23rd Annual MARYLAND GROUNDWATER SYMPOSIUM

MDE

Session Guidebook

Wednesday, September 24, 2014

Sponsored by the Water Supply Program

Dear Participants:

MDE's Water Supply Program welcomes you to the 23rd annual Maryland Groundwater Symposium. Since the first symposium was first held in 1992, this event has continued to grow, with about 450 attendees this year. We are fortunate to again have an impressive cadre of presenters, representing all levels of government, the academic community, and the private sector. This year we have a very diverse agenda, ranging from public health protection to controlling waste, managing water quantities, understanding the physics of groundwater flow and developing sound policies.

We are pleased that the Environmental Protection Agency Region III Drinking Water Branch continues to support our efforts. In addition, without your support, this program would not have survived. We appreciate your continued interest in the latest developments in groundwater science and policy. We hope you will enjoy today's presentations, and find the symposium a worthwhile event.

Saeid Kasraei
Program Administrator
Water Supply Program

Remember to recycle your
plastic cups and cup holders,
as well as this program and
any other materials you receive today.

SYMPOSIUM AGENDA

Morning Plenary: Embassy Room

9 - 9:15 a.m.	**Welcome and Opening Remarks**
9:15 - 9:45 a.m.	**Keynote Address – Robert M. Summers, Ph.D., Secretary, Maryland Department of the Environment**
9:45 - 10:15 a.m.	**Local Environmental Health – Mark Williams, Conference of Environmental Health Directors**
10:15 - 10:45 a.m.	**The Future in Water Availability Science at the USGS** **Eric J. Evenson, Water Program Office, U.S. Geological Survey**

Break | 10:45 – 11:05 a.m.

Morning Session One | 11:05 – 11:35 a.m.

Groundwater Availability in the Appalachian Plateaus
Kurt J. McCoy, U.S. Geological Survey
Maryland Room

Lead and Hexavalent Chromium Groundwater Investigation, Green Valley, Monrovia, Frederick County, Maryland
Christopher H. Ralston, Maryland Department of the Environment
Wayne Room

MiniMBR™… Finally, an Affordable and Energy Efficient MBR (membrane bio-reactor) Treatment Process for Small Flows
Robert Kershner, Kershner Environmental Technologies, LLC
Embassy Room

Innovative Agricultural Practices to Mitigate Groundwater Nutrient Contamination
Jason Keppler, Maryland Department of Agriculture
Regency Room

Morning Session Two | 11:45 a.m. - 12:15 p.m.

Patuxent Aquifer Test Drilling in the Waldorf Area, Charles County, Maryland
Andrew Staley, Maryland Geological Survey
Maryland Room

Stormwater Management Basins and Road Salt Loading to Groundwater in Baltimore County
Joel Moore, Ph.D., Towson University
Wayne Room

Tricks of the Trade: Remediating Failing Septic Systems
Richard Piluk, Anne Arundel County Department of Health
Embassy Room

Sewage Sludge Management Update
Allison Marong, Maryland Department of the Environment
Regency Room

Lunch | 12:15 - 1:30 p.m.

Afternoon Session One | 1:30 – 2 p.m.

The Role Hydrology will Play in Stabilizing Afghanistan
Christopher A. Gellasch, Ph.D., Uniformed Services University of the Health Sciences
Maryland Room

Overview of Groundwater Quality for Maryland, Delaware and the District of Columbia
Brandon Fleming, U.S. Geological Survey
Wayne Room

The Chesapeake Water and Septic Homeowner Education (WaterSHEd) Project
Daphne Pee, University of Maryland
Embassy Room

Animal Feeding Program Update
Gary F. Kelman, MS, CEP, Maryland Department of the Environment
Regency Room

Afternoon Session Two | 2:05 – 2:35 p.m.

Lessons from Development of Source Water Protection Plans, Central Maryland (2012-2014)
Harvey A. Cohen, Ph.D., P.G., S. S. Papadopulos and Associates
Maryland Room

Software Enabled Stakeholder Engagement: Contamination Monitoring and Clean-Up
Timothy Seiple, Pacific Northwest National Laboratory
Wayne Room

Cooperative Efforts to Address Nitrogen in the Chesapeake Bay Watershed
Jay Prager, Maryland Department of the Environment
Embassy Room

Base Flow Discharge to Streams and Rivers: Terminology, Concepts, and Base-flow Estimation Using Optimal Hydrograph Separation
Jeff P. Raffensperger, Ph.D., U.S. Geological Survey
Regency Room

Break | 2:35 – 2:50 p.m.

Afternoon Session Three | 2:50 – 3:20 p.m.

Maryland Water Appropriation and Use Permits - Evaluation Data, Tools and Methods
Sam Glover and Mahmoud Mahmoud, Maryland Department of the Environment
Maryland Room

Incorporating Groundwater Quality Data from Multiple Data Sets into a GIS-Based Format: The Garrett County Experience
Heather Quinn, Maryland Geological Survey
Wayne Room

Bay Restoration Fund Moving into the Future
Joshua Flatley, Maryland Department of the Environment
Embassy Room

Model Development for Three-Dimensional Land Movement Simulation due to Groundwater Pumping from an Aquifer System
Dong Hee Kang, Ph.D., P.E., Morgan State University
Regency Room

Afternoon Session Four | 3:25 – 3:55 p.m.

Fracking a Municipal Supply Well: An Unexpected Success Story from the Maryland Piedmont
Mark W. Eisner, P.G., Advanced Land and Water, Inc.
Maryland Room

No Presentation
Wayne Room

The Transient Water System Sanitary Survey "What are we looking for?"
Travis E. Sterner, Maryland Department of the Environment
Embassy Room

Master Watershed Stewards: Recharging Maryland's Aquifers – One BMP at a Time.
Terry R. Matthews, M.S., Charis Communications Counselors, Inc. and Howard County's Watershed Stewards Academy
Regency Room

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ABSTRACTS OF PRESENTATIONS

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MORNING SESSION ONE
11:05 – 11:35 a.m.

Groundwater Availability in the Appalachian Plateaus

Kurt J. McCoy
U.S. Geological Survey
Maryland Room

The U.S. Geological Survey's Groundwater Resources Program is conducting an assessment of groundwater availability throughout the United States to gain a better understanding of the status of the Nation's groundwater resources and how changes in land use, water use, and climate may affect those resources. The Appalachian Plateaus groundwater availability study has recently been initiated to quantify current groundwater resources in Permian-, Pennsylvanian-, and Mississippian-age aquifers from Alabama to New York. The study will evaluate how regional groundwater budgets have changed over time, and provide the foundational groundwater-related datasets to support other Federal and State water-resource investigations. The intent of the study is to improve datasets for adaptive management of drinking-water resources, aquatic ecosystems, and continued energy resource development in the region. A better understanding of groundwater availability in the Appalachian Plateaus thus plays a central role in sustained economic development of the region.

Lead and Hexavalent Chromium Groundwater Investigation, Green Valley, Monrovia, Frederick County, Maryland

Christopher H. Ralston
Maryland Department of the Environment
Wayne Room

In May 2014, the MDE published the following report, REPORT OF RESULTS FOR LEAD AND HEXAVALENT CHROMIUM GROUNDWATER INVESTIGATION, Green Valley / Monrovia, Frederick County, Maryland. This presentation will highlight the study and report findings, as well as present specific recommendations to water supply professionals. A synopsis follows:

Since 2005, the MDE has been investigating and overseeing the cleanup of petroleum contamination in the groundwater in the vicinity of the former Green Valley Citgo Station and the Green Valley Plaza in Monrovia, Maryland. Petroleum contamination in groundwater, including MTBE, was found to be impacting six residential supply wells located down-gradient of the GVC Station as well as several commercial supply wells in the immediate vicinity of the GVC Station. Several interim measures were taken by the responsible party, including installation and maintenance of granulated activated carbon filtration systems for impacted supply wells, and removal of underground storage tanks. In 2011, the RP began operation of an in-situ chemical oxidation remediation system to address remaining MTBE.

In 2012, some residents of the Monrovia community raised concerns that they thought the ISCO system had contaminated supply wells with elevated levels of hexavalent chromium and lead. In response to these concerns, the ISCO system was turned off and the MDE conducted an investigation that addressed the following concerns: (a) whether concentrations of hexavalent chromium and/or lead were above health or regulatory standards used by MDE, such that there may be a public health risk warranting regulatory action; (b) whether detections of these metals in wells were connected to the operation of the ISCO system; (c) whether these metals are naturally-occurring in groundwater or originate from plumbing materials; and (d) whether subsurface water quality conditions, such as pH, are contributing factors in the presence of these metals in water. To address these concerns, between October 2012 and July 2013, samples from 25 residences and the on-site monitoring well network were collected. Samples were collected from point-of-use locations (e.g. a kitchen faucet), as well as at various locations throughout the plumbing of several homes to try to identify the source of elevated lead concentrations.

The investigation concluded that as designed the ISCO system had a highly-localized impact. Also, the detections of lead and hexavalent chromium in residential drinking water samples were not related to the operation of the ISCO system.

MiniMBR™…Finally, an Affordable and Energy Efficient MBR Treatment Process for Small Flows

Robert Kershner
Kershner Environmental Technologies, LLC
Embassy Room

Schools, campgrounds, small commercial buildings and cluster subdivisions typically produce low volumes (< 3,000 gallons) of sanitary wastewater each day. Most of these systems have historically relied on age-old septic treatment technology to deal with sewage prior to sub-surface effluent disposal. Given new groundwater nutrient limitations and a push in some regions for water recycling, many wastewater technology companies have entered the market of small advanced treatment processes. As with most treatment concepts, economies of scale often dictate the viability of a process for any given application.

The MBR (membrane bio-reactor) process has become widely accepted as a proven and reliable technology for low flows but at a high cost and with significant power requirements and operational and mechanical complexity. This presentation will introduce the first MBR process (MiniMBR™) that has been engineered to address the economies of scale specifically for these very small systems. Developed and manufactured in Reisterstown, Maryland, this new concept in MBR plant design operates with low energy consumption, full automation and can be installed at a price that is competitive with or less than other aerobic treatment technologies that may not be able to reliably meet the effluent treatment limitations required for high level nutrient removal or water recycling and re-use.

Innovative Agricultural Practices to Mitigate Groundwater Nutrient Contamination

Jason Keppler
Maryland Department of Agriculture
Regency Room

To help mitigate the impacts of agricultural nutrient and sediment loading to local waterways and the Chesapeake Bay, traditional agriculture best management practices (BMPs) such as cover crops and conservation tillage have been effective in managing surface runoff from cropland. Recent studies of nutrient delivery pathways on Maryland's Eastern Shore have shown that up to 70% of the nitrogen and phosphorus is entering waterways through groundwater discharge. As a result, the Maryland Department of Agriculture is collaborating on innovative pollution remediation strategies that help address agricultural groundwater nutrient issues.

The Maryland Department of Agriculture, in collaboration with the University of Maryland, College of Agriculture, local Soil Conservation Districts, the Natural Resource Conservation Service (NRCS), Oklahoma State University, the USDA Agricultural Research Service and the Midshore Riverkeeper Conservancy, have been researching and demonstrating three innovative agricultural management practices on the Eastern Shore which have the potential for wide-scale adoption throughout the agricultural community.

Water control structures are highly effective in reducing nitrogen in drainage ditches. These structures utilize flash boards or risers which effectively retain drainage. This process results in an anoxic environment which promotes denitrification. In addition, by retaining water during the height of the growing season, improved crop root development and yields are likely during dry years. The system also reduces flashiness during storm events, further reducing sediment loads.

With the introduction of the new Phosphorous Management Tool (PMT) in Maryland, many farmers are concerned about their ability to continue to utilize manure as a nutrient source when crop fields are phosphorus limited. Over the past seven years, the University of Maryland has been conducting field scale research using Phosphorus Sorbing Materials (PSMs) as a mechanism to reduce phosphorous loads. Iron slag or calcium rich materials such as gypsum are highly reactive to dissolve phosphorous and initial results have shown a 70% reduction potential. The adoption of PSMs offer a potential solution to farmers that may be constrained by phosphorus limited fields.

With the prevalence of large scale use of drainage tile on the Eastern Shore, there is an increased risk of nitrate leaching into groundwater. An innovative design using wood chips as a bioreactor offers a potential solution to efficiently remove nitrate from drainage waters. This practice is relatively inexpensive and are generally located at the edge of field, thus cropland is not taken out of production. Essentially a trench is excavated at the outfall of a drainage tile, filled with woodchips and covered. An anaerobic environment is created within the trench whereby wood chips provide a carbon source for denitrifying bacteria. Remediation potential of up to 95% for nitrogen has been demonstrated.

MORNING SESSION TWO
11:45 a.m. – 12:15 p.m.

Patuxent Aquifer Test Drilling in the Waldorf Area, Charles County, Maryland
Andrew Staley
Maryland Geological Survey
Maryland Room

Public water in Charles County Maryland is supplied primarily by groundwater from the Magothy, Upper Patapsco, Lower Patapsco, and Patuxent aquifers. In recent years, increasing population in the County has created an ever larger demand on the aquifers and water-levels have declined as much as 3 to 4 ft per year. In the early 1980's, water-levels in the Magothy aquifer in the Waldorf area declined to the point where management restrictions had to be implemented by the Maryland Department of the Environment (MDE). More recently in 2007, water-level declines in the Lower Patapsco aquifer in the Bryans Road area necessitated additional management restrictions by MDE.

Previous ground-water flow and optimization modeling had identified the Patuxent aquifer (the deepest aquifer in the County) as having the potential to handle an increased supply while taking stress off of the shallower aquifers. Existing information on the Patuxent aquifer was mainly available from the up-dip area at Indian Head and Bryans Road in the western portion of the County, but very little information was available concerning its hydraulic characteristics and water-supply potential in the north-central portion (Waldorf area) of the County.

In 2013, the Maryland Geological Survey, in cooperation with the Charles County Department of Planning and Growth Management, drilled four deep Patuxent aquifer test wells in the Waldorf area to better define the aquifer's thickness, extent, and hydraulic properties near existing infrastructure in this area. The test wells were drilled to basement crystalline rock and ranged in depth from 1441 to 2120 feet. The test wells were sampled for water quality, and continuous water-levels were recorded to determine short-term trends. This talk will present data collected during this project with further discussion of water-supply challenges in this region.

Stormwater Management Basins and Road Salt Loading to Groundwater in Baltimore County

Joel Moore, Ph.D.
Towson University
Wayne Room

Over the last two decades, the research and environmental communities have become increasingly aware that road salt is impacting soil, groundwater, and stream chemistry. Stream chemistry has been the focus of most road salt research with many studies documenting that chloride and sodium concentrations in streams have increased to several times background concentrations in rural streams and to orders of magnitude over background in urban and suburban streams. To date, less work has been done on road salt loading to groundwater, and in particular, the role that stormwater management basins (SMBs) play in directing road salt runoff into groundwater and streams. SMBs are a best practice management tool used to direct runoff from impervious surfaces into groundwater rather than directly into streams. SMBs are typically installed with the goals of reducing the hydrological flashiness of urban/suburban streams and of reducing nutrient loading.

Over several years, a suburban site northwest of Baltimore that contains secondary and tertiary roads, relatively dense row/townhome development, and two SMBs has been studied to determine road salt effects on soil, groundwater, and stream chemistry. Water and soil/aquifer samples were collected from the SMBs, from a shallow groundwater aquifer down gradient of the SMBs, and from a second-order stream into which the groundwater flows. For the winter of 2013–14, chloride and sodium concentrations increased from summer to winter and then decreased again in spring in groundwater below the SMBs, in the groundwater aquifer, and in the stream. In groundwater below the SMBs, chloride and sodium concentrations exceeded the EPA secondary limit year-round and approached seawater concentrations. In the groundwater aquifer, average chloride and sodium concentrations were nearly 200 times higher than background concentrations for groundwater in a nearby watershed and were above the EPA secondary limit for most of the year in wells near the SMBs and above the limit for part of the year in wells farther down gradient from the SMBs. Flow of water high in chloride and sodium through the soil/aquifer matrix altered soil chemistry. Soil pH values in areas affected by road salt were 5.5–7 as compared to background values of 4–4.5, and the percentage of sodium in the cation exchange complex was as much as 40% as compared to background values of 0%. Alteration of soil/aquifer matrix chemistry means that impacts of road salt on this system will continue for years even if salt application is reduced or stopped. In the stream, average chloride and sodium concentrations were ~125 times higher than background concentrations and exceeded the EPA secondary limit for most of the winter. Work done elsewhere in this watershed demonstrated that chloride and sodium concentrations throughout the year were higher in sub-watersheds containing SMBs than those without, which suggests that loading of road salt into groundwater resulted in a year-round impact on stream chemistry. Thus to fully understand the long-term effects of road salt runoff, groundwater chemistry must be studied given the importance of baseflow contributions to streamflow, particularly in the summer and fall.

Tricks of the Trade: Remediating Failing Septic Systems

Richard Piluk
Anne Arundel County Department of Health
Embassy Room

All too often failing septic systems are replaced with new systems without consideration of the cause of failure of the existing system. The presentation will show many examples of failing systems and what was done to correct the systems without having to install new systems. Some innovative designs for new drain fields will also be shown.

Sewage Sludge Management Update

Allison Marong
Maryland Department of the Environment
Regency Room

The Maryland Department of the Environment's sewage sludge management regulations were originally promulgated in 1986, and had been largely unchanged since that time. The Department worked with the State Biosolids (Sewage Sludge) Task Force and stakeholders to complete a full rewrite of these regulations. These new regulations went into effect on May 26, 2014. The changes are designed to incorporate elements of the US Environmental Protection Agency (EPA) 40 CFR Part 503 Regulations and incorporate the updated Maryland Department of Agriculture (MDA) nutrient management requirements for application of sewage sludge on agricultural land. The changes are also designed to streamline and clarify the permitting process with the ultimate goal of protecting public health and the environment, including the surface and groundwater of the State. Allison Marong, Head of the Sewage Sludge Utilization Section for MDE will provide an update on some of the changes the new regulations will have on the management of sewage sludge.

AFTERNOON SESSION ONE
1:30 – 2:00 p.m.

The Role Hydrology will Play in Stabilizing Afghanistan

Christopher A. Gellasch, Ph.D.
Uniformed Services University of the Health Sciences
Maryland Room

Afghanistan is a mountainous, arid country with limited surface water supplies. The complex geology of this country includes active tectonics and mountain ranges with many fault-controlled valleys. Decades of conflict have limited field studies that will improve the understanding of this geology. Afghanistan is subdivided into three distinct hydrogeological areas: the Central Highlands, the Northern Plain, and the Great Southern Plain. Most groundwater is located in the Central Highlands, where water of sufficient quantity to meet the needs of the population was historically accessed through underground karez systems. More recently, groundwater has been accessed primarily by drilling wells into unconsolidated alluvial aquifers located in mountain valleys and basins. These new wells have greatly increased the amount of water available for domestic and agricultural uses but the aquifers receive limited amounts of recharge.

Water is a key factor in improving the living conditions in Afghanistan. A lack of sustainable, high-quality water supplies can have a negative impact on the ability of military forces to conduct operations to help stabilize the country. This same scarcity of potable water can have a negative impact on the local population and a majority of Afghans do not have access to clean drinking water. Efforts to drill larger and deeper wells in order to access more groundwater may be counterproductive in the long run as aquifers quickly become depleted. Laws related to groundwater usage and aquifer protection either do not exist, are decades out of date, or are not properly enforced. An understanding of hydrogeological conditions in Afghanistan is required in order to minimize exposures to natural and anthropogenic sources of contamination that may pose either acute or chronic health risks. Sustainable projects that improve the quantity and quality of water available to both military forces and the local population are important to long term stability of Afghanistan.

The opinions expressed herein are those of the author, and are not necessarily representative of those of the Uniformed Services University of the Health Sciences, the Department of Defense, or the United States Army.

Overview of Groundwater Quality for Maryland, Delaware and the District of Columbia

Brandon Fleming
U.S. Geological Survey
Wayne Room

Groundwater in Maryland, Delaware, the District of Columbia, and surrounding states has been sampled and analyzed for water quality for decades. Many groundwater-quality sampling efforts were conducted to answer specific questions, and the design of a given network of wells depends on factors including spatial scale, constituents of concern, and availability of resources. Over the years, results of these monitoring efforts by the U.S. Geological Survey (USGS) and many partner agencies have been stored in the USGS National Water Information System (NWIS) through the USGS MD-DE-DC Water Science Center (WSC) local NWIS database. These data, quality assured by the MD-DE-DC WSC, consist of more than five hundred thousand groundwater-quality results from over five thousand wells. Ninety percent of these results were collected after 1980. This large amount of data provides an opportunity for water resource managers to address issues that are often beyond the scope of a single data collection effort.

This presentation will provide a summary of groundwater-quality information currently available from the locally maintained NWIS database. Additionally, an overview of several current USGS groundwater-quality monitoring efforts in the region will be discussed. Time-series plots and maps of the spatial extent of selected water-quality constituents at various scales will be presented to demonstrate the potential data mining applications that can provide insight into current water-resource issues.

The Chesapeake Water and Septic Homeowner Education (WaterSHEd) Project

Daphne Pee
Univeristy of Maryland
Embassy Room

The Chesapeake Water and Septic Homeowner Education (WaterSHEd) Project is a joint University of Maryland Extension and School of Public Health effort designed to teach homeowners how to protect their drinking water, manage their water and septic systems, and prevent groundwater contamination and surface water pollution. Since homeowners must act as their own water and wastewater treatment managers, little is known about how they maintain their private drinking water and septic systems.

To better understand how these homeowners are managing their systems and provide them with needed information, the Chesapeake WaterSHEd project has offered free Safe Drinking Water and Septic System Management clinics. To date, five clinics have been held in four counties. Each clinic has included three components: 1) Testing the homeowners' drinking water for total coliform bacteria, fecal coliform bacteria, E. coli, Enterococcus spp., pH, total dissolved solids, nitrates, sulfates, and arsenic; 2) Assessing the homeowners' knowledge, behavior, and needs relating to their private wells and septic systems; and 3) Educating homeowners on proper maintenance of their well and septic systems. With approximately 150 attendees, the project team has amassed a great deal of private drinking water quality and behavioral data from across the state. The project team is currently in the process of analyzing the water quality and survey data. Additionally, the team has initiated follow-up surveys to assess whether homeowners actually conducted the management practices that they said they intended to do. This presentation will address the project's goals, methodology, findings, resulting impacts, and future efforts.

Animal Feeding Program Update

Gary F. Kelman, MS, CEP
Maryland Department of the Environment
Regency Room

The Maryland Department of the Environment (MDE) began regulating concentrated animal feeding operations in 1996 by issuing the first General Discharge Permit for Animal Feeding Operations. There were a total of seven AFOs covered by that permit, mostly dairy cattle, beef cattle and swine operations. The US Environmental Protection Agency (EPA) revised their regulations to include poultry operations in 2003. After challenges from both environmentalists and organizations representing animal producers, EPA issued its regulations in 2008. MDE's Water Management Administration revised COMAR to comply with the revised Federal regulations and drafted the current General Permit for Animal Feeding Operations. MDE's AFO regulations and permit were approved in 2009. EPA approved MDE's revised Animal Feeding Operation Program in 2010. The program was transferred to MDE's Land Management Administration (LMA) on July 1, 2009. LMA issued the 5-year combination National Pollutant Discharge Elimination System (NPDES) and State Discharge Permit as a General Permit with an effective date of December 1, 2009. This permit regulates the discharge to surface water (CAFO/MAFO) and to groundwater (MAFO). Over 600 AFOs have applied for coverage, mostly poultry, but also dairy cattle, beef cattle, ducks, horses and swine operations. MDE is in the process of drafting the renewal of the AFO Permit and has also learned much about implementing this program. Gary Kelman, Head of the AFO Section for MDE will focus on these aspects of the AFO Program and will also provide an update.

AFTERNOON SESSION TWO
2:05 – 2:35 p.m.

Lessons from Development of Source Water Protection Plans, Central Maryland (2012-2014)
Harvey A. Cohen, Ph.D., P.G.
S. S. Papadopulos and Associates
Maryland Room

From 2012 to 2014, S.S. Papadopulos & Associates, together with Chesapeake Environmental Management completed, Source Water Protection Plans (SWPP) for eight public water systems (PWS) in central Maryland, on behalf of MDE's Water Supply Program. The populations served by these PWS range from about 1,200 to 190,000 in Frederick, Carroll, Harford, Cecil, and Anne Arundel Counties. These setting of these PWS ranged from small towns (Thurmont, Woodsboro) to county seats (Westminster, Elkton, Bel Air) and suburban, unincorporated areas (Fountaindale in Frederick County and Glen Burnie in Anne Arundel County). Completion of the Source Water Protection Plans included updating of existing Source Water Assessment Areas (SWAAs), development of system-specific recommendations for source water protection, and working with the PWS owner/operators to refine recommendations, costs, and schedules for implementation.

All eight of these systems derive their water supply from wells, with half also using surface water. None of the PWS had implemented contingency plans specific to source water issues. Existing Emergency Operations Plans and Hazard Management Plans already in place for some municipalities could, however, be modified to suit PWS-specific needs. For all eight systems, recommendations were made for either implementation of a new Wellhead Protection Ordinance (WHPOs) or modifications to an existing WHPO. PWS concerns regarding these WHPOs varied. Some towns had specific concerns about the overlay between SWAAs and existing development districts. Some PWS preferred an overall approach that focused on BMPs, rather than prohibited land uses. Finally, there was discussion over whether the best option for some PWS was implementation of a full-scale WHPO, or legislative adoption of a BMP water manual that could be updated more easily over time. We found two significant obstacles for protecting water supplies that could be addressed in future: 1) limited coordination between county and local governments, particularly when watersheds serving the community are outside town boundaries, and 2) the lack of resources available, particularly to small systems.

Software Enabled Stakeholder Engagement: Contamination Monitoring and Clean-Up

Timothy Seiple
Pacific Northwest National Laboratory
Wayne Room

What does a large federal groundwater clean-up project like the U.S. Department of Energy's (DOE) Hanford Site in Washington State have in common with a regional watershed restoration effort like the Chesapeake Bay?

Both address dynamic, complex environmental issues subject to a variety of laws that present myriad cross-disciplinary problems impacting multiple stakeholders, who enumerate multiple technical objectives, the study and implementation of which generate vast amounts of data that help re-characterize the issues and monitor progress over time, often decades.

Much of the data, documentation, and records of decision are often distributed across an intricate web of contractors and agencies that evolve around such projects, each with their own isolated networks and data management systems. These fractured data and software ecosystems pose severe challenges for stakeholders (including regulators), who are trying to access and compile data to perform independent oversight to ensure their interests are represented, certify laws are being followed, and verify milestones are being met.

DOE has partnered with the Pacific Northwest National Laboratory (PNNL) on the PHOENIX (PNNL-Hanford Online Environmental Information System) project, which seeks to address these very data access, transparency, and integration challenges at Hanford. A major thrust of this project is to ensure stakeholders have equal access to current information to afford them equal opportunity to participate in regulatory process and to influence outcomes.

PHOENIX is a family of spatially-enabled web applications providing quick access to decades of valuable scientific data and insight through intuitive query, visualization, and analysis tools. PHOENIX is being used to streamline investigative and analytical processes at Hanford, saving time and money, broadening participation in the clean-up process, and helping to discover new correlations hidden in disparate legacy data.

Currently, PHOENIX provides applications addressing the following stakeholder needs

- Performance reporting
- Data query and browsing
- Near-real time analysis
- Reduced scale modeling

This presentation will demonstrate web-based software applications in each software category and briefly discuss the substantive impacts that each has had on the Hanford community, as an analog for enhancing stakeholder engagement for the Chesapeake Bay community.

Cooperative Efforts to Address Nitrogen in the Chesapeake Bay Watershed

Jay Prager
Maryland Department of the Environment
Embassy Room

The Chesapeake Bay is the largest estuary in the United States and one of the largest and most biologically productive estuaries in the world. Despite significant efforts by federal, state, and local governments, water quality standards have not been met. Pollutants largely responsible for impairment of the Bay are nitrogen, phosphorus, and sediment. The United States Environmental Protection Agency (EPA), in coordination with the Bay watershed jurisdictions of Maryland, Virginia, Pennsylvania, Delaware, West Virginia, New York, and the District of Columbia (DC) established a nutrient and sediment pollution diet for the Bay known as the Chesapeake Bay Total Maximum Daily Load (TMDL). Efforts to reduce the nitrogen discharged to the Chesapeake Bay from on-site sewage disposal systems will be examined. Nitrogen loading rates and best management practices will be presented specific to the State of Maryland as well as for the multi-state watershed.

Base Flow Discharge to Streams and Rivers: Terminology, Concepts, and Base-flow Estimation Using Optimal Hydrograph Separation

Jeff P. Raffensperger, Ph.D.
U.S. Geological Survey
Regency Room

A reliable supply of freshwater is critical for sustaining human populations as well as ecosystem needs. One component of freshwater resources that contributes large volumes of water to stream discharge, but that is difficult to measure, is base flow. Quantitative estimates of base flow are necessary to address questions of the vulnerability and response of aquatic ecosystems to natural and human-induced change in environmental conditions. For the purposes of this talk, and considering two scales of analysis (reach and watershed), a distinction is made between groundwater discharge (flux of water from the saturated groundwater system to a stream reach) and base flow (estimated using streamflow and other data at a measurement site or gage at the watershed scale). There are several important differences between groundwater discharge and base flow: 1) because groundwater discharge is difficult to measure, it is more likely than base flow to be estimated from a model output or from some other analysis; 2) in addition to non-event groundwater discharge, base flow includes other anthropogenic sources of water (such as water treatment plant effluent), whereas groundwater discharge does not (with the possible exception of irrigation). Base flow is generally not measured directly, but is estimated from observations of streamflow and/or stream water chemistry. Hydrograph separation methods used to estimate base flow may be classified as: 1) Graphical Hydrograph Separation (GHS) methods, which are based on older graphical techniques for delineating base flow and quickflow; 2) analytical methods, such as Recursive Digital Filter (RDF) methods, which use time series analysis with one or more adjustable parameters and a recursive (backward time step) formula to estimate base flow; and 3) Chemical Mass Budget (CMB) methods, which use measured concentrations or isotopic ratios of end members (typically precipitation and non-event groundwater discharge) and apply conservation of mass to the water and chemicals to estimate base flow and quickflow.

Eckhardt (2005, How to construct recursive digital filters for base-flow separation: Hydrological Processes, v. 19, no. 2, p. 507-515) proposed an RDF to estimate base flow that has two parameters: a recession constant (alpha) and a maximum base-flow index (beta). The recession constant can be estimated using a variety of approaches that use streamflow during time periods when groundwater recharge is not occurring. In this study, beta is estimated, or optimized, using observed discrete or continuous specific conductance (SC) data, and a time-varying base-flow SC value; quickflow SC and other parameters are estimated through the optimization. The method satisfies both water and chemical mass balances, and has a physical basis (the recession constant, alpha); it has been applied to select watersheds in Maryland and throughout the Chesapeake Bay watershed. The results of this study will be used to further several National Water-Quality Assessment goals related to understanding lag times for nitrate transport to streams in the subsurface, and to assist in development of dynamic and base-flow SPARROW (Spatially Referenced Regression on Watershed Attributes) models.

AFTERNOON SESSION THREE
2:50 – 3:20 p.m.

Maryland Water Appropriation and Use Permits – Evaluation Data, Tools and Methods

Sam Glover and Mahmoud Mahmoud
Maryland Department of the Environment
Maryland Room

Water users in Maryland who wish to use more than 5,000 gallons of groundwater per day on an annual average basis, or any amount of surface water are required to apply for a permit. Some water uses, such as firefighting and small agricultural uses of less than 10,000 gallons per day (gpd) are exempt. The application process for water use permits sometimes takes from a few weeks to over a year to complete depending on many factors such as the use of the water, the source, the quantity and the location of the source in the State.

The State geologist or engineer must evaluate each and every water use permit application to ensure that the use is compliant with State laws, is reasonable, and does not adversely impact the resource or other users of the resource. Evaluation of a State of Maryland Water Appropriation and Use permit application involves gathering data from many sources such as the MDE Water Management Administration databases, the USGS, the MGS, the DNR, NOAA-NCDC and many other national scientific databases.

Based on the adage that a picture is worth a thousand words, MDE Water Supply Program staff has compiled a series of images to present a visual explanation of the data sources, tools and methods used in the permit evaluation process to arrive at permit decisions. The presentation consists of three main components.

1. The types of data that are used in a permit evaluation.
2. What the data represents and
3. How the data is used in the evaluation.

The images presented cover a broad spectrum of permit application evaluation tools and resources such as maps, scientific drawings, data plots, diagrams and other illustrations that are used to evaluate a groundwater or surface water permit application.

At the end of this presentation, the audience may realize why there are no shortcuts to obtaining a water appropriation and use permit and why the process takes longer than expected for some applicants.

Incorporating Groundwater Quality Data from Multiple Data Sets into a GIS-Based Format: The Garrett County Experience

Heather Quinn
Maryland Geological Survey
Wayne Room

The potential development of natural gas reserves of the Marcellus Shale in western Maryland has raised concerns about future groundwater contamination in the region. To identify future change, it is necessary to acquire and/or compile data on current conditions. To address this issue, the Maryland Geological Survey (MGS) recently completed a compilation and review of existing water quality data (drinking water sources) in Garrett County, Maryland. The compilation focused primarily on groundwater from wells but also included some drinking water sources from springs and surface water where available. The work was conducted in cooperation with the Garrett County Health Department and the Maryland Department of the Environment Water Supply Program. Data were acquired those two agencies as well as the MGS and the U.S. Geological Survey.

The data were compiled into a geographic information system (GIS) using ESRI's ArcGIS software to allow for geospatial review of the distribution of the data across the county in relation to geologic units as well as other features. Four parameters—arsenic, chloride, manganese and radon—were selected for a more focused review and analysis by both GIS and statistical methods. The study identified some data gaps and issues warranting further study, as well as some intriguing correlations. Arsenic concentrations, for example, exceeded primary drinking water standards in approximately 7 percent of the sample sites, yet exceedances were not evenly distributed across all geologic units. Approximately 20 percent of sample sites in the Hampshire Formation exceeded the arsenic Maximum Contaminant Level (MCL) of 0.010 mg/l, whereas exceedance rates in other geologic formations were less than 8 percent. The study also identified some database components where relatively modest changes to sampling documentation and database parameters could improve data comparability between the data sets of the different agencies. Compilation of county water-quality data into a geospatial format can help Health Departments and other agencies identify where additional testing is warranted for specific water-quality constituents. Lack of information on sample collection, analytical procedures and reporting levels limits the amount of interpretation possible on the combined data set.

Bay Restoration Fund Moving into the Future

Joshua Flatley
Maryland Department of the Environment
Embassy Room

The Bay Restoration Fund and the Waste Water Permits Program of MDE have been working on the creation of an online database system that will encompass the reporting and installations of BAT systems in Maryland. Through this database system, manufacturer representatives, operation and maintenance providers, local county jurisdictions and State level regulators will be able to monitor and track the BAT systems for compliance and proper operation. Right now, this database system is still in beta testing phase but is becoming closer to final unveil. This presentation is going to identify the steps included in working with the database system as well as examples of system capabilities.

Model Development for Three-Dimensional Land Movement Simulation due to Groundwater Pumping from an Aquifer System

Dong Hee Kang, Ph.D., P.E.
Morgan State University
Regency Room

Groundwater withdrawal from an aquifer system or discharge other fluids (oil or gas) from any geologic formation (e.g., shale) causes land subsidence and earth fissures. Land movement due to groundwater withdrawal is getting worse and worse due to increasing demand of water use and limited resources of freshwater, particularly in developing area. Hydraulic fracturing used in natural gas wells injects millions of gallons of water, sand and chemicals at high pressure into a wellbore to create small fractures and release the gas. Therefore, hydraulic fracturing also may cause many water-related pollution events may lead to land subsidence by lowering the reservoir pore pressure by removal considerable large volumes of fluid like groundwater.

Over the past decades, many experts have attempted to develop modules to evaluate transient land subsidence accurately and efficiently by making use of the MODFLOW, a program developed by USGS for simulation of groundwater flow. Developed modules established by previous investigators such as MODFLOW were only able to deal with the vertical displacement (subsidence). In the present research, a new package is developed not only for three-dimensional (3-D) movement in response to groundwater withdrawal from an aquifer system but also for a specific storage coefficient that is stress or hydraulic head dependent.

Zhang (2009) developed a module (DIS) embedded to a preexisting version MODFLOW-96 to simulate the 3-D transient land movement. Zhang's module is inherently a linear elastic model as the MODFLOW assumes that the specific storage coefficient is a constant. In reality, the specific storage normally is not a constant and related to stress history instead. Using a constant storage coefficient may result in inaccurate prediction of aquifer movement. Therefore, the stress-dependent or hydraulic head-dependent specific storage coefficient was applied to a new module which is based on a mechanics model simulating nonlinear stress-strain relationship of soils. The module for material nonlinearity using an exponential model was first developed and incorporated into the MODFLOW-96 by Li and Ding (2013). However, the volume compression simulated by the exponential model can be kept going forever as long as loading increases. In reality, this is not true as the volume of soil mass cannot be compressed to zero due to conservation of mass. Therefore, Kang and Li (2014) proposed a new hyperbolic relation between bulk stress and strain in this investigation.

The purpose of this research is to investigate impacts of the new nonlinear hyperbolic model on the land movement in response to groundwater discharge. To do so, first to establish a conceptual model of an aquifer system with a fully penetrating pumping well, then to develop a numerical model for simulating aquifer movement impelled by hydraulic force, and finally to evaluate the two nonlinear stress-strain models (Note: the research led by Dr. J. Li, S. P. Massie Chair of Excellence under DOE grant #: DE-NA0000720)

AFTERNOON SESSION FOUR
3:25 – 3:55 p.m.

Fracking a Municipal Supply Well: An Unexpected Success Story from the Maryland Piedmont

Mark W. Eisner, P.G.
Advanced Land and Water, Inc.
Maryland Room

Hydraulic Fracturing (i.e. "fracking") has been used for years to increase the apparent yield of low-capacity domestic supply wells completed in tight bedrock formations. Most commonly this is done to overcome regulatory minimum yield requirements for domestic supply wells. A well with a blown yield less than one gallon per minute might be fracked and found then to possess a yield slightly in excess of the minimum threshold for approvability.

Many hydrogeologists typically had been skeptical regarding the capability for water well fracking to enhance the true long-term sustainable yield of a bedrock supply. Fracking often was seen as a "tricky" technique to overcome a regulatory standard more than as a means to achieve true, long-term capacity improvement. Fracking simply was not trusted by many in the hydrogeological profession as a means for enhancing the true, long-term sustainable yield of water supply wells.

Despite these considerable doubts, in the throes of the regional and severe drought of 2002, a Maryland municipality undertook a fracking approach to improve the long-term sustainable yield of a recently drilled and tested supply well. The program involved a classical 72-hour constant-rate test, a specialized fracking program (involving more pressure and more control than typically used on a domestic supply) and then a repeat pumping test of 60 days duration.

To the immense satisfaction of the benefiting municipality and to the surprise of the involved hydrogeological community, this municipal supply well demonstrated nearly a 50% improvement in yield. After a decade of operation, water withdrawal reports continue to reflect long-term well performance in excess of the pre-fracking 72-hour pumping test.

This talk will present the background, data, findings, interpretations and recommendations associated with that fracking project. Surprising as it seems, in some circumstances water well fracking indeed may be a viable tool in the hydrogeological toolbox for the enhancement of the long-term sustainable capacity of municipal and other high-capacity bedrock water supply wells in Maryland and similar bedrock locations.

No presentation
Wayne Room

The Transient Water System Sanitary Survey "What are we looking for?"

Travis E. Sterner
Maryland Department of the Environment
Embassy Room

This presentation will focus on what we are looking for while doing an inspection at a transient water system. It will also link the field information to the sanitary survey form.

Master Watershed Stewards: Recharging Maryland's Aquifers – One BMP at a Time.

Terry R. Matthews, M.S.
Charis Communications Counselors, Inc. and Howard County's Watershed Stewards Academy
Regency Room

It is well documented that unconfined aquifers are throughout the state of Maryland and are the principal source of groundwater in the western part of the state. However, what is not well documented is the impact of impervious cover on groundwater recharge, as these aquifers are primarily recharged by precipitation. According to Maryland Department of the Environment's (MDE's) 2012 Annual Report to the Maryland General Assembly, "Groundwater is the source of crucial, continuous base flows to Maryland's rivers, streams and wetlands…. About twenty-six percent of Maryland citizens obtain their drinking water from groundwater sources" (p. 4).

Precipitation that has the opportunity to slow down, spread out and soak into the soil past the vegetation root zone becomes groundwater. However, because of development, particularly in urban areas, natural landscapes are being transformed into impervious cover, such as roads, rooftops and parking lots. Precipitation as it encounters impervious cover creates flow termed stormwater runoff. According to the Environmental Law & Policy Center (2011), "More than 40 studies show a growing scientific consensus that stream degradation…occurs at a threshold around 10%-15% of impervious area in a watershed" (p. 2) from stormwater runoff. In conjunction with these findings, Virginia's average annual water budget with urbanization illustrates these net impacts on groundwater recharge (Virginia Cooperative Extension, 2011):

i. Natural Ground Cover = 11 inches
ii. 10-20% Impervious Surface = 9 inches
iii. 35-50% Impervious Surface = 6 inches
iv. 75-100% Impervious Surface = 2 inches

Based on the above there is significant opportunity to offset existing impervious surface impacts on groundwater recharge through the implementation of best management practices (BMP) on existing private and public properties.

However, adoption of household stormwater BMP, in general has been a slow process. The University of Maryland in 2012 conducted a survey in Howard County.
Two key findings of the survey were:

- Existing adoption levels were low for all household stormwater BMPs, particularly rain gardens (2.5%) and rain Barrels (7.6%).
- The ratio on awareness-to-adoption is much greater than one for all practices (e.g., for every 17 households that have heard of rain gardens only one household has an existing rain garden) (Newburn, Alberini, Rockler & Karp, 2013, p. 3).

The Watershed Stewards Academy (WSA) is a training program to empower residents to improve groundwater recharge potential and the water quality of local streams through community outreach and implementation of small-scale stormwater management practices. The Academy provides Stewards with knowledge and expertise from lecturers, training in using watershed assessment tools for analyzing stormwater runoff, and hands-on experience leading stormwater management and behavior change projects.

It is the intent of this presentation to raise awareness that implementing residential stormwater BMPs, while critical to comply with the 2025 Bay TMDL, is of equal importance for aquifer recharge and Maryland's drinking water supply. That WSAs work to compliment counties watershed plans by educating and advising homeowners and homeowner associations on best management practices to reduce the volume of stormwater runoff. This module will address how Master Watershed Steward's implementation of BMPs offsets the impact of impervious cover. Attention will be given to how WSAs through education accomplishes its mission and the practices it uses to do so. The anticipated outcome for the presentation is to challenge stakeholders' to become involved with their local Watershed Stewards Academy.

PRESENTER BIOGRAPHIES

PRESENTER BIOGRAPHIES

Harvey A. Cohen is an Associate with S.S. Papadopulos & Associates in Bethesda, MD. He received a BA in geology from Cornell University, and a PhD in geological Sciences from Princeton University. Dr. Cohen has led water resources and geological investigations throughout the United States, in Turkey, and in Cyprus. Dr. Cohen is co-editor of the American Geological Institute's Geoscience Handbook (AGI Datasheets, 4thEdition).
e-mail: hcohen@sspa.com

Mark W. Eisner, P.G. possesses more than 28 years of experience in the environmental and hydrogeological sciences and directs investigations for private and public sector clients. His water resources expertise includes the occurrence, movement, use and management of both groundwater and surface water, its susceptibility and properties when contaminated and methods for its safe and sustainable development. On numerous occasions, Mr. Eisner has testified as an expert on matters related to water resources, resources, hydrogeological conditions and related environmental issues. Specific areas of his technical expertise include mathematical modeling of hydrogeologic systems, groundwater supply exploration and development, pumping tests and contaminant investigations.
e-mail: meisner@alwi.com

Eric J. Evenson has been with the U. S. Geological Survey (USGS) since 1992 and has served as the Coordinator for the National Water Census since that program was created in 2011. He also coordinates the USGS Water Program Office. The USGS National Water Census is the Survey's planned activity on the science and data that supports water availability decision-making. Previously, Evenson served as Regional Program Officer of the USGS, Northeastern Region Water Programs from 2002 to 2010, and served from 1992 through 2002 in the USGS, New Jersey District Office, first as the Associate District Chief and then the District Chief. He worked for the environmental consulting firm of Metcalf & Eddy, Inc from 1990 to 1992 and worked for the New Jersey Department of Environmental Protection's Division of Water Resources from 1979 to 1990. During his tenure at the Division of Water Resources, Evenson was integrally involved with the Water Supply and Safe Drinking Water Programs, Planning and Standards, the New Jersey Geological Survey, and the development of the Clean Ocean Program.

Mr. Evenson is a graduate of University of Nebraska at Lincoln with a B.S. in Zoology and a M.S. in Ecology. He has served at various times as a member of the Management Committee of two National Estuary Programs - Delaware Bay and Barnegat Bay and as an alternate commissioner representing the State of New Jersey on the Delaware River Basin Commission.
e-mail: eevenson@usgs.gov

Joshua Flatley is the Program Lead of the Bay Restoration Fund and is responsible for the management and oversight of all 23 counties throughout the State of Maryland for the implementation of the Bay Restoration Fund. He is also the Chair of the Best Available Technology Review Committee for the evaluation of performance of onsite sewage disposal systems through the Bay Restoration Fund. Joshua has strong ties into GIS and Access databases and frequently reports information to other agencies pertaining to the Bay Restoration Fund.
e-mail: joshua.flatley@maryland.gov

Brandon Fleming is a hydrologist with the USGS Maryland, Delaware, District of Columbia Water Science Center, in Baltimore, MD. He received both a Bachelor's and Master's degree in Geology from the University of Massachusetts, Amherst. His research interests include fractured rock hydrology, groundwater/surface water interactions, and groundwater quality.
e-mail: jbjflemin@usgs.gov

Lieutenant Colonel Christopher A. Gellasch is an active duty Army Environmental Science and Engineering Officer and currently assigned as an assistant professor in the Department of Preventive Medicine and Biometrics at the Uniformed Services University of the Health Sciences in Bethesda, Maryland. He received his Ph.D. in Hydrogeology from the University of Wisconsin-Madison, his M.S. in Geological Sciences from Indiana University, and his B.S. in Geology from Eastern Michigan University. He was deployed to Afghanistan from 2005-2006 and has written several papers related to the hydrogeology of the country.
e-mail: christopher.gellasch@usuhs.edu

Sam Glover began his professional career as an exploration geologist with the Ministry of Lands, Mines & Energy in Monrovia, Liberia. For the past 20 years he has worked as a geologist with the Maryland Department of Environment, Water Supply Program, in the Source Protection & Appropriation Division where he is responsible for evaluating potential adverse impacts of large water withdrawals from ground and surface water sources in Maryland. He holds a B.Sc. in Geology from the University of Liberia and a M.Sc. in Energy Resources from the University of Pittsburgh.
e-mail: Samuel.Glover@maryland.gov

Dong Hee Kang, Ph.D., P.E. had been granted an M.S degree in hydrology from Chung-Ang University and Ph.D. in environmental engineering from Purdue University. Dr. Kang has expertise in the area of fate and transport emerging contaminants, soil and groundwater remediation, and land movement. He has studied a phytoremediation to evaluate the fate and transport of cyanide compounds in soil and groundwater. When he worked at the University of Minnesota, he evaluated the fate and transport of antibiotic compounds in water, soil, and plant systems. Currently he is working as research associate at Morgan State University to simulate land movement by modifying MODFLOW.
e-mail: donghee.kang@morgan.edu

Gary F. Kelman is the manager of the AFO Program at MDE. This program implements the Clean Water Act in regard to point source and groundwater discharges from animal feeding operations, potentially a major source of nutrient pollution of the Chesapeake Bay. Gary coordinates the interests of several organizations including USDA's Natural Resources Conservation Service, the Maryland Department of Agriculture, the EPA, both Region 3 and Headquarters as well as the various trade associations relevant to the livestock industry, the University of Maryland Extension and farm lenders. Gary received a MS in Civil Engineering from the University of Maryland and a BS in Life Sciences from Philadelphia University. He also is a Certified Environmental Professional (CEP).
e-mail: gary.kelman@maryland.gov

Jason Keppler is the Watershed Implementation Program Manager for the Maryland Department of Agriculture. He has over 19 years' experience in agricultural conservation program delivery and is currently oversees the implementation of the agricultural sector's responsibilities under the Chesapeake Bay TMDL. Prior to his current position, Mr. Keppler reviewed conservation grants administered through the Maryland Agricultural Water Quality Cost-Share (MACS) Program and was a Non-Point Source Environmental Technician for the West Virginia Conservation Agency.
e-mail: jason.keppler@maryland.gov

Robert Kershner graduated from Penn State University in 1985 with a Bachelor of Science degree in Mechanical Engineering. He gained valuable experience with BCM Engineers doing water and wastewater plant design before joining a manufacturer's representative firm as a sales engineer for the Chesapeake Bay market in 1991. Robert established Kershner Environmental Technologies, LLC in 2001 that has since grown to 10 employees with three offices in the mid-Atlantic region. In 2009 he formed Innovative Treatment Products, LLC to develop new ideas and concepts. ITP, LLC manufactures these technologies designed to solve treatment problems for niche markets in our water environment.
e-mail: r.kershner@ketllc.com

Mahmoud Mahmoud is a compliance and regulatory engineer with the Maryland Department of the Environment, Source Water Protection and Appropriation Division. His responsibilities include ensuring the protection and wise use of the State's water resources and compliance with water appropriation and use laws/regulations. This is accomplished by using hydrology modeling techniques to predict potential impacts to the resource and other users from large ground and surface water withdrawals.
e-mail: Mahmoud.Mahmoud@Maryland.gov

Allison Marong has worked at the Maryland Department of the Environment since 2007 and serves as the Head of the Sewage Sludge Utilization Section. Allison has a degree in Civil Engineering from Virginia Tech.
e-mail: allison.marong@maryland.gov

Terry Matthews has served at the municipal, county, state and federal levels in the environmental field, predominately in a leadership capacity for more than 30 years. Mr. Matthews is Director of Training & Development for Charis Communications Counselors, Inc. and Program Coordinator for Howard County's Watershed Stewards Academy. He has served as Chairman of Maryland's State Water Quality Advisory Committee, on the Board of Directors for the Maryland Association of Municipal Wastewater Agencies, and as a member of the Stakeholder Advisory Committee for TMDL Watershed Implementation Plan. Mr. Matthews' expertise is Organizational Behavior and Behavior Change.
e-mail: trmatt@umd.edu

Kurt J. McCoy has been employed as a hydrologist with the US Geological Survey since 2002. Kurt has worked on aquifer studies in a number of states including West Virginia, Pennsylvania, Wyoming, New Mexico, and Virginia. His focus has been on understanding of groundwater flow and regional heterogeneity in stratified montane terrains. Kurt holds a master's degree in Geology from West Virginia University.
e-mail: kjmccoy@usgs.gov

PRESENTER BIOGRAPHIES

Joel Moore received his Ph.D. in Geosciences from Penn State University and was a postdoctoral fellow at Northwestern University. His research interests are low temperature geochemistry and earth surface processes with research tools including isotopic traces and geochemical modeling. Since starting at Towson in 2011, his research has focused on carbon capture and sequestration and on urban geochemistry, particularly road salt impacts on streams and groundwater.
e-mail: moore@towson.edu

Daphne Pee is the Coordinator for the Chesapeake Water and Septic Homeowner Education Project. Prior to assuming this position, she worked as the Regional Liaison for the University of Maryland's Mid-Atlantic Water Program. During that time, she learned about Penn State's Master Well Owner Network and helped to expand that programming into Maryland as the Chesapeake WaterSHEd. Ms. Pee received her B.S from the University of Maryland and a Master of Environmental Management from Duke University. She does not subscribe to cable. As such, she has no access to college basketball and, sadly, no preferences in basketball dynasties.
e-mail: dpee@umd.edu

Richard Piluk received his MS from the Civil Engineering Department of the University of Maryland. Rich is a Public Health Engineer for the Anne Arundel County Health Department and has been designing onsite wastewater treatment systems for many very difficult sites in the county since 1973. Rich has been specializing in the design of nitrogen reducing systems for the last thirty years.
e-mail: hdrpiluk@aacounty.org

Jay Prager, Deputy Program Manager for the Wastewater Permits Program, is responsible for discharges to surface and ground water. This program includes MDE's regional consultants who provide technical assistance and oversight to local approving authorities for on-site water and wastewater systems. Previously he served at MDE as the Chief of the On-site Systems Division, a regional consultant, section head and project manager for the Innovative and Alternative On-site Sewage Disposal Program. He currently is serving on the State Board of Environmental Health Specialists.
e-mail: jay.prager@maryland.gov

Heather Quinn has been with the MGS for 14 years with several years in the Hydrogeology & Hydrology Program. Within hydrogeology, her work has focused primarily on Coastal Plain aquifers and wells. Previous MGS work included developing GIS maps and datasets of geology, mined land and karst features. Prior to MGS, she worked for over 10 years in groundwater and environmental consulting and earlier for several years as a marine scientist evaluating estuarine eutrophication and a geologist working in applied micropaleontology research. She has an M.S. in geology and a B.A. in geology & Fine Arts.
e-mail: heather.quinn@maryland.gov

Jeff P. Raffensperger is a hydrologist with the USGS MD-DE-DC Water Science Center. He received his Bachelor's degree in Geology from the University of Maryland in 1985, his Master's degree in Hydrogeology from Louisiana State University in 1988, and his Ph.D. in Hydrogeology from The Johns Hopkins University in 1993. Jeff has worked for the USGS MD-DE-DC Water Science Center since 1999. Since that time, he has been involved with several projects studying hydrologic processes and modeling. He has been a member of the National Water-Quality Assessment (NAWQA) Integrated Watershed Studies (IWS) Team since 2013.
e-mail: jpraffen@usgs.gov

Christopher H. Ralston is the Administrator of the Maryland Department of the Environment's Oil Control Program. He has been with MDE since April 2009 and previously served as the Chief of the OCP Remediation Division. Prior to working for Maryland, Mr. Ralston was an environmental consultant for 10 years specializing in petroleum remediation projects. In his current capacity, he is responsible for directing and coordinating the Department's oil pollution and tank management activities. Mr. Ralston has a BS in Environmental Science from the University of Delaware and a Masters of Environmental Engineering from the Johns Hopkins University.
e-mail: chris.ralston@maryland.gov

Timothy Seiple is a GeoInformatics Scientist with the Pacific Northwest National Laboratory, Richland WA. His research interests include autonomous data and analysis systems and translating scientific modeling results into actionable information via service-based transformational analytics.
e-mail: Timothy.Seiple@pnnl.gov

Andrew Staley is a hydrogeologist with the Maryland Geological Survey. He has conducted field investigations of aquifer systems in the Maryland Coastal Plain, and has worked extensively with developing regional GIS coverages of the aquifers and confining units of the Coastal Plain.
e-mail: andrew.staley@maryland.gov

Travis E. Sterner has worked at MDE Water Supply since 1998. He has worked with well and groundwater contamination issues since being hired at MDE and is currently serving as the MDE representative on the State Board of Well Drillers.
e-mail: Travis.Sterner@Maryland.gov

Robert M. Summers, Ph.D. was appointed Secretary of the Maryland Department of the Environment by Governor Martin O'Malley on April 28, 2011. Dr. Summers leads the Department's planning, regulatory, management and financing programs to protect public health, ensure a safe and reliable water supply, restore and protect air quality, water quality, wetlands and waterways, clean up contaminated land and ensure proper management of hazardous and solid wastes.

Dr. Summers has served the citizens of Maryland for 28 years in various capacities within Maryland's progressive and nationally recognized environmental programs, with emphasis on scientific and technical issues related to water pollution control, drinking water protection and federal, State and local government environmental laws and regulations. Between 2001 and 2007, he served as the Director of MDE's Water Management Administration and prior to that served for 4 years as Director of MDE's Technical and Regulatory Services Administration. Throughout his career, Dr. Summers has been a key contributor to the multi-jurisdictional Chesapeake Bay restoration effort.

Dr. Summers is Maryland's Commissioner on the Susquehanna River Basin Commission and the Appalachian States' Low-Level Radioactive Waste Commission. He is Chairman of the Governor's Climate Change Commission and represents the Governor on the Maryland Bay Restoration Fund Advisory Committee and the Advisory Committee on the Management and Protection of the State's Water Resources.

Dr. Summers received his B.A. (1976) and Ph.D. (1982) in Environmental Engineering from the Johns Hopkins University. Prior to joining Maryland's environmental programs, he worked as a post-doctoral research associate at the State University of New York, Marine Sciences Research Center in Stony Brook, NY and as a research assistant at the Johns Hopkins University's Chesapeake Bay Institute.

Dr. Summers and his wife have three adult children and live in Baltimore, MD. They enjoy hiking, canoeing and sailing on the region's rivers, Chesapeake Bay and the Atlantic coast.
e-mail: robert.summers@maryland.gov

Mark Williams, R.E.H.S./ R.S. is the Director of the Charles County Division of Environmental Health Services and current President of the Maryland Conference of Local Environmental Directors.
e-mail: marka.williams@maryland.gov