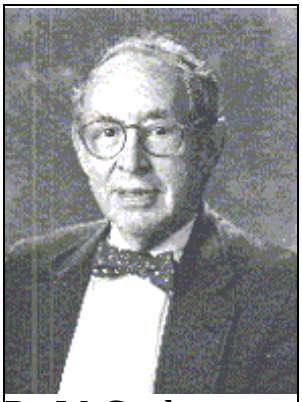
Maryland Water Resources Research Center

Department of Civil & Environmental Engineering
University of Maryland
College Park, Maryland 20742

Fall 2003 | Dr. Allen P. Davis, Director | Dr. Phil Kearney, Assoc Dir.

Maryland Water Policy - What Does the Future Hold?

On October 24, 2003, *The Maryland Water Resources Research Center* will sponsor a 1-day conference on *Maryland Water Policy - What Does the Future Hold?* Seven eminent speakers have been invited, highlighted by Professor W. Gordon Wolman of The Johns Hopkins University. A few of the topics to be discussed are: What are Maryland's current water policy issues? What policies govern water suppliers, i.e., river basins and utilities? How will we allocate future water supplies between agricultural and urban users? How will continued urban sprawl affect future water needs?



Dr. W. Gordon (Reds) Wolman

In addition to the speakers, the conference will include a student poster contest and an open panel discussion with the speakers at the end of the program. The complete agenda is shown on page 3. The conference is open to anyone interested in State water issues. The Center will cover all costs, including registration, breaks, lunch and parking associated with the meeting. An electronic registration website is set up at www.waterresources.umd.edu Registration is required to attend.

From the Director

Since this summer marks the 30th anniversary of Senator Mathias' initiative to "Save the Bay," much has been written lately about our progress on Bay restoration. A major financial investment has been made to improve the water quality and ecosystems of the Bay. The Chesapeake Bay is a Maryland treasure and supports the economy and viability of the State through tourism, industry, and recreational activities.

Inside this Newsletter

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Yet, what do we have to show for the millions (billions?) of dollars invested? Recent articles have criticized progress in improving Bay

quality. This summer, the largest anoxic zone ever recorded has engulfed the Bay. We do have a few success stories (the Rockfish population), but most Bay stories do not yet have a happy ending.

One detail that should not escape our analysis is that population in the Bay watershed has doubled over the past 30 years. Additionally, land development has increased at a rate faster than population, promoting sprawl. The importance of this growth, and its impact on the Bay, should not be underestimated. Maybe all of the programs implemented and the money spent on Bay improvement have made a difference. Maybe the problem is that all of our improvements are being canceled out by the tremendous stresses from growth over the past few years. Perhaps we are lucky that things haven't gotten worse and that the Bay is not completely dead. Of course, such logic is far from satisfying. Holding our own is not making progress. We need to continue to work hard to improve the Bay in the face of the massive development and land use pressures faced by the watershed.

Sound fundamental research is a necessary tool in this fight. Science, policy, and engineering research will lead the way to understanding the complexities of the Bay ecosystems and to develop policies and technologies to deal with the continued stresses that we place on the Bay and its watershed and airshed. As we look to the future, we need to also look at the past. As long as the population of the Bay watershed grows, the problem of restoring the Bay to the state that we desire becomes more complex.

Request for Proposals - 2004 Funding

Proposals for the 2004 *Maryland Water Resources Research Center* funds are now being solicited. The Center is seeking requests for three types of proposals this year (with their estimated funding levels): regular research projects ($15k to $30k), summer graduate fellowships ($3.6k) and seed research projects ($2k to $5k). Requirements for the 2004 summer fellowship program are presented below. The seed project program is new for the Center and solicits proposals aimed at developing exploratory projects, with the deliverable being a major proposal for submission to another agency such as the National Competitive Grants program. The PI would be the team leader in developing a broad-based project on a high priority subject.

For information on proposal preparation, go to our web site at *www.waterresources.umd.edu.* Specific questions may be addressed to the Associate Director at (301-405-6829) or e-mail *pk56@umail.umd.edu* Proposals are due in the WRRC office (1147 Martin Hall, University of Maryland, College Park 20742) by close of business (4:30 PM) on Friday, November 14, 2003.

2004 Summer Fellowship Program.

For the fourth year, the Center will offer summer assistantships to selected outstanding graduate students. Selection of awardees will be made in late November based on a) evaluations of student's records, b) strength of advisor's recommendation, and c) prospects that the research will benefit our understanding and management of Maryland's water resources. The most important benefit of this project will be simply its contribution to the educational mission of the Center. Interested applicants should contact Dr. P. C. Kearney for details at *pk56@umail.umd.edu* Summer Fellowship proposals must be submitted to our office by November 14, 2003. Guidelines can be found at Center website.

CUAHSI

The University of Maryland is one of more than 70 member universities in the Consortium for the Advancement of Hydrologic Science, Inc. (CUAHSI). CUAHSI continues to be busy with the administrative details of launching a new organization and fund-raising. In May 2003, the National Science Foundation awarded a five-year grant (approximately $6 million) to CUAHSI for core operations as well as for prototyping activities for integrated large-scale Hydrologic Observatories and a Hydrologic Synthesis Facility. A "paper prototype" of a hydrologic observatory for the Neuse River basin in North Carolina has begun and results will be

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Sponsored by The Maryland Water Resources Research Center

October 24, 2003
Margaret Brent Room
Stamp Student Union Building
University of Maryland
College Park, MD 20742

8:30 - 8:40	**Welcome + Opening Remarks**
8:40 - 9:25	**Keynote Speaker - *Speculation on Water Issues and their Policy Implications* - M. Gordon Wolman (Director) and Herbert Sacks, Division of Environmental Health Engineering, The Johns Hopkins University.**
9:25 - 9:55	***Linkages between Agricultural, Urban and Environmental Water Concerns*- Doug Parker, Agriculture and Resources Economics, University of Maryland**
9:55 - 10:10	***Break***
10:10 - 10:40	***Water Supply as a Factor in Local Growth Management* - James Cohen, Urban Studies and Planning, University of Maryland**
10:40 - 11:10	***Public Policy Water Issues* - Matthias Ruth, School of Public Policy, University of Maryland**
11:10 - 11:40	***Policy Implications of Water Supplied from the Susquehanna River Basin* - Paul Swartz, Executive Director, Susquehanna River Basin Commission**
11:40 - 1:00	***Lunch and Poster Session - Prince George's Room***
1:00 - 1:30	***Current Maryland Water Policy Issues* - Robert Summers, Maryland Department of the Environment**
1:30 - 2:00	***Maryland Utilities and Water Supply Policy* - Roland Steiner, Washington Suburban Sanitary Commission**
2:00 - 3:00	**Panel Discussion**

Contact persons

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The Conference is supported by the U.S. Geological Survey and the Colleges of Agriculture and Natural Resources, Engineering and Life Sciences at the University of Maryland.

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presented at the Fall American Geophysical Union meeting. A competition for site assessment grants to develop hydrologic observatories proposals will be held in early 2004. A workshop was held in July 2003 to develop a Request for Proposals for the Hydrologic Synthesis Center, and further announcements are forthcoming. The envisioned Synthesis Center would provide infrastructure to unify the diverse, multi-faceted, interdisciplinary community of hydrologic science, and to enhance the capability to address big questions, especially at the frontier interfaces between traditional subdisciplines. A proposal for a $2.5-million two-year project to develop a data model and prepare an RFP for a Center for Hydrologic Information was submitted to the NSF Geoinformatics program in May 2003. Interested persons can find further details about these happenings on the CUAHSI web site *www.cuahsi.org*

CUAHSI has produced a new 4-page informational brochure, which can be found on the web site. Dr. Kaye Brubaker, Maryland's CUAHSI representative, also has some hard copies; inquire with her if interested. Email: *klbrubak@eng.umd.edu*

Research Projects Supported in 2003

Two new projects and one continuing project were funded by the Maryland Water Resources Research Center in 2003. New Projects:

***Response of Macro Invertebrates to Road Salt Runoff in Headwater Streams* - William Lamp, Department of Entomology, University of Maryland, and Saundra Crane, MEES Graduate Student, University of Maryland**

***Fate of Alkylphenolic Compounds in Wastewater Treatment Plants and a Sub-estuary of the Chesapeake Bay* - Alba Torrents, Department of Civil and Environmental Engineering, University of Maryland, and Clifford Rice, Environmental Chemistry Laboratory, USDA/ARS**

Continuing Project:
***Investigations of Isotopic Methods for Identifying Atmospheric Deposition of Nitrates to the Chesapeake Bay* - James Farquhar, Department of Geology, University of Maryland**

Water Resources Poster Contest

The *Maryland Water Resources Research Center* is sponsoring a poster contest as part of its Water Policy Conference on October 24, 2003. A panel of judges will view the posters and award prizes of $200 for the top poster and $100 and $50 for the second and third place winners. The top three winners will also receive award plaques. Interested students should forward a title + a 50 word abstract to the Center by Sept 15. Guidelines can be found at the website or by contacting Phil Kearney.

Center Sponsors Nonpoint Water Pollution Panel Discussion: Ecological, Economic, Civic and Policy Perspectives

On Thursday, April 24, 2003, Antonia Giardina, graduate student, *Sustainable Development and Conservation Biology*, held a panel discussion on nonpoint water pollution at the University of Maryland, College Park. Undergraduate and graduate students made up the majority of the audience. Four panelists presented 20-minute presentations on the ecological, economic, civic, and policy perspectives of nonpoint water pollution.

Mr. Kenneth Belt, a hydrologist/aquatic ecologist with the US Forrest Service presented *Urban Nonpoint Sources Along an Urban-Rural Gradient: Intertwined Hydrologic Systems.* Mr. Belt stressed how the ageing urban infrastructure allows large amounts of water and pollution exchange between the natural and engineered systems.

Dr. Suzie Greenhalgh, a senior economist at the World Resources Institute presented *Awakening The Dead Zone: An Investment For Agriculture, Water Quality, and Climate Change.* She described how nutrient trading among point and nonpoint sources in the Mississippi River Basin would reduce nutrients in the Gulf of Mexico.

Ms. Laurie Duker, Director of Conservation at LakeNet, discussed A *Citizen's Initiative to Reduce Nonpoint Water Pollution In Lakes: Lessons Learned.* Ms. Duker's presentation drew on the experiences of local groups working to clean up the Lake Champlain watershed.

Finally, Mr. Stuart Lehman, an environmental scientist in the US Environmental Protection Agency's Nonpoint Source Control Branch presented *Nonpoint Source Policy and Watershed Management.* Mr. Lehman discussed the different regulations, tools, and incentives available to watershed managers and planners.

Following the presentations, the panelists took questions from the audience and engaged in an informative discussion. Questions ranged from the specifics of nutrient trading markets to the broad role of science in decision-making. Discussions continued at a reception where students shared ideas with the panelists.

The USGS Internship Program - Cooperative Opportunities

Several opportunities for collaborative work with Federal agencies are available through the Center. First, is the USGS internship program. USGS personnel are able to fund student interns through the Maryland WRRC. Generally, the research project is a collaborative endeavor between a USGS scientist and a University faculty member. Several Maryland internships have already been supported with the Baltimore and Reston, VA USGS offices. Details on the internship program can be found at the USGS website (http://water.usgs.gov/wrri/internship.html**) and by contacting the Maryland director.**

Additionally, a mechanism is in place to easily allow funds from Federal agencies to be transferred to universities through the water centers. The Maryland Center has recently facilitated such a partnership between a University of Maryland faculty member and the U.S. Army Corps of Engineers. Other Centers have used this arrangement for research with U.S. EPA and other agencies. Again, details can be found by contacting the Maryland director.

Updated Web Site

The *MWRRC* continues to update its web site and improve its usefulness. First, we now have a new address *www.waterresources.umd.edu* The site has been upgraded to include some photos of Center work and activities. Also, links to the USGS/National Institutes of Water Resources information is prominently presented. We continue to provide archived information on Center-sponsored projects and resulting publications. We also maintain two news lists, one for announcements of seminars, RFPs, and similar items of interest. A second list contains jobs and positions in the water resources area.

Rain Garden Initiative on Campus Celebrated for Environmental Engineering Research and Education.

U.S. Congressman Steny Hoyer, Prince George's County Executive Jack Johnson, and Jon Capacasa of the U.S. Environmental Protection Agency joined J. Dennis O'Connor, Vice President for Research & Dean of Graduate Studies and Professor Allen P. Davis from the Department of Civil and Environmental Engineering on Monday, April 14, 2003 in an event to celebrate the installation of a pair of rain gardens on Campus.

Rain gardens, also known as bioretention facilities, are plots of soil, sand, and plants that are carefully designed to improve the environmental characteristics of storm water runoff. Parking lots, buildings, and other structures contribute pollutants to rainwater runoff. Urban development also removes the natural filtering and infiltration characteristics of the land. Runoff from developed areas,

Rep. Steny Hoyer, Vice President J. Dennis O'Connor, Prince George's County Executive Jack Johnson, Mr. Jon Capacasa of the U.S. EPA, and Dr. Allen P. Davis.

however, can be channeled into rain gardens where filtering and other processes capture and remove pollutants such as sediments, oils, and heavy metals. The treatment also slows down the flow of water to reduce downstream erosion. "This project is one more way to think about how we grow smart, how we grow by protecting the environment, and how we grow with clean water clearly in our mind," offered Rep. Hoyer.

"The pollution battles that we are fighting today include runoff from paved areas and manmade development. This rain garden is a powerful demonstration to look at stormwater as a resource rather than a waste product," added Mr. Capacasa, Acting Director, Watershed Protection Division, EPA Region III. The beneficiary of the Campus rain gardens, ultimately, will be the Chesapeake Bay. The rain gardens will improve water quality in Campus Creek and the Paint Branch. The rain gardens were built through collaboration between the University and the Prince George's County Department of Environmental Resources. County Executive Johnson, who reinforced his message that the county is "absolutely committed to the environment," praised this collaboration. The gardens were designed by Neil Weinstein of the Low Impact Development Center, a nonprofit organization dedicated to protecting the environment and water resources through novel design techniques. "Our rain gardens serve two purposes," added Davis.

"They are operating systems, so that water that comes off of this parking lot can be cleaned and purified by the soils and the grasses. Also, they are research facilities; they have plastic and concrete channels to monitor water flow and pollutants in and out." Davis, who led the University's effort to bring the gardens to campus, added, "By setting these up as research facilities, we can expand this technology beyond the University of Maryland." Installing the rain gardens on campus also allows them to be used in a variety of settings to educate students and others in novel environmental management techniques.

The presence of the rain gardens on campus will complement the work that Davis, with collaboration of others, has done on this technology over the past decade. The new rain gardens have two novel research components. One of the cells contains a submerged layer with an overdrain to promote the removal of nitrate from the runoff via microbial denitrification processes. This modification was optimized in the laboratory by Davis, Dr. Eric Seagren, Associate Professor of Civil and Environmental Engineering, and graduate student Hunho Kim (Funded through the *Maryland Water Resources Research Center*). A second research component is the use of *Thlaspi* plants in the rain gardens. *Thlaspi* is known to specifically hyperaccumulate zinc from soils and may allow better management of heavy metals in runoff. These plants are being monitored by Dr. J. Scott Angle, Professor of Agronomy and Associate Dean for the College of Agriculture and Natural Resources, to evaluate their performance in a rain garden situation. In addition, Professor Pat Kangas, coordinator for the Natural Resources Management Laboratory, is monitoring the ecology of the rain gardens, following the behavior and survival of the vegetation.

With continued Federal funding, plans are underway to install several more bioretention facilities in the same general area, around parking lots surrounding the Comcast Center. At least one more rain garden will be rigorously monitored for its performance in the removal of toxic pollutants, such as mercury and PCBs, which may be present in ultra-trace levels in runoff from active parking lots in urban areas.

"I am pleased, as a member of Congress," Rep. Hoyer concluded, "to try to facilitate funding these ideas, turning them from ideas into the reality of a cleaner environment, a higher quality of life, a better campus, a better Prince George's County, a better Anacostia, and a better Chesapeake Bay."

Featured Scientist- Dr James Farquhar

James Farquhar is affiliated with the Department of Geology and Earth Systems Science Interdisciplinary Center. He has a B.S. degree (1987) from Washington and Lee University (Geology), an M.S. degree from the University of Chicago (Geophysical Sciences), and a Ph.D. degree from the University of Alberta (Earth and Atmospheric Sciences). His research and that of his students and research associates focuses on the application of the rare isotopes of oxygen and sulfur to study a variety of environmental, geochemical, and cosmochemical questions, including studies of atmospheric evolution of Earth, atmospheric deposition of nitrate and sulfate, evolution of water early in the solar system, developing tools to study the antiquity of biological sulfur metabolisms, and experimental studies of photochemical isotope effects. His laboratory is located in the newly renovated Geochemistry Corridor in the chemistry building at the University of Maryland.

James Farquhar

A little over three years ago, Dr. Farquhar documented an unusual sulfur isotope signature in some of Earth's oldest rocks. This signature disappears in rocks that are younger than 2.45 billion years old. Because this type of isotope signature is only known to be produced by gas-phase (atmospheric) reactions, Farquhar's results have been interpreted to signal a major change in the Earth's sulfur cycle and the Earth's atmosphere. The observation is presently held as the strongest line of geological evidence for the transition from an oxygen and ozone poor atmosphere early in Earth history to one more like the present atmosphere that contains significant quantities of oxygen, and enough ozone to shield solar ultraviolet radiation. This approach has recently been extended in an NSF-funded study to provide evidence for the operation of plate tectonic-like processes early in Earth history. In a paper published last December in *Science,* Farquhar, Boswell Wing (Department of Geology and ESSIC), and their collaborators documented the same sulfur isotope signature in miniscule sulfide inclusions in diamonds from the Orapa Kimberlite pipe in Botswana, Africa.

Dr. Farquhar has three current graduate students: Katherine Cooney, supported by a MWRRC research grant, has focused on applying a similar isotopic approach to understand deposition of atmospheric nitrate and sulfate to the Chesapeake Bay watershed. Atmospheric ozone and nitrogen oxide chemistry are known to produce large isotope effects for ^{17}O, one of the rare isotopes of oxygen. This signature is imparted to atmospheric nitrate and sulfate, making measurements of ^{17}O a tool to study deposition of atmospheric nitrate and sulfate. Cooney is studying the potential uses of this tool to constrain the fluxes of atmospheric nitrate and sulfate to the Chesapeake Bay watershed.

Mark Tyra is supported by a NASA cosmochemistry grant focusing on the use of oxygen isotope analyses of primitive meteorites to decipher the history of reaction between minerals and water in primitive meteorites. These meteorites are thought to be fragments of planetesimals that evolved early in the solar system and were subsequently disrupted and sent into Earth crossing orbits. They preserve information about chemistry that occurred very early in the history of the solar system.

David Johnston has spent the past summer working at the Biological Institute of the University of Southern Denmark to study sulfur isotope fractionations produced by bacterial metabolic processes. Johnston's research is supported by the Carnegie Institution of Washington's NASA Astrobiology Institute grant. This work focuses on describing the isotopic signatures of different metabolic pathways and

devising ways to identify their presence in the geological and possibly cosmochemical record. The goal will be to study when specific metabolic processes become evident in the geological record of sulfur and to provide data that can be used to test hypotheses about the time when they first evolved.

The underlying theme of all of this work is a focus on using information gained from measurements of all isotopes of oxygen (^{16}O, ^{17}O, ^{18}O) and sulfur (^{32}S, ^{33}S, ^{34}S, ^{36}S) to gain insight into processes that cannot be obtained by measurement of only the most abundant isotopes of these elements (^{16}O, ^{18}O, ^{32}S, ^{34}S) which is the most common approach presently used by geochemists. The additional information is often related to the role of atmospheric chemistry in present and past environments, but it can also be related to understanding the movement (fluxes) of materials between different reservoirs. Dr. Farquhar and his research group comprise one of only a handful of labs who are exploring their uses.

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