowed engineers and scientists to perform analyses and designs more efficiently. For a study in Harris County, Texas, the availability of geospatial data and a desire to design hundreds of detention ponds led to the development of a detention pond design tool (Volume-Time Tool) that uses geospatial data from ArcGIS, and flow data from HEC-HMS and HEC-RAS. Data extracted from the geodatabases are used to characterize potential detention pond sites and define physical limitations for the detention pond.

Volume-Time Tool uses The Volume-Time Control method for detention pond design. The Volume-Time Control method is an alternative to traditional stormwater runoff detention policies. This method reflects an understanding that the use of peak-discharges alone is not an adequate criterion for elimination of adverse impacts of stormwater runoff. The Volume-Time Control method considers all components of the hydrologic cycle to ensure that the designed pond mitigates adverse impacts in the immediate runoff area and at downstream locations. The Volume-Time Control method ensures that the outflow volume of the designed pond during the critical time period under post-development conditions does not exceed the pre-development critical time period volume. A case study for Harris County, Texas is presented. In this case study, Volume-Time Tool is used with ArcGIS, HEC-HMS and HEC-RAS for runoff simulation and detention pond design as part of a county-wide watershed master plan.

KEYWORDS: Detention pond design, geospatial hydrology, volume-time method, HEC, GIS.

Session 6 TUESDAY, OCTOBER 19, 2004

MODERATOR: Gerald E. Seaburn **LOCATION: Athena**

8:00 "The National Ramifications of the Miccosukee Case"

-DOUGLAS, MILLER, General Counsel, Central Arizona Water District

The issue in the Miccosukee case is whether you need an NPDES permit under the Clean Water Act to transfer water from one water body to another where the two are different in quality. The Miccosukee Tribe filed a citizens suit against SFWMD in U. S. District Court for the S.D. Florida, arguing that the "S-9 Pumping Station" operated by SFWMD is discharging pollutants into the Everglades without an NPDES Permit, in violation of the Clean Water Act.

SFWMD made two arguments: 1). The two bodies of water are really one. 2). The S-9 Pumping Station is not adding anything to the water that it discharges that was not already there.
Therefore, there is no "addition of pollutants" by S-9 to a "water of the United States" within the meaning of the Clean Water Act. SFWMD filed a petition for certiorari with the U.S. Supreme Court. The NWRA and other water users supported the petition, and subsequently filed amicus briefs urging the Supreme Court to reverse the 11th Circuit decision because of its likely adverse effects on Western water users. The U.S. opposed cert, but after cert was granted, filed a brief urging the Supreme Court to reverse

Supreme Court Decision "The Good News" - The Supreme Court reversed and remanded the case to the district court for further proceedings on the factual dispute about whether the C-11 canal/basin and WCA-3 are distinct water bodies.
"After reviewing the full record, it is possible that the District Court will conclude that C-11 and WCA-3 are not meaningfully distinct water bodies. If it does so, then the S-9 pump station will not need an NPDES permit."

Supreme Court Decision "The Bad News" - The pumping of water by a state water management agency that adds nothing to the water being pumped can constitute the "addition of a pollutant from a point source " to "waters of the United States," triggering the need for an NPDES permit. The term "discharge of a pollutant" covers point sources that do not themselves generate pollutants

Supreme Court Decision "The In-Between News" - The Government and SFWMD argued that all "navigable waters" should be treated as a single water body (the "unitary waters" theory). Under this theory, an NPDES permit would not be required when water from one navigable water body is put into another, even if the two are radically different in quality. The Supreme Court left open the "unitary waters" theory ("the Government's . . .'unitary waters argument' is open to the [SFWMD] on remand"). However, the Court expressed serious doubts about the theory, and addressed the potential impact of its decision on Western water users.

KEYWORDS: Miccosukee, NPDES, SWFWMD, CWA, S-9 pumping station.

8:30 "Evaporation, Precipitation, and Associated Salinity Changes at Indian River Lagoon, Florida"

-D. M. SUMNER, Hydrologist, U. S. Geological Survey, Altamonte Springs, FL
-G. BELAINEH, Senior Engineer Scientist, St. Johns River Water Management District, Department of Water Resources, Palatka, FL

The distilling effects of evaporation and the diluting effects of precipitation on salinity at two estuarine sites in Florida were evaluated based on measured values of daily evaporation and precipitation. Despite the larger magnitude of measured evaporation (about 1,585 mm year-1) compared to precipitation (about 1,200 mm year-1) between February 2002 and January 2004, the variability of monthly precipitation-induced salinity changes was over three times greater than the variability of evaporation-induced changes. Use of a constant, mean value of evaporation, along with measured values of daily precipitation, was sufficient to produce simulated salinity changes that contained little monthly (standard error = 0.33 and 0.51 g kg-1 month-1 at the two sites) or cumulative error (less than 1 g kg-1 yr-1) compared to simulations that used measured daily values of evaporation. This result indicates that temporal variability in evaporation may not be critical to simulation of salinity within the lagoon. Comparison of evaporation- and precipitation-induced salinity changes with measured salinity changes indicates that factors other than evaporation or precipitation, such as surface-water and ocean inflows, explained most (96%) of the changes in salinity within a flow-through area of the lagoon. However, evaporation- and precipitation-induced salinity changes explained most (61%) of the variability in salinity at a flow-restricted part of the lagoon.

KEYWORDS: Evaporation, precipitation, salinity, lagoon, estuary.

Session 6 *(continued)* TUESDAY, OCTOBER 19, 2004

9:00 "Spatial and Temporal Variation of Water Quality for Integrated Water Resources System at a Citrus Grove in South Florida"

-ASHOK N. SHAHANE, Hydrologist, Scientific Evaluation Section, Bureau of Pesticides, Division of Agricultural Environmental Services Florida Department of Agriculture and Consumer Services, Tallahassee, Florida

To evaluate the potential impact to ground and surface water quality during and after the conversion of ranch land to a citrus grove, the Florida Department of Agriculture and Consumer Services undertook a long-term monitoring project at a citrus grove in South Florida. This summary report describes the spatial and temporal variation of water quality observed at the citrus site. FDACS collected water samples quarterly from 15 locations throughout the water management system from 1989 to 2000. Sample locations included potable wells, surface water locations, tile drains and an irrigation well. Each sample was analyzed for pesticides, nutrients and copper. Residues of aldicarb and its degradates (sulfone and sulfoxide), bromacil, chlorpyrifos, dinitroaniline, diuron, ethion, imidacloprid, norflurazon and simazine were detected in the surface water on the site. Analyte levels at these 15 locations indicated that the water quality improved as water moved from the tile drains through the water retention system to the point of discharge (i.e. no or only trace levels of analytes at the exit). Aldicarb was the only detected analyte that showed a temporal trend. Specifically, the aldicarb application in March 1995 resulted in surface water detections of aldicarb in the following wet season, but by November the residues were greatly diminished to the point of being undetectable. Aldicarb data for subsequent years have further corroborated such a temporal pattern.

KEYWORDS: Citrus grove, long-term monitoring project, water quality impact, pesticides, nutrients, copper, surface and ground water, spatial and temporal variations.

9:30 "Groundwater Recharge from the Gila River in Safford Valley Arizona"

-T. ALLEN J. GOOKIN, Gookin Engineers, Ltd., Scottsdale, AZ

In Arizona, the Gila River is allocated by a Federal District Court approved computerized "Call System". Development of the Call System by the technical experts required consideration in integrating tremendous water losses in the Safford Valley during flooding events. These losses are shown in this paper to be due to massive groundwater pumping in the Safford Valley.

This paper documents the impact of the groundwater pumping on the flood flows in the Safford Valley and demonstrates that surface-groundwater interactions after extensive groundwater pumping have caused losses of up to 10,000 acre-feet per day during flood events.

KEY WORDS: Call System, groundwater pumping, flood, Safford Valley, Gila River, Recharge.

Session 7 TUESDAY, OCTOBER 19, 2004

MODERATOR: Antonius Laenen **LOCATION: Athena**

10:30 "Western Washington Hydrology Model"

-DOUGLAS BEYERLEIN, Vice President, AQUA TERRA Consultants, Everett, WA

The Western Washington Hydrology Model (WWHM) was developed for the State of Washington Department of Ecology by AQUA TERRA Consultants to size stormwater control facilities in western Washington, based on flow duration standards. Flow duration is defined as the percent of time flow exceeds a specific flow value.

The WWHM uses one or more long-term local precipitation gages for each of the 19 counties in western Washington and then scales the precipitation to the user's site using published NOAA rainfall map data.

The WWHM computes stormwater runoff for a site selected by the user. The WWHM runs HSPF (Hydrological Simulation Program Fortran), a U.S. EPA watershed model, in the background to generate 40+ years of hourly runoff data. Stormwater runoff is computed for both predevelopment and post-development land use conditions. The WWHM routes the post-development stormwater runoff through a stormwater control facility of the user's choice.

The available types of stormwater control facilities include standard trapezoidal pond, infiltration pond, tank (cylindrical, arched), vault, and irregular-shaped pond. The facility can be either manually sized or the user can use the WWHM pond optimization feature (AutoPond) to size the facility.

The Department of Ecology standards require that post-development flow durations not exceed pre-development flow durations for the range of erosive flows. The WWHM computes the required flow duration information and reports if the facility meets Ecology's standards.

The WWHM can be customized for a specific jurisdiction (city, county, or watershed) in western Washington or anywhere in the U.S. to better represent the hydrology of the jurisdiction's watersheds and/or to include new criteria or standards.

KEY WORDS: Hydrology, modeling, stormwater, HSPF, WWHM, development, design, optimization, flow duration, erosive flows

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11:00 "Near-Term Forecasting of Surface Water Supplies for Regional Water Quality"

-JANICE LANTRIP, P.E., M.S.C.E.,Tampa Bay Water, Clearwater, FL
-MITCHELL GRIFFIN, P.E., Ph.D., CH2M HILL, Gainesville, FL
-ALAA ALY, P.E., Ph.D., INERA Incorporated, Niwot, CO

Tampa Bay Water serves more than two million residents in the Tampa Bay region. Tampa Bay Water's mission is to reliably provide its member governments with supplies of high-quality drinking water, while meeting present and future needs in an environmentally and economically sound manner. To help accomplish this mission reduction of groundwater pumping is required. In the fall of 2002 new alternative supplies from surface water were brought online.

Tampa Bay Water manages raw water supplies by utilizing an optimization model which produces a weekly groundwater pumpage schedule based on current hydrologic conditions and forecasted surface water supplies. Due to the complexity of the Hillsborough River System watershed (including groundwater and surface water interactions, several major tributaries, spring discharges, and man-made routing and flow control structures) forecasting near-term surface water availability from this system required developed of a two-step modeling process involving artificial neural networks (ANNs) to forecast flows from the upper and middle basins and HEC-RAS models to route the ANN forecasted flows through the lower basin. The development of the prototype ANNs has been completed using approximately 14 years of data to train, validate and test each model. The HEC-RAS prototype models for the lower basin are also complete. Presently, the combined models are being tested for validity. Early indications are that the models provide reasonably accurate forecasts for daily flow rates for up to seven days into the future. This paper focuses on the development and validation of the combined ANN and HEC-RAS models.

KEY WORDS: Alternative water supplies, optimization model, surface and groundwater interaction, Tampa Bay water.

Session 7 *(continued)* TUESDAY, OCTOBER 19, 2004

11:30 "Cumulative Environmental Effects of Contemporary Forest Management Activities in Headwater Basins of Western Oregon"

-ARNE SKAUGSET, Associate Professor, Department of Forest Engineering, Oregon State University, Corvallis, OR
-ROBERT GRESSWELL, Aquatic Ecologist, Forest and Rangeland Ecosystem Science Center, USGS, Bozeman, MT
-JUDITH LI, Associate Professor, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR
-MICHAEL ADAMS, Research Ecologist, Forest and Rangeland Ecosystem Science Center, USGS, Corvallis, OR
-KERMIT CROMACK, Professor, Department of Forest Science, Oregon State University, Corvallis, OR

The majority of the timber harvest in the Pacific Northwest comes from the minority of the forested land base that is owned by the private industrial forest sector. One potential obstacle to the continued flow of solid wood from these lands is concern regarding the anticipated environmental effects of the intensive management of these lands that result from a lack of knowledge regarding the actual environmental effects caused by contemporary forest management activities at a watershed scale. The Hinkle Creek Paired Watershed Study was designed to fill that gap in knowledge. The watersheds for the Hinkle Creek study are owned by Roseburg Forest Products who in conjunction with federal and University researchers and private industrial, state, and federal forest land managers have collaborated to develop a state-of-the-art paired watershed study. The research in these watersheds will address the effects of forest management on the physical, chemical, and biological characteristics and habitat quality of small streams without fish and larger streams with fish.

The congruence of recent technological innovations and the location of this study provide an excellent opportunity to substantially increase the understanding of the environmental consequences of the management of forested watersheds. The research approach will employ a new generation of sensors including passive integrated transponders (PIT tags) that allow daily and seasonal tracking of the movement of fish using stationary readers as well as mobile antenna. Detailed and continuous measurement of discharge, temperature, and sediment load at spatially explicit locations will put the movement of the fish into a physical context. Finally, recent innovations in GIS technologies allow the spatially dynamic interactions between the physical and biological phenomena to be described. These advances in technology combined with the willingness of the landowner to allow them to be used in a managed landscape will set a new standard for what we can learn and how we may be able to truly better understand the environmental effects of forest management at a watershed and landscape scale.

KEY WORDS: forest management, paired watershed study, cumulative effects, water quality, fisheries, aquatic ecology.

12:00 "Use of Unsteady Techniques to Evaluate Flood Storage Reservoirs on Indian Creek"

-CHRISTIAN A. SMITH, P.E., President, Aenon Consultants, Ltd., Bolingbrook, Illinois,

The 16 square mile Indian Creek watershed has the reputation of being one of the "worst flooders" in Kane County, Illinois. During the 1996 storm event many residential, multifamily and commercial structures were inundated by flood waters. In the year 2000, a significant retail development within the upper Indian Creek watershed provided an opportunity for Kane County to evaluate the entire watershed in an effort to identify economically feasible flood mitigation projects along the stream corridor. Because of the complex nature of flood flows within the upper portion of the watershed, unsteady flow modeling was chosen as the preferred means to understand the hydrologic response of the existing watershed and any proposed flood mitigation solutions. This paper explores the historic flooding condition, the choice of computational methods, unsteady flow model development and proposed mitigation solutions. This paper also presents a discussion regarding some of the interesting results obtained.

KEY WORDS: Flood mitigation, Indian Creek watershed, modeling floods.

Session 8 TUESDAY, OCTOBER 19, 2004

MODERATOR: Doug Glysson **LOCATION: Athena**

1:45 "Intensive Hydrologic Data Collection in a Small Watershed West-Central Florida"

-KEN TROUT, Research Hydrogeologist, Center for Modeling Hydrologic & Aquatic Systems, University of South Florida, Tampa, FL
-MARK ROSS,Director, Center for Modeling Hydrologic and Aquatic Systems, University of South Florida, Tampa, FL

Detailed high-resolution data were collected in a small watershed in west-central Florida to measure hydrologic storages and fluxes. The watershed is characterized by 120 to 180 cm of rainfall per year, a competent underlying clay layer at depths varying from 1 to 3 meters and a high water table. Measurements were made at 5 to 10 minute intervals for surficial aquifer elevations, soil moisture from the water table to land surface, stream flow into and out of the watershed, runoff, precipitation, pan evaporation, solar radiation, temperature, wind speed and direction, humidity and barometric pressure. In addition to providing a valuable data set to parameterize or test hydrologic models, several significant findings can be derived from this study. Evapotranspiration of plant communities can be measured by the change in total soil moisture from the water table to land surface during daylight hours and lateral and/or vertical fluxes can be estimated from the change in total soil moisture during nighttime hours. Riparian vegetation can significantly reduce baseflow to streams by intercepting fluxes from upland areas. The dominant runoff mechanism during the wet season is saturation excess and, depending on the ET behavior of land cover, saturation can occur at any location on the runoff plain.

KEY WORDS: surface water, groundwater, data collection, hydrologic data, watershed data, model.

2:15 "Gridded Hydrologic Data in HEC-HMS"

-LEO R. KREYMBORG, WEST Consultants, Inc., Tempe, Arizona, 84284

While traditional hydrologic models have used point-source gage records for hydrologic inputs, the use of gridded hydrologic data allows spatially distributed data in the form of a grid overlaid onto the watershed. These grids can provide a much finer level of detail than point source data. Gridded data also provides opportunities to combine different types of data in ways that are difficult or impossible otherwise. For example, for snowmelt modeling, the correlation between elevation and temperature can be used to improve estimates of temperatures at locations between temperature gages.

The U.S. Army Corps of Engineers Hydrologic Engineer Center's (HEC's) hydrologic modeling program HEC-HMS provides support for gridded hydrologic data. Multiple precipitation or temperature grids can be conveniently combined into one file. Gridded data can be generated and extracted either through utilities available from HEC, or grids can be created and processed through custom programs by utilizing the extensive HEC Java libraries. The Distributed Snow Process Model (DSPM), scheduled to be incorporated into the next major release of HEC-HMS, provides the ability to model snowmelt by grid cell.

KEY WORDS: hydrology, GIS, HEC-HMS, Grids, Precipitation, Snow.

2:45 "Assessing Best Management Practice Effectiveness in Multiple Dimensions and Scales"

-GEORGE GARY ICE, National Council for Air and Stream Improvement, Inc., Corvallis OR

Best Management Practices (BMPs) are used to avoid or minimize water quality impacts from nonpoint source (NPS) activities such as forestry and agriculture. An important part of state nonpoint source control programs is developing appropriate BMPs, measuring their effectiveness, and modifying them as needed. Here we describe different dimensions and scales that can be used to evaluate the effectiveness of BMPs. Some of these effectiveness dimensions include: reductions of physical or chemical loads compared with historic practices; reductions of physical or chemical loads using BMPs compared to unrestricted activities; effectiveness in meeting water quality or habitat goals; biological response to BMPs; comparison of BMP impacts with physical, chemical, and biological variations due to natural disturbances; and public acceptability of impacts from BMPs. BMPs must also be assessed to determine whether they are practical to apply (e.g., technologically, institutionally, and economically feasible). Each of these dimensions has value and limitations and can be assessed over narrow or broad spatial and temporal scales. The "art" of assessing BMP effectiveness is in selecting relevant dimensions and scales for testing and testing hypotheses that are answerable. In some cases, integrated measures of effectiveness that directly answer policy concerns can be selected.

KEY WORDS: agriculture, Best Management Practice (BMP), dimensions, economics, effectiveness, forestry, nonpoint source (NPS), scale, water quality.

Session 9 TUESDAY, OCTOBER 19, 2004

MODERATOR: Robert Annear **LOCATION: Athena**

3:30 "The Integrated North Tampa Bay Hydrologic Model"

-GREG RUSKAUFF, INTERA Incorporated, Las Vegas, NV,
-PATRICK TARA, INTERA Incorporated, Tampa, FL,
-ALAA ALY, INTERA Incorporated, Niwot, CO,

A regional integrated model was developed and calibrated for the north Tampa Bay Area to be used as a long-term regional resource management tool. The conceptual model of the area suggests that there is ubiquitous communication between the surface and groundwater due to high rainfall and subtropical climate, and the many streams, wetlands, and lakes. In the surface water system the main stem river flows are attenuated by storage in adjacent connected wetlands, and augmented during intense rainfall events or very wet conditions by flow from pothole wetlands that conditionally connect to the through-flowing surface water system. The conceptual model also includes complex three-dimensional flow from sinkhole collapse features that may account for up to 90% of vertical leakage into the karstic limestone of the Upper Floridan aquifer system. The public-domain codes HSPF and MODFLOW were used for the model. All hydrographic features (lakes, wetlands, rivers, and river storage attenuation) treated as MODFLOW river cells. Land use classification was used to subdivide each basin into 7 groups of soils. The model was calibrated to aquifer head at 700 observation wells and surface water flow at 38 gaging stations. Other information used included baseflow estimates, 120 transmissivity estimates, spring flow, land use, and evapotranspiration estimates. The unknown stage storage relationships for wetlands were a major calibration parameter. The simulation time frame was from 1989 through 1998, and incorporated both drought and flood conditions. Challenges with this integrated approach included constraining parameters on land-use category, long run times, inaccurate GIS data, and overall model complexity.

KEY WORDS: North Tampa Bay hydrologic model, management tools.

4:00 "Simulation Models for Assessment of Pathogens at a Watershed Scale"

-LINDELL ORMSBEE,Department of Civil Engineering, University of Kentucky, Lexington, KY,
-RAMESH S. V. TEEGAVARAPU
-ANIL TANGIRALA

Assessment of spatial and temporal variation of pollutant loadings in streams within a watershed is essential from a water quality management perspective. Often process-based models are used to derive watershed quality management alternatives. However under data-poor conditions, it is often difficult to calibrate and validate these models. Conceptually simple simulation models that are not over-parameterized are known to be superior to process-based models in many situations to model and understand the fate and transport of pollutants. In the current study, water quality management solutions are sought for pathogen impaired streams in several watersheds of southeastern region of Kentucky caused mainly due to straight pipes and failing septic systems. In order to develop management solutions, fate and transport of pathogens in streams have to be modeled and understood. To assess the pathogen loads simulation models under deterministic, stochastic and semi-stochastic frameworks are developed in the current study. The models consider both point and non-point sources that cause impairment of streams, stream and watershed decay processes and generally accepted loading functions. Stochastic behavior of loads as well streamflows is characterized using appropriate statistical distributions. The simulation models are applied to several watersheds in the southeastern region of Kentucky. Preliminary results suggest the potential utility of assessing pathogen loading using all the three approaches for water quality management.

KEY WORDS: Water quality management, pollutants modeling, pathogens modeling, watershed sector.

4:30 "Development of Nutrient Susceptibility Index in Support of Establishing Nutrient Criteria for Streams and Rivers"

-LIAN-SHIN LIN, Ph.D., P.E., Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL
-MOMCILO MARKUS, Ph.D. Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL
-AMY RUSSELL, Illinois State Water Survey, 2204 Griffith Drive, Champaign, IL

This study is to develop a nutrient susceptibility index in support of establishing nutrient criteria for streams and rivers. The process of setting nutrient criteria is complicated due to various designated water uses that require different level of water quality protection. The complexity is compounded by diversity in habitat conditions. Scientists have found that a stream's response to nutrient enrichment depends on various habitat factors such as velocity, canopy cover, and stream width/depth. The habitat conditions may differ considerably from a reach to another and the local nature calls for use of reach-scale habitat conditions to characterize nutrient susceptibility.

Algae are either the direct or indirect cause of most problems related to nutrient enrichment. They are a result of the combined effect of stream's susceptibility and nutrient loads. In this study, two sets of monitoring data of Illinois streams and rivers are used to demonstrate the approach. Specifically, statistical methods are applied to develop a relationship between algal biomass and nutrients (e.g., total nitrogen and total phosphorus). Residuals of the developed relationship are considered to be attributable to streams' susceptibility to nutrients. Variability of the residuals (i.e., susceptibility values) is then explained by habitat conditions. The susceptibility-habitat model allows use of habitat monitoring data to predict stream's susceptibility and the algae-nutrient model can be used to classify the streams based on their susceptibility. The classification system will help develop site-specific nutrient standards based on stream's tolerance to nutrients. It also can be used to prioritize streams and rivers for the TMDL and watershed management purposes.

KEY WORDS: National susceptibility index, pollution loads, TMDL, watershed management.

Session 10 TUESDAY, OCTOBER 19, 2004

MODERATOR: Emitt Witt **LOCATION: Zeus B & C**

3:30 "Estimation of Snowmelt Runoff in a Watershed by Using Satellite Images Processing and GIS"

-ALIREZA SHABAFAR, Climatological Research Institute (CRI), I.R.of Iran Meteorological Organization (IRIMO), Mashhad- Iran
-MOHAMMAD B. SHARIFI, Department of Civil Engineering, Ferdowsi University, Mashhad - Iran

Most of watersheds with considerable annual yield are located in mountains. Much of precipitation in these watersheds is in the form of snow. Estimation of snowmelt runoff in different seasons is very important in water resources management. Snowmelt Runoff Model (SRM), which was developed and applied to Alpine mountains watersheds by Martinec in 1975,nowadays is used as an operational model in more than twenty-five countries.

"Kameh"watershed located on the North-East of "Torbat Heydarieh"in Khorasan province, I.R.of Iran has been selected as a reference watershed and all of the hydro meteorological and hydrological data of this watershed has been recorded for several years.

In this work images taken by NOAA satellite in AVHRR format have been analyzed with making use of Remote Sensing (RS) soft wares and snow covered area witch is one of the most important input parameters of SRM model, has been determined. Then making use of Geographical Information System (GIS) soft wares such as Arc/View has reproduced hypsometric map of watershed. Next, hydrological and hydro meteorological data such as precipitation and temperature and physiographic parameters of watershed have been transferred to SRM model and snowmelt runoff, which is simulated by SRM model, has been compared with actual snowmelt runoff recorded at hydrometric station. Finally, SRM model has been calibrated for Kameh watershed, and has been shown that SRM can be used as an operational model in similar watersheds for prediction of snowmelt runoff in the case of temperature increase due to global change.

Key Words: Geographical Information System, Remote Sensing, Snowmelt Runoff, Snow Hydrology, Watershed, Hydrograph.

4:00 "Decision Support System and Water Quality of Amdary River for Ecosystem Restoration""

-A. B NASRLIN, The Institute of Water Problems of the Uzbek Academy of Science Uzbekistan, Tashkent

The political and economical stability of Uzbekistan depends on an effective consumption of water resources and environmental policy. Here it is possible to use the applied developments on the basis of GIS - technologies on Decision Support Systems (DSS). The authors during ten years was engaged in hydro ecological monitoring with using of GIS (Geographical Information System) so that his experience in scientific operation was necessary for practical using the applied development. Those persons responsible for accepting of solution are the different level specialists and principals which use the benefit from quickly found fact or elementary data analysis as the beforehand prepared report or maps on computer's screen. The developing of virtual system of hydro ecological monitoring of surface waters quality the in the Aral Sea basin for 1980-2002, based on the system Arc View. GIS 3.1 will allow simultaneously to receive retrospective analysis of water-salt balance of Amudarya river with concretely hydrochemical components divided on 4 groups (mineralizing, organic, metals, bio components). That will be the aqueous parameters, socio-economical, nature geographic etc. Having click on the block the user will receive access to integrated results of different scientific researches. The results of researching can allow to estimate a hydro ecological situation more really and to open the principal features of the method of application of monitoring of arid zone which will help the in water safety and water economies entities to plan and to forecast an ecological situation in the complex of the Aral Sea basin with usage a GIS and DSS.

Keywords: Water quality, GIS, hydro-ecological monitoring, Decision Support Systems.

4:00 "Content of Radionuclides in Natural Waters Surrounding Armenian APS""

-LAURA GHALACHYAN, Institute of Hydroponics Problems of National Academy of Sciences of Republic of Armenia, Yerevan,, Armenia
-KATIA KOCHARIAN, Institute of Hydroponics Problems of National Academy of Sciences of Republic of Armenia, Yerevan,, Armenia
-MARIAM AVETISYAN, Institute of Hydroponics Problems of National Academy of Sciences of Republic of Armenia, Yerevan,, Armenia
-LUSIA TATEVOSYAN, Institute of Hydroponics Problems of National Academy of Sciences of Republic of Armenia, Yerevan,, Armenia

The solving of ecological problem in Armenia connected with the reopening (1995) of Armenian Atomic Power Station (APS) is of great importance. The Armenian APS is situated in the village Metsamor in the Armavir region in the Republic of Armenia. The water of river Metsamor flowing from Lake Akna is used in the APS. It is well known that any APS during its work throws into the environment much dangerous artificial radionuclides, the most biologically harmful among which are 90Sr and 137Cs as far as their activity lasts long. Starting from 1996 radiation monitoring (90Sr, 137Cs) has been conducted in natural waters (artesian water, river Metsamor, Lake Akna), soils and different crops in ambient areas of Armenian APS. The studies are of great practical importance as far as they allow creating recommendations the application of which in the region will lead to artificial radionuclides' content decrease in crops. As a result we can obtain ecologically pure agricultural product. The lowest radioactivity is registered in artesian water (90Sr=0,021 bk/l, 90Sr =0,031 bk/l) and the highest radioactivity - in water flowing from APS (90Sr=0,067 bk/l, 137Cs=0,069 bk/l). We can assume that the contact of water with soil, dust, climatic precipitations, and radioactive substances thrown into the environment from APS can be the source of radioactive pollution of natural waters. It is important to mention as well that during years artificial radionuclides' content in natural waters has not changed significantly and is within allowed concentration limits.

KEY WORDS: Armenian APS, radiation monitoring, artificial radionuclides, natural waters, pollution

Session 11 WEDNESDAY, OCTOBER 20, 2004

MODERATOR: Suzanne Pierce **LOCATION: Athena**

8:00 "National Water Master Planning in Jordan: The Use of Interactive Digital Planning Tools"

-HAZIM EL-NASER, Minister of Water and Irrigation & Minister of Agriculture, Ministry of Water & Irrigation, Amman-Jordan
-SUZAN TAHA, National Water Master Plan Director, Ministry of Water & Irrigation, Amman-Jordan

Within the Water Sector Planning Support project funded by the German Technical Cooperation (GTZ), a constellation of digital water balancing tools was designed, and implemented, in order to enable the Ministry of Water and Irrigation to carry out nation wide water balances based on the most recent data and various development scenarios, and therefore support efficient water sector planning.

The tools consist of (a) Eleven interactive modules for the assessment of the present water management situation and projection of water resources and demand; (b) A database for storing projected demand and resources data; and (c) A balancing module to balance the resources and demand for the entire Kingdom or selected parts of it. The Modules, which run through a GIS application, are linked to the ORACLE water resources and uses databases and thus allow for the regular updating of the NWMP.

The Digital Water Master Planning tools, currently deployed at the MWI can be used to continuously monitor and analyze the current water management situation and assess water resources and demand projections. These tools assist in evaluating reasonable options and strategies to reverse water imbalances, and in managing and developing Jordan's water resources. Other uses for the tools include the performance and evaluation of daily water management tasks.

The modular structure of the tool enables the development and refinement of the modules for the various sectors, thus ensuring the sustainable use of the planning tool. Through the separate data tables linked to each module, transparency in water balancing is ensured. The modules also can be adapted to specific situations of different countries since the users can be familiarized with the internal procedures of the system. Permanent enhancement of the Digital Planning tool also is possible because new modules and algorithms can be integrated into the tool.

KEY WORDS: District water management plan, Jordan, Interactive Digital Planning tools, modular structure.

8:30 "Drought and Flood Management Based on Real-time Monitoring Groundwater-Surface Water Interaction and Forecasting of Groundwater Levels and Soil Moisture"

-ROELOF STUURMAN, Netherlands Institute of Applied Geoscience TNO, Utrecht, the Netherlands
-ATE VISSER, Netherlands Institute of Applied Geoscience TNO, Utrecht, the Netherlands
-ROBBERT VAN MONTFOORT, Netherlands Institute of Applied Geoscience TNO, Utrecht, the Netherlands
-YPE VAN DER VELDE, Netherlands Institute of Applied Geoscience TNO, Utrecht, the Netherlands
-MARC BIERKENS, Netherlands Institute of Applied Geoscience TNO, Utrecht, the Netherlands

During the last decade the Netherlands was experiencing from floods and droughts. These calamities created severe economic damages in the agricultural as well as in the private sector. In 2004, farmers suffered from decreased yields because of the very dry summer and the temporally prohibition of sprinkler irrigation. Also arboriculture had to bear additional costs because of saline surface water. Even dikes collapsed, because of decreased groundwater levels. During the same period the Netherlands suffered from groundwater inconvenience due to high groundwater levels, flooding and peak floods. In 1998 even whole polders and towns in the delta area had to be evacuated as high river levels threatened to collapse dikes. Around 200,000 people had to leave their homes and to be given shelter elsewhere.

The general approach to combat these problems is to restore the natural and/or historical elasticity (flexibility) of the water system and to apply the process knowledge of the water system in the shallow subsurface. Part of this approach will be based on a general strategy of "retain-store-and-if-absolutely-necessary-than-discharge" surface water.

During the presentation we will demonstrate new knowledge about the interaction between groundwater and surface water and demonstrate new operational tools for drought and flood management: (1) the groundwater-surface water relations are studied in the field and quantified using (modflow) modeling. (2) a real-time monitoring system is installed and (3) a groundwater level and soil moisture forecasting method is developed at a 10 days and a six months time-scale.

KEY WORDS: Drought and Flood Management Model, real-time forecasting, ground water and surface water interaction, soil moisture.

Session 11 *(continued)* WEDNESDAY, OCTOBER 20, 2004

9:00 "Identification of Groundwater Discharge and Recharge Site through Temperature Time Series Analysis"

-REZA N. GHANBARI, Department of Civil Engineering and Mechanics, University of Wisconsin-Milwaukee, Milwaukee, WI
-HECTOR R. BRAVO, Department of Civil Engineering and Mechanics, University of Wisconsin-Milwaukee, Milwaukee, WI

In order to estimate the water budget components in a watershed and subsequently develop water resources planning criteria, it is necessary to identify the gaining and losing portions of the creeks and rivers within the basin. In this study we analyze temperature time series to identify discharge and recharge sites in the Allequash, North, and Stevenson Creeks within the Trout lake Basin, Northern Wisconsin. The Trout Lake basin has been the subject of studies since 1980 through the programs: Northern Temperate Lakes "Water, Energy, and Biogeochemical Budget" (WEBB) Project and Long Term Ecological Research (LTER) supported by US Geological Survey (USGS) and National Science Foundation (NSF), respectively. Results of this study are compared with those obtained using the Analytic Element Modeling (AEM) in previous studies. Those studies identified a High Groundwater Discharge (HGD), a Weak Groundwater Discharge (WGD) and a Groundwater Recharge (GR) sites on the Allequash, North, and Stevenson Creeks respectively. The AEM provided basin-wide understanding of the groundwater-surface water interaction. We searched for verification of AEM results as mentioned above using the method of temperature time series analysis. In this study we use stream water temperature and sediment temperature underneath the streams collected by the USGS. The method of time series analysis has some limitations but its implementation is easier, faster, and less expensive than other methods such as numerical modeling; it is usually used as a screening tool in initial model development process.

KEY WORDS: Recharge and discharge, water budget, Temperature Time Series, Lake Trout Basin.

9:30 "How Much Complexity is Warranted in Regional Flood Frequency Analysis?"

-SANJA PERICA, University of Utah, Department of Civil and Environmental Engineering, Salt Lake City, UT
-MATTHEW STAYNER, University of Utah, Department of Civil and Environmental Engineering, Salt Lake City, UT

Reliable estimates of flow statistics are needed for water resources management purposes. Regional regression models, usually of power-form, are repeatedly used to make estimates of a flood quantile for ungaged, unregulated sites using selected climatic and physiographic factors as predictors. Equations are developed for a region that is identified as homogeneous based on underlying hydrologic/ meteorologic properties. Such relations, for example, have been established at various times for most of the United States by the USGS and compiled in "The National Flood Frequency Program." With the growth of GIS based watershed models, such as ArcHydro or Watershed Modeling System, extensive sets of basin parameters can be easily obtained and investigated as potential predictors of flood quantiles. As a result, prediction equations tend to be more complex than they used to. However, based on our study for several watersheds in the USA, it appears that more complex equations actually often generate less accurate flood estimates than very simple equations that consist of only one or two predictors. Equations appear to be highly sensitive to estimation errors in explanatory variables. That is true whether equations are applied in calibration or prediction mode.

KEYWORDS: Regional flood frequency analysis, watershed management, GIS, Regional regression models.

Session 12 WEDNESDAY, OCTOBER 20, 2004

MODERATOR: Pat Leahy **LOCATION: Athena**

10:30 "Application of Hydrograph-Derived Streamflow Indices in Hydrologic Studies"

-BISHER IMAM, Associate Adjunct Professor, Department of Civil & Environmental Engineering, University Of California, Irvine, CA
-EYLON SHAMIR
-SOROOSH SOROOSHIAN

Daily streamflow observations have been the key hydrologic information used in designing water resources systems and calibrating hydrologic models. Traditional approaches either aggregate daily streamflow into monthly values, such as the case in time-series analysis, or rely on the streamflow hydrograph as the key hydrologic element to be preserved in model calibration. However other information can be gained by conducting diagnoses on daily streamflow hydrographs. Such diagnoses can result in condensing the information pertinent to watershed behavior, and further improve the ability to calibrate hydrologic models, or to identify patterns of change that may not be obvious through time-series analysis of the daily or monthly record.

This paper investigates the utility of such diagnostic tools, particularly with respect to parameter estimation. Information in the form of streamflow indices that describe the shape of a streamflow hydrograph in an integrated manner are extracted for multiple mid-size (223-4790 km2) perennial headwater basins with a long record of streamflow. An examination of the utility of the proposed indices in parameter estimation is conducted using data from the Leaf River, located in Fort Collins, Mississippi. It is shown that constraining the parameter estimation by selecting only those parameters that result in model output which maintain the indices, as found in the historical data, can improve the reliability of model predictions as manifested by (a) improvement of the prediction of low and high flow, (b) improvement of the overall total biases, and (c) maintenance of the hydrograph's shape for both long-term and short-term predictions.

KEY WORDS: diagnostic tools, hydrographs, index, streamflow indices.

11:00 "Estimation of Evaporation and Hydrologic Parameter Using Continuous Soil Moisture and Water Table Monitoring"

-MANDA RAHGOZAR, Department of Civil and Environmental Engineering, University of South Florida, Tampa, FL
-MARK ROSS, Department of Civil and Environmental Engineering, University of South Florida, Tampa, FL

A new methodology is proposed for estimation of evapotranspiration flux at small spatial and temporal scales. The method involved simultaneous measurements of soil moisture profiles and water table heads along runoff flow plain transects. Precipitation and in-situ soil moisture data were measured at 5 minute intervals in a shallow water table field site in West Central Florida throughout 2002 and 2003 Calendar year. The soil moisture probes were installed in very close proximity to the transect wells. The change in soil moisture volume is coupled with one dimension (1D) finite difference approximation transect flow model. Changes in soil moisture not attributed to lateral or deeper vertical flows were assumed to be either from evapotranspiration (ET) or rainfall infiltration depending on whether they were negative or positive respectfully. No significant positive fluctuations were observed in the absence of rainfall. Quarterly and annual observed ET yield the variability and magnitude for different landuse and are presented in tabular and graphic form for the land covers investigated. Results are presented for 1) an ungrazed Bahia pasture grass which averaged near 31.7 and 34.3 inches for total ET and interception capture (Ic) in 2002 and 2003 respectively, 2) for a mixed zone of pasture grass and forest trees with an average of 41.5 to 49.3 inches and 3) alluvial wetland forest typical of west central Florida of 51.8 to 56.3 inches. In addition to ET estimation, other components of the water budget, infiltration, runoff and lateral flows are also explored in this research.

KEY WORDS: Alafia River, variable specific yield, vadose zone, soil moisture probes, shallow water table.

11:30 "Water Quality in Cattaraugus Creek, Northwestern New York State"

-GLORIA PATRICIA BASTO SALGADO, Department of Geological and Environmental Studies, Youngstown State University, OH
-THOMAS DIGGINS, Department of Biological Science, Youngstown State University, OH
-CARL JOHNSTON, Department of Biological Science, Youngstown State University, OH

Assessing the ecological health of rivers has become one of the most important environmental goals worldwide. Water quality assessments include a wide range of parameters that determine, or at least estimate, the condition of a stream at any given time. Physical, chemical, and biological data have been intensively used in the last decade. In contrast, to date microbial aspects, such as quantification and diversity, in streams are currently poorly characterized. The present study aims to identify possible relationships between physical and chemical characteristics, benthic community structure and microbial quantification as a holistic understanding of water quality of the Cattaraugus Creek, Zoar Valley Canyon, New York State. Our study provides a first unified baseline that will be used for further monitoring and development of future watershed management practices. Physical and chemical variables are being measured using either an YSI 6600 Multiparameter Probe or standard wet chemistry methods. Additionally, benthic macroinvertebrate community and microbial quantification including fecal coliform, direct total microbial counts, and heterotrophic plate count (HPC) are being cataloged at nine sampling sites at Cattaraugus Creek. Preliminary results from summer and fall 2003 have not indicated any significant association between water quality and bacteria numbers (regression of Coliform Forming Units-CFUs- on water quality factors -principal component analysis of dissolved oxygen, chlorophyll, turbidity, temperature and pH-). Thus far benthic macroinvertebrate data appeared to be influenced more by substratum type (bedrock, riffle-cobble and pool-soft sediment) than by water quality variables. Further data will be collected during the spring, summer, and fall 2004.

KEY WORDS: Cattaraugus Creek, streamflow water quality, holistic approach.

GUEST SPEAKERS

OPENING PLENARY SESSION — TUESDAY, OCTOBER 19, 2004

12:15 "The National Ramifications of the Miccosukee Case"

-KAY BROTHERS, Deputy General Manager, SNWA Engineering / Operations

Kay Brothers was appointed deputy general manager of Southern Nevada Water Authority Engineering and Operations in 2002. Previously, she served as director of SNWA's Resources Department, where she managed planning activities to protect existing water resources and to acquire future resources.

Brothers graduated in 1977 from the New Mexico Institute of Mining and Technology with a Bachelor of Science degree in environmental engineering. She began her career in the petroleum and mining industry focusing on environmental compliance, water treatment design and groundwater monitoring and mitigation facility design.

She joined the Las Vegas Valley Water District in 1986 as a hydrologist and helped develop the district's artificial recharge program to store treated Colorado River water in the Las Vegas Valley's groundwater aquifers for future use. She served as director of SNWA Resources from 1995 until 2002, when she was promoted to deputy general manager.

Brothers is active in regional and national water issues. She currently serves as president of the Nevada Water Resources Association and serves on the Board of Directors for the Water Education Foundation and Water for the West Foundation.

LUNCHEON — MONDAY, OCTOBER 18, 2004

12:15 "The National Map"

-KEVEN ROTH, U.S. Geological Survey, Geography Discipline

SESSION 6 — TUESDAY, OCTOBER 19, 2004

8:00 "The National Ramifications of the Miccosukee Case"

-DOUG MILLER, General Counsel for the Central Arizona Water Conservation District

Douglas K. Miller is General Counsel for the Central Arizona Water Conservation District (CAWCD), the multi-county political subdivision responsible for operating and repaying Arizona's share of the costs of constructing the Central Arizona Project. He has practiced in the natural resources area almost exclusively since graduating from Stanford Law School in 1974. He spent three years with the Department of Justice representing the Environmental Protection Agency and other federal agencies in actions under the Clean Water Act, the Clean Air Act, and other federal environmental laws. Thereafter, he practiced for approximately six years with the law firm of Fennemore Craig in Phoenix working in the environmental area and areas relating to management of federal lands and mining law. Since joining CAWCD as its counsel in 1984, Mr. Miller's areas of practice have included water law, federal reclamation law, and environmental law as they relate to the Central Arizona Project.

AWARDS LUNCHEON — TUESDAY, OCTOBER 19, 2004

12:30 MODERATOR: Pat Leahy

R. K. Linsley Award: This award, established by the American Institute of Hydrology in 1988, is named in honor of Ray K. Linsley, another great leader in the hydrological sciences. The award is presented for major contribution in the field of surface-water or engineering hydrology.

C. V. Theis Award: This award, first established in 1986 by the American Institute of Hydrology, is named in honor of C. V. Theis, one of the truly great leaders in the hydrological sciences. The award is presented for major contribution in the field of groundwater hydrology.

AIH Founders Award: This award, established by the American Institute of Hydrology in 1990, is to honor the three founders of AIH, Sandor C. Csallany, Roman Kanivetsky, and Alexander Zaporozec, for their initiative and vision in forming the American Institute of Hydrology. The award, consisting of an engraved plaque, is given periodically at the discretion of the Executive Committee to an AIH member for outstanding, long, and dedicated service to the Institute.

SUNDAY, OCTOBER 17, 2004 — LOCATION

8:00 am - 5:00 pm **Hydrologic Field Methods** . . . . . **Zeus C**
Instructor: John Moore, P.H.G
Cost: AIH Members $260, Non-Members $300, Students $200

Includes guides for site investigations and report preparation. The objective of this course is to present current standards methods, and guides for planning and undertaking hydrogeologic field investigations. The guides were developed to produce uniform and high quality data. The course will focus on field methods to define environmental site characteristics. The course emphasizes conceptual models, water level measurements, well inventory, well drilling, aquifer tests, computer programs, sample collection, project planning, and report preparation. Source references for this course are USGS. Techniques for Water-Resources Investigations and American Society for Testing and Materials (ASTM) standard guides for soil, rock, and groundwater. It is based on Field Hydrogeology- a guide for site investigations and report preparation, by John Moore, Lewis Publishers 2002. The attendees will receive a course notebook of the guides presented in the course. The course has been presented at the IAH Congresses in Canada, Australia, Munich, and Argentina. It was also presented at the AIH annual meeting in St Paul and at Hydrogeology Days in Belgrade (2004). Dr. Moore is a retired USGS hydrologist and Adjunct Professor at Metro State College. He has more than 40 years experience as a hydrologist. He is the past president of IAH and AIH. Engineers, geologists, environmental scientist, entry level hydrogeologists and students would benefit from this course.

8:00 am - 5:00 pm **Introduction to HEC-RAS** . . . . . **UNLV**
Instructors: Tom Piechota and Glenn Tootle, P.E., P.H.
Cost: All $280

In this course, you learn basic applications of the United States Army Corps of Engineers Hydrologic Engineering Center River Analysis System (HEC-RAS) model in determining floodplain elevations of rivers and creeks. Instructors provide an overview of open channel hydraulics including flow regimes, energy equations and backwater curve profiles. You benefit from hands-on computer lab sessions using HEC-RAS. This course will be held on the campus of University of Nevada, Las Vegas. Transportation to and from the classroom will be provide if needed. Students will receive certificates for (8) PDH's for attending/completion of the course. Dr Tom Piechota is an Assistant Professor, Civil and Environmental Engineering at the University of Nevada, Las Vegas' Department of Civil and Environmental Engineering. His interests are interdisciplinary in the areas of surface water hydrology, stormwater quality in urban environments, hydroclimatology, water resources planning and Geographic Information Systems. Mr. Glenn Tootle is a graduate research assistant/instructor at NULV and holds a Master of Civil Engineering from the University of Florida. He is a registered Professional Engineer in the states of Nevada and Florida and a Register Professional Hydrologist with AIH.

THURSDAY, OCTOBER 21, 2004 — LOCATION

8:00 am - 5:00 pm **Integrated Surface Water/Groundwater Modeling with the Integrated Hydrologic Models (IHM)** . . . . . **Apollo 5**
Instructors: Alaa Aly, Ph.D., P.E., Jeff Geurink, Ph.D., P.E. and Patrick Tara, P.E.
Cost: Members/Nonmembers $300, Students $150

The Integrated Hydrologic model (IHM) is a fully integrated surface water groundwater hydrologic model. The IHM employs HPSF (supported by the EPA) to simulate the surface water budget and MODFLOW (supported by the USGS) to simulate the saturated groundwater flow. Between the surface water model and the groundwater model components is a three layer vadose zone model. The IHM simulates the full hydrologic cycle from precipitation to ET and baseflow. The IHM along with the principle components is a public domain hydrologic model. The model utilizes Access database as well as data developed through GIS analysis. The training course will cover integrated modeling theory and model conceptualization, and data development; an online demonstration of the IHM on a small scale application will also be included. The course will be broken into morning and afternoon sessions. The morning session will cover the theory and implementation details. The afternoon session will focus on the hands-on small scale model application. The attendees will leave the short course with copies of the Theory Manual and User's Manual. They will also be provided with class notes and an example IHM application. The attendees of this course should be regulators, managers, engineers, or geologists interested in surface water and groundwater interactions and integrated hydrologic modeling. The instructors were on the IHM code development team. Dr. Geurink and Mr. Tara were also team members responsible for the conceptualization, data development, and calibration of the IHM for a large regional application in Southwest Florida. Dr. Geurink and Mr. Tara have over 14 years of experience working with and developing integrated hydrologic models.

9:00 am - 4:00 pm **Using Concepts of Watershed Hydrology** . . . . . **Apollo 2**
Instructor: P. Black, P.H.
Cost: $100

This is an animated/narrated auto-tutorial short course that Peter Black created and markets. All participants will receive the CD and workbook. The workshop will consist of proceeding through the entire short course, pausing at the end of each unit (PowerPoint slide) for questions and comments/perspective, and will include an intensive review and discussion of the course's 24 thought-provoking study questions. Upon completion, attendees will be better informed about basic ecological hydrology and will be prepared to conduct similar workshops for their associates, clients, cooperators, partners, or students. The course is open to interested local area educators, students, consultants, government officials, and regulators, as well as citizens, members of interest groups, and water resources management officials. Water resource conservation begins with discussion and interchange of information on the basics: this workshop provides that opportunity. Peter E. Black is Distinguished Teaching Professor of Water and Related Land Resources, Emeritus, at the SUNY College of Environmental Science and Forestry in Syracuse, NY. He has taught and conducted research at SUNY since 1965. He has taught forest management, surveying, and forest hydrology, and has offered courses in watershed hydrology, watershed management, conservation policy, environmental impact analysis, and seminars. He has given short courses to a variety of technical and lay audiences in the United States and internationally.

POSTER PRESENTATIONS

Session Coordinator: Suzanne Pierce
Location: Parthenon 4

Title	Author
Magnitude and Frequency of Western U.S. Droughts	G. Tootle, T. Piechota, J. Timilaena
Ratios of Short Duration to 24-Hour Rainfall for Frequency Analysis	C. Young and B. McEnroe
Determination of Chlorophenols, Nitrophenols and Methylphenols in Ground-Water Samples Using High Performance Liquid Chromatography	Z. Lin, S. Huling, G. Jungelavec
GIS-Based Models for Erosion Susceptibility, Sediment production, and Earthflow Potential within the North Santiam River Basin, Oregon	S. Sobieszcyk and M. Uhrich
Surface-Water Flow and Transport Model on the Southern Florida Everglades	R. W. Schaffranek
Modeling Streambed Heating in Shallow Streams, Part 2	R. Annear and S. Wells
Are Oil-Field Brines Used for Dust Abatement Really Harmless?	Y. Eckstein
Ground Water/Surface Water Interaction During Runoff Events in Maple Creek, Nebraska	R. Zelt, C. Knowlton, J. Carpenter, and J. Vogel
Salinization and Predevelopment Recharge of the Rio Grande Aquifer, El Paso/Juarez Area - A New Model	B. Hibbs, M. Merino, C Eastoe, and J. Hogan
Trace Element and Isotopic Evolution Along a Ground Water Flowpath - Irvine Sub-Basin, California	H. Nation, D. Martinez, B. Hibbs, and M. Marino

Setup before: 6:00 pm, Sunday, October 17, 2004
Breakdown after: 10:30 am Wednesday, October 20, 2004

EXHIBITORS/SPONSORS

Exhibitor Coordinator:
Location: Parthenon 4

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2006 AIH 25th ANNIVERSARY MEETING, BATON ROUGE, LOUISIANA

International Conference
"Challenges in Coastal Hydrology and Water Quality"

May 2006 (or to be decided)

The AIH Executive Committee, after substantial discussion and analysis, regarding the success of our Annual Meetings, has approved a proposal to hold future conferences in the Spring or early Summer months and with a more regional focus. The preparation for a major conference, such as the 25th Anniversary, necessitates that AIH forego an annual meeting in 2005. We intend to make our meetings have greater value to all attendees; thereby, hopefully increasing participation.

THEME

To provide an international forum for information exchange and discussion on all aspects of hydrology, hydrometeorology, hydraulics, and water quality issues pertinent to coastal processes and environment.

TOPICS

- Hydrology and Coastal Processes
- Hydrologic Pathway from Terrestrial and Coastal Ecosystems
- Hydrologic Processes in Coastal Wetlands and Floodplains
- Fresh Water and Salt Water Interactions
- Eutrophication and Hypoxia in Coastal Waters
- Coastal Wetland Restoration
- Surface and Ground Water Interaction in Coastal Regions
- GIS Applications in Coastal Hydrology Studies
- Potential Global Change Effects on Coastal Water Resources
- Socioeconomic Factors and Coastal Water Policies

FIELD TRIPS

- Atchafalaya River Basin (Mississippi Diversion)
- Mississippi River Delta National Wildlife Refuge (deltaic development)
- Constructed LaBranche Wetlands (wetland restoration)

COURSES

- HEC RAS
- MikeShe
- Hydrologic Field Methods

PAPERS

- Abstracts of less than 500 words
- Refereed Publications

POTENTIAL SPONSORS and PARTNERSHIPS

- Louisiana Governor's Office of Coastal Activities
- Louisiana Department of Natural Resources (Atchafalaya River Basin Program)
- Louisiana Department of Wildlife and Fisheries
- Louisiana Department of Environmental Quality
- Lake Pontchartrain Basin Foundation
- Louisiana Sea Grant College
- Louisiana Water Resources Institute
- USGS, Louisiana District Office
- US Army Corps of Engineers, New Orleans District
- Greater Baton Rouge Chamber of Commerce
- Baton Rouge Convention and Visitors Bureau
- LSU AgGenter and Main Campus

CALL FOR PAPERS

To participate in this Special Occasion and present a paper, please submit a 250-word abstract of your paper to AIH Headquarters by July 1, 2005. Speakers will be notified of their acceptance by November 1, 2005.

CONFERENCE CHAIRS

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CONFERENCE COMMITTEE

(Under development. International, national and local members are being recruited.)

ADVISORY COMMITTEE

The scope of this committees deliberations should be broad and include everything from promotional materials (E.G. letterhead, pins, etc.), awards (e.g. proposed ne Water Quality Award), activities (e.g. commemoration and special symposia at the 2006 AIH Annual meeting). The committee is not being asked to organize the 2006 meeting, but rather to interface with the AIH 2006 Meeting Organizing Committee.

MEMBERSHIP

Dr. L. Douglas James, Chair
Dr. Alex Zaporozec
Dr. Vijay Singh
Dr. Ken Brooks
Dr. Joe Rosenshein
Dr. Gerald E. Seaburn