Maryland
Department of
the Environment

2017

ANNUAL MARYLAND GROUNDWATER SYMPOSIUM

SPONSORED BY THE
WATER SUPPLY PROGRAM

Dear Participants:

Welcome to the 26th Annual Maryland Groundwater Symposium. We are thrilled to have more than 450 participants this year. The symposium is energized by your continued support and participation over the past 25 years. You have helped us to shape this event into a premier groundwater educational event in Maryland.

Our goal is to provide you with a forum for discussing the most recent technical, regulatory, and policy issues associated with groundwater in Maryland, and ultimately highlight the importance and value of water. This event is the perfect backdrop for discussion and networking on how we value and manage our water resources in Maryland.

We are grateful for the support afforded to us by attendees, the Maryland Department of Environment's leadership and continued financial support from the Environmental Protection Agency Region III Drinking Water Branch. Most importantly, the Symposiums' success lies with the unselfish contribution of our presenters. Their willingness to share their knowledge and expertise has made this event possible. We are very fortunate to have an impressive cadre of expert presenters again this year.

Thank you for your continued support, and we hope you will enjoy the sessions being presented today.

Saeid Kasraei
Program Administrator
Water Supply Program

Morning Plenary: Embassy Room

9:00 – 9:15 a.m. **Welcome and Opening Remarks**

9:15 – 10 a.m. **Keynote Address**
Prevention of Disease and Injury Associated with Building Water Systems
Aaron A. Rosenblatt, Gordon & Rosenblatt, LLC

10 – 10:45 a.m. **Onsite Wastewater System Management for Chesapeake Bay Watershed Nutrient Load Reductions**
Victor D'Amato, P.E., Tetra Tech

Break | 10:45 – 11:05 a.m.

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

Evaluation of Radon Occurrence in Groundwater from 16 Geologic Units in Pennsylvania, 1986–2015, with Application to Potential Radon Exposure from Groundwater and Indoor Air
Eliza Gross, U.S. Geological Survey, Pennsylvania Water Science Center
Maryland Room

Design-Build of a 1 MGD Demonstration Facility for Advanced Treatment and Managed Aquifer Recharge - Phase 3 of HRSD's SWIFT Program
John J. Dano, P.E., HRSD and Aaron W. Duke, P.E., BCEE, Hazen and Sawyer
Regency Room

How to Go from Septics to Sewers – An Overview
Janice Outen, MDE Water Resources Planning
Embassy Room

Using a Well Camera to Assess the Integrity of Maryland's Long-Term Water-Level Monitoring Wells
Andrew Staley, Maryland Geological Survey
Wayne Room

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

Well Water Quality in the Appalachian Plateau Physiographic Province of Maryland
Tiffany VanDerwerker, P.G., Maryland Geological Survey
Maryland Room

Maryland Department of the Environment Guidelines for Use of Class IV Reclaimed Water – Status and Case Study
Ching-Tzone Tien, Ph.D., P.E., MDE Water Discharge Permits Division
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Priority Funding Area Law and Sewer Extension Projects
Chuck Boyd, Maryland Department of Planning
Embassy Room

On-Site Sewage Disposal System Evaluations in Maryland: the Past, the Present, and the Future
Kevin Barnaba, Home Land Environmental Health Labs
Wayne Room

Lunch | 12:15 – 1:30 p.m.

CERTIFICATES FOR THE 26TH ANNUAL MARYLAND GROUNDWATER SYMPOSIUM

Thank you for attending the 26th Annual Groundwater Symposium. You will receive an e-mail from gws@mcet.org within two weeks of this event with a link to MDE's Program Evaluation Survey.

Once you complete the evaluation you will be able to download a certificate of attendance for this program. **The link will be available for three weeks and certificates will ONLY be available after completion of the survey and during this timeframe.** Please add gws@mcet.org to your e-mail address book to ensure receipt of this e-mail.

Afternoon Session One | 1:30 – 2 p.m.

Assessing Effects of Groundwater Withdrawals on Surface Water-Groundwater Interactions in Fractured Rock Aquifers
Zachary M. Neal, Advanced Land and Water, Inc.
Maryland Room

Conserving Groundwater through Nontraditional Irrigation Water: Assessing Farmers' Needs and Water Quality
Rachel Rosenberg Goldstein, Ph.D., M.P.H., University of Maryland, College Park
Amy R. Sapkota, Ph.D., M.P.H., University of Maryland, College Park.
Regency Room

MDE Financial Assistance for Septic to Sewer Connection Capital Projects
Elaine Dietz, MDE Water Quality Financing Administration
Embassy Room

Managing Residential Heating Oil Storage Systems and Environmental Impacts from Fuel Oil Spills
Susan Bull and Drew Miller, P.G., MDE Oil Control Program
Wayne Room

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

Arsenic in Drinking Water in St. Mary's County: An Intern's Study
Ann Rose and Jonathan Feid, St. Mary's County Health Department
Maryland Room

Evaluation of an Agricultural Application for a Water Appropriation and Use Permit in the Columbia Aquifer
Robert Peoples, MDE Water Supply Program
Regency Room

Case Study: Southern Kent Island Sewer Extension Project
Todd Mohn, P.E. and Steve Cohoon, Queen Anne's County Department of Public Works
Embassy Room

Transient Water System Sanitary Surveys (Part 1)
Travis E. Sterner, MDE Water Supply Program
Wayne Room

Break | 2:35 – 2:50 p.m

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

Drinking Water Health Standards Comparison and Chemical Analysis of Groundwater for 72 Domestic Wells in Bradford County, PA, 2016
John Clune, U.S. Geological Survey
Maryland Room

Challenges of Source Water Protection Implementation – How One Water System Balances Economic and Public Health Interests
Mark W. Eisner, P.G., Advanced Land and Water, Inc. (Part 1)
Regency Room

Challenges and Progress in Bringing a Public Sewerage System to Lewistown, MD
Barry Glotfelty, LEHS, Frederick County Health Department and
Kevin Demosky, Frederick County Division of Utilities and Solid Waste Management
Embassy Room

Transient Water System Sanitary Surveys (continued)
Travis E. Sterner, MDE Water Supply Program
Wayne Room

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

Frequently Asked Questions Regarding Water Appropriation and Use Permits/Exemptions and Well Approvals
John Grace and Robert Peoples, MDE Water Supply Program
Maryland Room

Challenges of Source Water Protection Implementation – How One Water System Balances Economic and Public Health Interests
Mark W. Eisner, P.G., Advanced Land and Water, Inc. (continued)
Regency Room

Septic Connections and Maryland's Chesapeake Bay Restoration
Jim George, Ph.D. and Yen-Der Cheng, MDE Municipal Surface Discharge Permit Division
Embassy Room

Optimizing Process Control for Nitrogen Removal in Small Flow Plants: Enhanced Biological Nitrogen Removal in Plants with Variable Flows & Underloaded Conditions
Brandon Friedland and Gary Lucas, Innovative Treatment Products, LLC
Wayne Room

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ABSTRACTS OF PRESENTATIONS

Morning PLENARY | 9:15 – 10:45 a.m.

Prevention of Disease and Injury Associated with Building Water Systems
Aaron A. Rosenblatt, Gordon & Rosenblatt, LLC

Every year, hundreds of thousands of preventable, often fatal infections are associated with exposure to pathogens from building water systems. Scalding and lead poisoning also cause significant numbers of serious injuries. The costs to society, both financial and human, are staggering. The principles of *Hazard Analysis and Critical Control Point* (HACCP) methodology—a structured, systematic, cost-effective paradigm best known for its successful use in food safety—have proven remarkably effective for preventing waterborne disease and injury associated with building water systems. There is a developing consensus among standard- and guidance-writing organizations that water management programs based on HACCP principles represent best practices for control of pathogens, such as *Legionella*, and other hazards associated with building water systems. Though terminology varies and the acronym HACCP is not always used, examples of HACCP-based programs include World Health Organization (WHO) Water Safety Plans; ANSI/ASHRAE Standard 188-2015, *Legionellosis: Risk Management for Building Water Systems*; NSF Protocol 453-2017, *Cooling Towers - Treatment, Operation and Maintenance to Prevent Legionnaires' Disease*; and Veterans Health Administration (VHA) Directive 1061, *Prevention of Healthcare-associated Legionella Disease and Scald Injury from Potable Water Distribution Systems.* The focus has been primarily on *Legionella* and, to a certain extent scalding. But there is a trend in new standards, guidelines and accreditation requirements toward water management programs that address multiple pathogens—e.g., *Legionella*, *Pseudomonas*, *Acinetobacter, Burkholderia*, *Stenotrophomonas*, nontuberculous mycobacteria (NTM)—in the context of physical and chemical hazards that might be exacerbated by microbial control methods. The complex challenges presented by simultaneously addressing multiple hazards militate for re-examination of *Legionella*-centric water management plans. Using HACCP principles as an organizing framework, the challenges of a multi-hazard practice standard are being addressed by NSF 444P, *Prevention of Disease and Injury associated with Building Water Systems,* a proposed ANSI standard now in development.

Onsite Wastewater System Management for Chesapeake Bay Watershed Nutrient Load Reductions
Victor D'Amato, P.E., Tetra Tech
Embassy Room

A recently-completed Chesapeake Bay Program Expert Panel reviewed the available science and provided recommendations on how to factor nutrient attenuation into Chesapeake Bay TMDL onsite wastewater treatment system (OWTS) load estimates. The Panel estimated TN reductions through the soil treatment unit and groundwater, resulting in a total of 12 separate TN attenuation rates ranging from 46% to 88% depending on OWTS location and

characteristics. Development and application of the methodology, limitations and future research needs, and implications for and case studies of its application and improved OWTS management will be discussed.

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

Evaluation of Radon Occurrence in Groundwater from 16 Geologic Units in Pennsylvania, 1986–2015, with Application to Potential Radon Exposure from Groundwater and Indoor Air

Eliza Gross, U.S. Geological Survey, Pennsylvania Water Science Center
Maryland Room

Indoor air radon concentrations increase by about 1 picocurie per liter (pCi/L) for each 10,000 pCi/L in groundwater used for domestic supply, adding to the average household indoor air concentration resulting from radon entering the building through foundation cracks. The U.S. Environmental Protection Agency (EPA) has established an action level of 4 pCi/L for indoor air radon exposure and proposed an alternative maximum contaminant level (MCL) of 4,000 pCi/L for public water supplies. While the EPA does not currently regulate radon in drinking water, it has proposed this alternative limit for public water supplies in states like Pennsylvania, which have an EPA-approved radon indoor air quality program. For states without an approved program, the EPA has proposed a lower, more protective, MCL of 300 pCi/L. Although domestic self-supply wells are unregulated in Pennsylvania, groundwater can be a notable indoor air radon source and health concern in those areas where groundwaters have extreme radon concentrations, as exposure to radon in indoor air is the second-leading cause of lung cancer.

The U.S. Geological Survey conducted a study in cooperation with the Pennsylvania Department of Health and the Pennsylvania Department of Environmental Protection to evaluate variations in radon concentrations in groundwater and to classify potential radon exposure from groundwater and indoor air. The study includes results from 1,041 groundwater samples collected during 1986–2015 from 16 geologic units in Pennsylvania, associated with 25 or more groundwater samples that were analyzed for radon. Results indicate 14 percent of samples had radon concentrations at or above the proposed alternative MCL of 4,000 pCi/L, and 87 percent exceeded the proposed MCL of 300 pCi/L. The highest radon concentrations were measured in groundwater from the schists, gneisses, and quartzites of southeast Pennsylvania.

Median radon concentrations by geologic unit for the groundwater samples (155-4,300 pCi/L) and indoor air samples (2.1-6.4 pCi/L) were used to classify radon exposure potential according to proposed and recommended regulatory limits. Geologic unit exposure potential classifications were mapped with public water-supply service areas to identify exposure potential of populations using domestic wells. The Peters Creek Schist in southeast Pennsylvania, known as the Wissahickon Formation in northeast Maryland, was

determined to be the area with highest potential for radon exposure from both groundwater and indoor air and was also identified as one of two units with the highest percentage of population assumed to be using domestic self-supplied water (81 percent), which puts the population at greater potential of exposure to radon from groundwater. Characterization of potential radon exposure from groundwater and indoor air is useful for drawing general conclusions about the presence and variation of radon and for informing Pennsylvania's citizens of potential risks of radon to human health.

Design-Build of a 1 MGD Demonstration Facility for Advanced Treatment and Managed Aquifer Recharge - Phase 3 of HRSD's SWIFT Program

John J. Dano P.E., HRSD and Aaron W. Duke, P.E., BCEE, Hazen and Sawyer

Regency Room

Hampton Roads Sanitation District (HRSD) treats approximately 125 million gallons per day (mgd) of wastewater for a population of nearly 1.7 million people in the Hampton Roads region. Development of HRSD's Sustainable Water Initiative for Tomorrow (SWIFT) program began with the recognition that an innovative solution was needed help manage regulatory requirements, while addressing regional water challenges.

The multi-phase SWIFT Program will add multiple advanced treatment processes to up to seven of HRSD's wastewater treatment facilities to produce finished water that exceeds drinking water standards and is compatible with the receiving aquifer. At full-scale, HRSD intends to produce over 100 mgd of finished water that will recharge the Potomac aquifer, thus significantly reducing nutrient loading to the sensitive Chesapeake Bay and providing significant benefit to the region by limiting saltwater intrusion, reducing land subsidence, and providing a sustainable source of groundwater, a necessity for continued economic expansion.

Phase 1 of the SWIFT program involved a feasibility study and extensive groundwater modelling to evaluate the potential costs and environmental and economic benefits of managed aquifer recharge. Phase 2 included operation of a room-scale pilot. Initial focus of the piloting effort was to compare granular activated carbon (GAC) and reverse osmosis (RO) advanced treatment processes. Pilot performance demonstrated that both treatment processes could effectively achieve the identified finished water-quality targets. However, an aquifer compatibility analysis showed that the carbon-based effluent is substantially more suitable for recharging the Potomac aquifer. A complete treatment train including coagulation/flocculation, sedimentation, ozonation, biological activated carbon filtration, GAC adsorption, ultraviolet disinfection, and chlorination was selected for further development.

Phase 3 includes design and construction of the SWIFT Research Center, which contains a nominal 1 mgd treatment facility. The objective of this phase is to demonstrate at a meaningful scale that advanced treatment will produce finished water that meets primary drinking water standards and is compatible with the groundwater chemistry and to monitor

the aquifer's hydraulic response. HRSD will collect at least 18 months of operational data to optimize the design of full-scale SWIFT facilities and to define future permitting requirements. The team of Crowder Construction Company and Hazen and Sawyer was selected and tasked with using the design/build project delivery method to meet the aggressive 12-month timeline for Phase 3. Substantial completion of the facility and process start up is expected in January 2018.

This presentation will highlight the drivers for SWIFT along with the challenges and unique approaches taken to balance the design of the demonstration scale treatment facility with the need to develop design and operational knowledge for future buildout of the SWIFT program. We will discuss how the hazard analysis and critical control point (HACCP) methodology was initially used to identify and manage chemical and microbiological risks. The presentation will also cover the project's unique approach toward meeting pathogen inactivation goals through multiple, flexible treatment barriers. In closing, the presentation will take a look at the future phases of HRSD's innovative SWIFT program.

How to Go from Septics to Sewers – An Overview
Janice Outen, MDE Water Resources Planning
Embassy Room

This presentation will describe the process to connect areas of failing septic systems to a wastewater treatment plant. First, a septic problem area must be identified and an engineering plan must be prepared for the proposed sewer service area and sewer lines. Next, the Comprehensive Land Use Plan as well as the County Water & Sewer Plan should be amended. After the Comp Plan and Water & Sewer plan have been amended, the applicant should request MDE funding. If there is a Priority Funding Area (PFA) issue, MDE will request a PFA exception from the Smart Growth Coordinating Committee. Finally, the applicant must apply for and receive permits. Throughout this process it is essential to have citizen input.

Using a Well Camera to Assess the Integrity of Maryland's Long-Term Water-Level Monitoring Wells
Andrew Staley, Maryland Geological Survey
Wayne Room

Maryland Geological Survey (MGS), along with the United States Geological Survey and Maryland Department of the Environment, collects water-level and water-quality data from a network of approximately 475 monitoring wells across the state. Data from these wells are critical in assessing the condition of the aquifers (gauging available drawdown) and in water-supply planning (calibrating groundwater-flow models). The average age of the wells is 35 years, though many date back to the mid-1900's or even earlier and are now showing signs of age. MGS has recently acquired a well camera to help assess the health of this monitoring well network.

A well camera with portable recording unit can be a useful tool to assess the health and integrity of monitoring wells. Problems such as breaks in the casing, casing corrosion, encrusted screen openings, bacterial accumulation, and debris blockages can all be seen in vivid color to inform exactly what needs to be done to rehabilitate a well. Periodic well camera surveys can be an important part of a comprehensive preventative maintenance or well management program. This session will present examples of common problems found during well camera surveys and will discuss the challenge of maintaining a large and aging well network.

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

Well Water Quality in the Appalachian Plateau Physiographic Province of Maryland
Tiffany VanDerwerker, P.G., Maryland Geological Survey
Maryland Room

Well water contamination related to the development of the Marcellus Shale natural gas reserves in Pennsylvania and elsewhere has underscored the need for a baseline evaluation of well water-quality data prior to natural gas development. In Maryland, water-quality data was obtained from more than 2,300 wells in the Appalachian Plateau Physiographic Province of Maryland (which includes all of Garrett County and the western portion of Allegany County), and was evaluated with respect to drinking-water standards, geologic unit, land use, topographic position, and other factors. Data sources included the Garrett County and Allegany County Health Departments, the Maryland Department of the Environment, the Maryland Geological Survey (part of the Maryland Department of Natural Resources), and the U.S. Geological Survey. Major ions, trace elements, radionuclides, nutrients, and other constituents were evaluated with respect to geologic unit, land use, topographic position (upland or valley), and other factors.

Well water in the study area tended to be near neutral, moderately hard, low in dissolved oxygen (reducing conditions), and low in dissolved solids. Arsenic concentrations exceeded the Maximum Contaminant Level (MCL) of 0.010 milligrams per liter (mg/L) in about 7% of wells sampled. Approximately 22% of samples collected in the Hampshire Formation exceeded the MCL. Iron concentrations exceeded the Secondary MCL (SMCL) of 0.3 mg/L in approximately 57% of wells sampled. The highest percentage of iron exceedances was observed in the Allegheny Formation (88%) and the lowest was from the Hampshire Formation (37%). Manganese concentrations exceeded the SMCL of 0.050 mg/L in approximately 54% of wells sampled. The highest percentage of manganese exceedances was observed in the Allegheny Formation (96%) and the lowest was from the Hampshire Formation (52%). Chloride concentrations exceeded the SMCL of 250 mg/L in approximately 2% of wells. Most elevated chlorides were likely associated with road salt or other surface-based sources, but several wells have characteristics of diluted brines. Nitrate

concentrations were relatively low throughout the Appalachian Plateau, which is likely due to reducing groundwater conditions, where ammonium is the dominant nitrate ion. Methane concentrations tended to be low (less than 10 percent were greater than 1 mg/L); concentrations were higher in valleys than hilltops or hillsides and higher in coal-bearing areas than non-coal areas. Land use was not determined to have a significant effect on groundwater compared to other areas of Maryland.

Maryland Department of the Environment Guidelines for Use of Class IV Reclaimed Water – Status and Case Study

Ching-Tzone Tien, Ph.D., P.E., MDE Groundwater Discharge Permits Division

Regency Room

The MDE Guidelines for Use of Class IV Reclaimed Water (MDE-WMA-002-07/15) were revised, finalized and posted on the MDE web site in July 2016. The 41 pages and 14 chapters of the Guidelines include Water Quality Treatment Standards (Chapter 4); Monitoring Requirements (Chapter 5); Design Criteria (Chapter 7); Operations and Maintenance (Chapter 9) and other pertinent subjects. The Guidelines were drafted and completed in 2.5 years by the MDE Water Reuse Committee, which consists of 25 members from state agencies, local government, consulting firms and environmental advocacy groups.

High-quality Class IV reclaimed water can be used for lawn irrigation in residential, commercial and industrial buildings; firefighting, flushing toilets and urinals in public buildings; decorative fountains; commercial laundries and car wash; and cooling and manufacturing processes. These guidelines apply only to use of Class IV reclaimed water generated from a centralized wastewater treatment works. Guidance on the use of Class I, II and III reclaimed water can be found in the Department's Guidelines for Land Application/Reuse of Treated Municipal Wastewaters (MDE-WMA-001-04/10).

This document does not address the use of other non-potable waters (e.g. the use of graywater, rainwater, etc.). The uses of other non-potable waters are addressed under applicable local plumbing codes as implemented by the local authority having jurisdiction. Additionally, certain uses of reclaimed water are excluded from the requirements of this guidance, including the use of non-potable water produced and utilized on-site by a treatment works holding a valid discharge permit from the Department. Industrial uses of reclaimed water will be reviewed on a case-by-case basis.

Two case studies using Class IV reclaimed water in Maryland will be introduced in this presentation.

Priority Funding Area Law and Sewer Extension Projects
Chuck Boyd, Maryland Department of Planning
Embassy Room

This presentation will provide an overview of Priority Funding Area (PFA) Law and its applicability to water and sewer service expansion projects. It will highlight the roles of local government and state agencies in the process of administering the PFA law; provide an in-depth explanation of the PFA eligibility criteria and how local governments can amend their locally designated PFA; and describe the PFA exception process some projects may need to be eligible for state funding.

On-Site Sewage Disposal System Evaluations in Maryland: the Past, the Present, and the Future
Kevin Barnaba, Home Land Environmental Health Labs
Wayne Room

The need to evaluate on-site sewage disposal systems for real-estate transactions in Maryland arose during the 1990s. As on-site sewage disposal systems began to age in the rural areas of the state, more and more new homebuyers found themselves faced with expensive repairs after purchasing their home. The real-estate industry began to see the need to have qualified professionals evaluate the on-site systems to protect homebuyers on their purchase.

As a new industry began to grow, the need to create standards arose. A law was passed that required the Maryland Department of the Environment to approve a course that educated prospective on-site system inspectors on the important aspects of a proper evaluation. The class was later provided by the Maryland Onsite Wastewater Professionals Association (MOWPA).

Challenges continue within the industry with inconsistencies with inspection protocol, differing policies within local health departments, lack of CEU requirements for inspectors, keeping up with advancing technologies, etc.

Fortunately, new technologies are available that are advancing the industry in ways never seen before. The use of cameras provides better ways to document the condition of the system at the time of the inspection. Sewer cameras allow evaluators to see components that were not possible to observe before. Sewer cameras also contain locators that make easy to find the exact location of underground components.

Afternoon Session One | 1:30 – 2 p.m

Assessing Effects of Groundwater Withdrawals on Surface Water-Groundwater Interactions in Fractured Rock Aquifers
Zachary M. Neal, Advanced Land and Water, Inc.
Maryland Room

Assessing and characterizing fractured bedrock aquifers is one of the more complex challenges facing consultants and professional hydrogeologists alike. In the course of working in these environmental settings, we often face a multitude of questions that clients and regulatory officials seek to understand. Are proposed groundwater withdrawals sustainable? What are the contributing sources of water being captured and removed by a well? Will the chemistry of the water change through time, and does the potential exist for water-quality concerns to develop in the future?

To answer these questions, we must strive to thoroughly conceptualize and understand the hydrologic system in question. In this regard, we must acknowledge two key principles: (1) that surface water and groundwater systems are truly a single resource, and should be analyzed as such, and (2) no two hydrologic systems are exactly the same, such that tools and methods of analysis may vary from project site to site. By analyzing only one component of the hydrologic system, we may not adequately understand the entire flow system and may make false interpretations regarding future well yield and/or water quality. Similarly, by limiting ourselves to the same set of "hydrologic tools" and methods of analysis, we may miss important details regarding the behavior of the flow system being studied.

During this presentation, we will briefly review the importance of formulating a preliminary conceptual model of bedrock aquifers, along with methods and resources that can be utilized to help us refine our conceptualization of site hydrogeology. Much of the presentation will focus on tools and methodologies that we can utilize to assess the effects of groundwater withdrawals on paired surface water-groundwater systems. Methods range from direct physical observations that can be made in the field to those that require laboratory analysis. We will explain the benefits of monitoring adjoining surface water bodies and the methodologies that can be utilized to both qualitatively and quantitatively understand how groundwater withdrawals come to affect these water bodies. We will discuss paired surface water-groundwater monitoring stations, heat tracing, differential gauging and temporal water-quality analyses, with an emphasis on graphical methods of interpretation, including bivariate plots and Piper Diagrams. Two large-scale, long-term pumping tests depicting these analytical tools will be presented as case studies. We also will articulate the limitations of the different tools and methods that can be employed, including the spatial scale at which they are utilized, and how to compare site-wide observations to generate a better, updated conceptual hydrogeologic model.

Conserving Groundwater through Nontraditional Irrigation Water: Assessing Farmers' Needs and Water Quality

Rachel Rosenberg Goldstein, Ph.D., M.P.H., University of Maryland, College Park
Amy R. Sapkota, Ph.D., M.P.H., University of Maryland, College Park.
Regency Room

As climate variability continues and places severe stress on high-quality agricultural irrigation water sources (e.g. groundwater), it is essential to explore alternative water resources for irrigating crops. To facilitate adoption of these nontraditional irrigation water sources, understanding of both farmers' needs and water quality is critical.

CONSERVE (COordinating Nontraditional Sustainable watER Use in Variable climatEs): A Center of Excellence at the Nexus of Sustainable Water Reuse, Food, and Health is an interdisciplinary USDA-funded project focused on conserving groundwater through nontraditional irrigation water-quality analysis, assessing concerns, developing on-farm water treatment technologies, and analyzing legal, economic and social constraints to adoption. Acceptance of nontraditional water (reclaimed, brackish, agricultural runoff, livestock wastewater and process waters) as a viable option for agricultural irrigation depends on reliable safe water quality, grower buy-in, and consumer preferences. However, to date, few studies exist on water quality of nontraditional water, and no studies exist on farmers' willingness to use, or real or perceived risks, of nontraditional water. A needs assessment survey covering farmers' current irrigation water sources, familiarity with nontraditional water, and concerns was distributed to Maryland farmers (n=156) in 2017, online and at stakeholder meetings.

Survey data were collected with Qualtrics and analyzed with STATA. Water sampling was conducted in Maryland and Delaware to determine water-quality indicator organism and bacterial pathogen levels contained in nontraditional waters. Nontraditional water sampled included treated wastewater effluent, surface pond water, surface non-tidal, and tidal river water. To date, samples (n=108) have been assayed for *Escherichia coli*, total coliforms (TC), *Enterococcus* spp., *Salmonella*, and *Listeria,* as well as *Aeromonas* spp. (n=89), by standard membrane filtration of a serial dilution of each sample and membranes incubated on appropriate microbiological media for each taxon. In addition, bacterial community profiles were generated and compared across water types and sampling dates using 16S rRNA gene sequencing.

Survey results found the majority of growers were concerned with water availability (72%), consider nontraditional water in agriculture at least moderately important (65%), and would use nontraditional water to supplement current water sources (80%) if available. Water quality and health risks were farmers' top concerns related to nontraditional water. Indicator bacteria and pathogen prevalence were highly dependent on surface water location and levels of most pathogens differed seasonally throughout the year. However, all samples tested for *Aeromonas* spp. were positive, with a mean level of 4.3 Log CFU/100 ml.

Enteric foodborne pathogen levels in reclaimed water samples were extremely low and non-detectable in most samples analyzed. *E. coli*, TC, and enterococci levels were also lower in reclaimed water samples compared to surface water. Bacterial community structure was most strongly influenced by seasonal changes in water temperature; however, water type had an effect as well. Results indicate the importance of the type of nontraditional water in terms of bacterial loads and suggest that climatic factors impact indicator and pathogen levels. Education and outreach will be central to communicating benefits and managing risks related to the adoption of nontraditional irrigation water as well as explaining possible treatment options to farmers.

MDE Financial Assistance for Septic to Sewer Connection Capital Projects
Elaine Dietz, MDE Water Quality Financing Administration
Embassy Room

Projects to connect septic systems to public sewer are eligible for grants and loans from MDE. Learn more about the funding, how to apply, and other useful details from this presentation.

Managing Residential Heating Oil Storage Systems and Environmental Impacts from Fuel Oil Spills
Susan Bull and Drew Miller, P.G., MDE Oil Control Program
Wayne Room

The Maryland Department of the Environment Oil Control Program receives over 200 spill reports per year related to the release of heating oil from residential underground and above-ground storage tanks. Impacts to the environment resulting from fuel oil releases can range from minimal to substantial, as can the complexity and cost to remediate the impacts. Proper management of residential fuel oil storage systems can help minimize the potential for releases. When releases do occur, the Oil Control Program faces a variety of challenges related to mitigating the release source, identifying and delineating the extent of impact, and remediating impacts to the maximum extent practical so that any residual impact does not pose an unacceptable risk to human health and the environment. The presentation will focus on providing information intended to enlighten and educate the audience regarding regulatory requirements, typical response scenarios, remediation objectives, and good management practices associated with residential fuel-oil storage systems.

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

Arsenic in Drinking Water in St. Mary's County: An Intern's Study
Ann Rose and Jonathan Feid, St. Mary's County Health Department
Maryland Room

Naturally-occurring arsenic impacts the drinking water in some portions of St. Mary's County. Owners of wells constructed under current drinking water standards are required to use water treatment technologies when arsenic is detected at levels exceeding the current EPA limit of 10 micrograms per liter (µg/L). The Maryland Geological Survey Report of Investigations 78 maps the extent and range of arsenic in groundwater based on a study of results of water samples collected in 2001 to 2003.

With assistance from a STEM Academy student intern, the St. Mary's Health Department studied drinking water sample results and completion reports of recently-constructed individual wells with reported arsenic levels exceeding 10 µg/L.

The results of the study will be presented along with the outcome of attempts to implement use of a geographic information system to compile the data. The results of outreach to well owners regarding maintenance practices for arsenic treatment units will also be presented. The benefits to local environmental health programs and workforce development through partnership with student interns will be discussed.

Evaluation of an Agricultural Application for a Water Appropriation and Use Permit in the Columbia Aquifer
Robert Peoples, MDE Water Supply Program
Regency Room

This presentation will review a recent application and analysis for a new Water Appropriation and Use Permit in Caroline County for crop irrigation. In Maryland, agricultural water withdrawals greater than an annual average of 10,000 gallons of water per day are required to apply for and obtain a Water Appropriation and Use Permit. The Maryland Department of the Environment Water Supply Program evaluates applications for Water Appropriation and Use Permits in adherence with State law. The basis of Maryland water law is the Reasonable Use Doctrine, which prescribes all landowners have the right to make a reasonable use of the water associated with their property; however, those rights are limited by the rights of other landowners to do the same and the ability of the resource to sustain the request.

The first step in evaluating an application is to ensure the water demand is reasonable relative to the proposed use. For crop irrigation, a water demand estimate is developed in accordance with research from the University of Maryland Agricultural Extension office.

Next, for withdrawals from the unconfined Columbia aquifer on Maryland's Eastern Shore, a hydrologic budget is developed to ensure that adequate recharge occurs at the project site on land owned or controlled by the applicant. Recharge must be greater than the withdrawal. The final analysis is to identify nearby users that utilize the same source. A well records database search is performed. Wells are located by tax map and parcel information. The proposed withdrawal rate is modeled based on aquifer characteristics to determine the amount of drawdown in the local area relative to nearby users.

Case Study: Southern Kent Island Sewer Extension Project

Todd Mohn, P.E. and Steve Cohoon, Queen Anne's County Department of Public Works
Embassy Room

The Queen Anne's County Sanitary Commission has established the South Kent Island Wastewater Subdistrict of the Queen Anne's County Sanitary District. On November 1, 2016, construction contracts were authorized to proceed with the first project phase to extend public sewer which will provide sewer service to nine (9) exclusive communities on South Kent Island (SKI). The areas to receive service have long-standing, documented failing on-site septic disposal systems (OSDS) creating a large public health concern. This project phase represents 60 percent of the overall four (4) phase plan. The collective SKI communities include 1,518 existing single-family residential homes, 8 non-residential uses and a maximum of 632 vacant infill lots. The project will be implemented in four phases over a 10-year period. Phase 1 of the project is estimated to be complete within the next five years. The Community-by-Community phasing schedule is:

Phase 1 - Kent Island Estates & Romancoke on the Bay - 2015-2021
Phase 2 - Tower Gardens - 2018-2023
Phase 3 - Queen Anne's Colony & Kentmorr - 2020-2024
Phase 4 - Chesapeake Estates, Sunny Isle of Kent, Normans & Matapeake Estates - 2021-2025

The County, MDP and MDE worked together to address the pollution caused by failing septic systems, technical issues relating on-site sewage disposal, Smart Growth requirements, anti-growth concerns, alternatives in the design of the proposed sewer system, affordability concerns and State funding requirements.

The proposed SKI service area is not in a Priority Funding Area (PFA) and there was a potential of 1,600 infill vacant lots. Unless there are failing septic systems, areas that are not in the PFA usually are not eligible for State funding. But State law also allows property owners to connect to an adjacent sewer line. In addition, the County needed a number of connections from the vacant lots so that the project would be affordable.
The County enacted an ordinance to merge lots in order to reduce the amount of infill development in the SKI service area to a maximum of 632 lots, a reduction of almost 1,000 lots. The project will provide public sewer to nine communities on SKI bordering the

Chesapeake Bay and the Eastern Bay. This area is of significant public health and environmental concern due to the large number of septic systems penetrating groundwater. Currently, almost all of the septic systems in the SKI service area discharge directly into groundwater and 70 percent are in the Critical Area. The SKI region has a high groundwater table and soils with poor permeability. These two characteristics are unsuitable for on-site sewage disposal systems (OSDS). The high groundwater results in insufficient treatment of pathogens found in sewage. The poor surficial soil permeability limits the utilization of alternative systems that do not penetrate groundwater. These site characteristics also facilitate the delivery of nitrogen to the Chesapeake Bay.

The County's initiative to provide public sewer will overcome the site limitations of the region by segregating the sewage effluent from the high groundwater and will provide superior treatment of the effluent at the existing Kent Narrows / Stevensville / Grasonville (KNSG) WWTP by eliminating pathogens as well as reducing the nitrogen loads to ENR levels.

MDE estimates that 30,400 pounds per year of nitrogen are currently being discharged into the Bay from the SKI service area. After connection to the KN/S/G wastewater treatment, MDE estimates that 13,100 pounds per year of nitrogen will be discharged from the SKI service area. This is a reduction of 17,300 pounds per year of nitrogen, which far exceeds the nitrogen reduction from alternative OSDS systems. This reduction in N loads will also help the County reach about 33 percent of its septic system goal for the Chesapeake Bay Watershed Implementation Plan.

County Staff researched public sewer collection systems nationwide in order to select an appropriate technology for this unique island peninsula service area. Estimated project costs were reduced significantly through the use of the septic tank effluent pumping (STEP) system that limits transmission of effluent to greywater. This technology eliminated the need for intermediate pumping stations and minimized sources for inflow and infiltration. The SKI Sanitary Project strikes a balance between solving a significant public health problem and allowing a limited amount of infill development. The project addresses the conflicts in technical, legal, political and financial issues that arise when projects are proposed to remedy failing septic systems.

Transient Water System Sanitary Surveys (Part 1)
Travis E. Sterner, MDE-Water Supply Program
Wayne Room

This two-part presentation will be geared towards educating County Health Department employees about the Safe Drinking Water Act and how it pertains to Transient Water Systems. The presentation will walk through the inspection form describing each of the eight section, with pictures and relevant examples. Information about the Revised Total Coliform Rule (RTCR) and the Ground Water Rule (GWR) will also be discussed along with

the forms associated with each rule. The presentation will be run in an open format welcoming questions as the presentation proceeds.

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

Drinking Water Health Standards Comparison and Chemical Analysis of Groundwater for 72 Domestic Wells in Bradford County, PA, 2016
John Clune, U.S. Geological Survey
Maryland Room

Groundwater samples were collected from 72 domestic wells throughout Bradford County during the summer of 2016 and analyzed for physical and chemical characteristics, nutrients, major ions, metals and trace elements, volatile organic compounds, gross-alpha particle and gross beta-particle activity, uranium, and dissolved gases, including methane and radon-222. Sampling results are presented in relation to drinking-water standards and are also used to identify natural processes and man-made influences that may explain the observed variations in water quality. A preliminary comparison and data synthesis incorporating other county groundwater studies (Lycoming, Sullivan, Pike and Wayne) will be presented.

Challenges of Source Water Protection Implementation – How One Water System Balances Economic and Public Health Interests (Part 1)
Mark W. Eisner, P.G., Advanced Land and Water, Inc.
Regency Room

Salisbury is a fast-growing municipality situated on and withdrawing groundwater from the extraordinarily productive and vulnerable Salisbury Paleochannel aquifer. Geologists believe that the Paleochannel may be part of the ancestral Susquehanna or Chesapeake Bay delta, deposited during the ice age when sea level was lower but river discharges were higher from glacial meltwater. The very coarse sediments of the Paleochannel suggest a high-velocity, high-discharge depositional environment unlike anything found today on the Eastern Seaboard.

The value of the Paleochannel as an important groundwater resource has been known for decades. The susceptibility to groundwater contamination borne of incompatible land uses also has been a focus of evaluation by MDE and the Maryland Geological Survey and resulted in land-use protection ordinances by both the City of Salisbury and by Wicomico County.

Given all of this, and in cognizance of continuing land-development pressures within the Paleochannel and elsewhere in the source water protection area, ALWI updated the 2003 Source Water Assessment following technical guidance and advice received from MDE. We then worked with the City to develop a customized set of recommendations, centered on

proscriptive land-use restrictions, but also entailing other measures to achieve ongoing source water protection.

Salisbury and Wicomico County already have separate, proscriptive ordinances (one City and one County). However, we found that both ordinances warranted revision. They did not address equally susceptible supply wells outside the Paleochannel and did not reflect differential risks posed by various contaminant species with differential distances and travel times from the release points to the wells. In light of this, we came to develop comprehensive recommendations for a singular multi-jurisdictional ordinance reflective of gradations in both distance (source-to-well) and specific nature of the contamination hazard. For consistency, we also recommend enforcement irrespective of the identity of those inconvenienced or affected.

Not long after the MDE-funded source-water protection plan update concluded, a new wave of development pressure again brought the local press to focus on the Paleochannel and its protection from contamination arising from incompatible land uses. We continue to recommend ordinance consolidation and, even more importantly, that their proscriptive measures be applied and enforced. Our presentation will present and discuss our ordinance recommendations in detail, in the context of recent proposed development activity.

Challenges and Progress in Bringing a Public Sewerage System to Lewistown, MD
Barry Glotfelty, LEHS, Frederick County Health Department and
Kevin Demosky, Frederick County Division of Utilities and Solid Waste Management
Embassy Room

Lewistown is an unincorporated town in northern Frederick County that was founded in 1841. The performance of the aging wells and septic systems in the Town led to the conclusion by the Frederick County Health Department that a public sewerage system was necessary infrastructure for the Town's sanitary needs. As Frederick County pursued upgrading its existing sewage treatment plant serving a public school, it also pursued incorporating the Town into the project. This presentation outlines the intergovernmental relationships and responsibilities of the County and State agencies necessary for the project to be approved and become eligible for funding. Those agencies include the Frederick County Division of Planning and Permitting, Division of Utilities and Solid Waste Management and the Frederick County Health Department; the Maryland Department of Planning; and the Maryland Department of the Environment.

Transient Water System Sanitary Surveys (continued)
Travis E. Sterner, MDE-Water Supply Program
Wayne Room

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

Frequently Asked Questions Regarding Water Appropriation and Use Permits/Exemptions and Well Approvals
John Grace and Robert Peoples, MDE Water Management
Maryland Room

MDE's Water Supply Program collaborates closely with local environmental health departments to ensure safe and adequate water supplies. The issues and questions that arise involving the application of Maryland's Water Appropriation and Use laws are as diverse as the water uses that are regulated. As a result, the Water Supply Program frequently receives inquiries from the local environmental health departments about policies and procedures relevant to the implementations of those laws.

When does the Maryland Department of the Environment (MDE) need to jointly approve Well Construction Applications? How can joint inspection add value to the well site review process? When should an Application for a Water Appropriation and Use permit be submitted to MDE? How do I estimate water demand? Which Water Appropriation and Use Permit applications need to be reviewed by the local environmental health department for consistency with the Master Water and Sewer Plan and local Planning and Zoning? What is a Notice of Exemption and when does it need to be submitted? When does a Residential Subdivision on individual wells need a Water Appropriation and Use Permit?

This presentation will attempt to answer these questions and many more. This presentation is designed for newer sanitarians at the local environmental health departments.

Challenges of Source Water Protection Implementation – How One Water System Balances Economic and Public Health Interests (continued)
Mark W. Eisner, P.G., Advanced Land and Water, Inc.
Regency Room

Septic Connections and Maryland's Chesapeake Bay Restoration
Jim George, Ph.D. and Yen-Der Cheng, MDE Municipal Surface Discharge Permit Division
Embassy Room

The Clean Water Act prohibits anybody from discharging "pollutants" through a "point source" into the "waters of the United States" unless they have an NPDES (National Pollutant Discharge Elimination System) permit. The permit translates general requirements of the Clean Water Act into specific provisions, including nutrient waste load allocations (WLAs) tailored to the operations of each "point source" discharging pollutants. After the implementation of the Chesapeake Bay Nutrient TMDL, point sources such as municipal WWTPs are facing challenges in meeting the nutrient WLAs required in the

NPDES discharge permits while planning for capacity upgrades to meet local growth demands. This presentation provides guidance to municipal WWTPs on how to generate additional nutrient discharge "credits" in their NPDES discharge permits through retirement and connection of on-site disposal systems (OSDS).

Optimizing Process Control for Nitrogen Removal in Small Flow Plants: Enhanced Biological Nitrogen Removal in Plants with Variable Flows & Underloaded Conditions
Brandon Friedland and Gary Lucas, Innovative Treatment Products, LLC
Wayne Room

Small decentralized wastewater treatment plants are often constructed to treat flow from a single development or customer rather than equalized mixed flows from various sources. This type of flow is common at schools, parks, churches, campgrounds, rest stops, convenience stores, shopping centers, etc., and generally does not exceed ~20,000 GPD. Inherently, the flows at these locations vary with the human occupancy, which can fluctuate daily, monthly or seasonally. This fluctuation results in high-flow events (peaks) and low-flow events (valleys) in water usage and sewage created. In the case of schools or campgrounds, a seasonal period of low flow could be up to 3-4 months long.
Daily fluctuations in flow can be a few hundred to a few thousand gallons of wastewater generated. Modern low-flow plumbing fixtures such as toilets, urinals and sinks accentuate the problem by concentrating the wastewater to a much higher level than in the past. These issues inherently lead to complications with the wastewater plants' ability to nitrify and especially denitrify. In Maryland, tight effluent nitrogen limits are paramount to meeting today's Chesapeake Bay nutrient removal goals.

So how does an operator run a biological wastewater treatment process under these extremely variable conditions and achieve high levels of total nitrogen removal? When sizing a system using standard flow consumption protocol, design engineers use published flow and loading parameters that may not exist once the facility is up and running. Turn-down of the process pumps, chemical feed systems and blowers are often a challenge with these types of plants. Control of dissolved oxygen in the aeration and anoxic zones is critical to meeting low levels of effluent nitrogen but is often difficult at best in this type of small wastewater treatment plant.

This presentation will discuss the innovative process strategies of design and controls used by ITP's engineering team to accomplish the goals of meeting high-quality treated effluent with an emphasis on low levels of total nitrogen to satisfy the needs of the Chesapeake Bay watershed.

PRESENTER BIOGRAPHIES

Kevin Barnaba is the President of Home Land Environmental Health Labs and contributor to Home Land Septic Consultant, LLC, a dedicated on-site sewage disposal system evaluation company that has been in business since 2006. He served as the Environmental Health Director for the Harford County Health Department from 2010 to 2016. Prior to becoming the Environmental Health Director, he worked in the On-Site Sewage Disposal Systems Program in Harford County starting in 1990. He is currently an active member on the Education Committee on the Maryland Onsite Wastewater Professional Association (MOWPA). He previously served on the Maryland Air Quality Control Advisory Council (2011-2016), the Maryland Bay Restoration Fund Advisory Committee (2014-2016), Harford County Environmental Advisory Board (2010-2016), Maryland Conference of Environmental Health Directors (2010-2016), and Aberdeen Proving Ground Restoration Advisory Board (2000-2008). He currently lives in Bel Air, Maryland, with his wife Laure and his two children, Aidan and Lila.
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Chuck Boyd is the Director of Planning Coordination for the Maryland Department of Planning. He is responsible for coordinating, preparing, and implementing major policy and management initiatives related to local planning assistance, environmental planning, and infrastructure policy planning. Tasked with a wide range of assignments, Chuck works with staff from the Department, other State agencies, local officials, stakeholders, and the public. He has over 30 years of planning experience working in both the public and private sector.
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Susan Bull is a Supervisor in the Remediation and State-Lead Divisions of the Oil Control Program at the Maryland Department of the Environment (MDE), where she and her staff are responsible for the front-line management, assessment, and remediation of approximately 250 active cases in Western Maryland and on the Eastern Shore. Susan received her Bachelor of Science degree in Biology from York College of Pennsylvania and has spent 20 years working for the Department, primarily with the Oil Control Program.
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Yen-Der Cheng is Chief of the Municipal Surface Discharge Permit Division for the Maryland Department of the Environment. This Division is responsible for issuing discharge permits for all the municipal WWTPs in Maryland. Yen-Der has been working for MDE for 15 years with experience in the planning, development and implementation of the Chesapeake Bay TMDL and local TMDLs.
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John Clune is the Principal investigator in Pennsylvania for the Bradford and Clinton County Groundwater Baseline Study, Glaciated Regional Curves Project and is working on the National Water-Quality Assessment (NAWQA) Program's study effort to describe past/future changes in Nitrogen in the Chesapeake Bay from 1960-2060. He provided research in Maryland/Delaware for the NAWQA Program, USGS Priority Ecosystems and Chesapeake Bay Small Watershed Studies. John is currently pursuing a Ph.D. at Pennsylvania State University.
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Steve Cohoon is the Public Facilities Planner with Queen Anne's County Department of Public Works. Steve grew up on the Eastern Shore living in and attending schools in Caroline and Talbot Counties before receiving his A.A. degree at Chesapeake College. He then attended Frostburg State University, receiving a Bachelor of Science degree in Geography with concentrations in Cartography and Urban Planning. He continued taking class work towards a Master's degree in Public Administration–Parks and Recreation and Resource Management at Frostburg State. Steve started his career with Queen Anne's County Planning and Zoning in 1996 as an entry-level planner, and throughout his employment with the County worked his way to the position of Director of Planning and Zoning. In 2015, he transferred to the Department of Public Works to focus on transportation, infrastructure and public facilities planning.
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Victor D'Amato, P.E. is an Associate Director with Tetra Tech. He is a registered professional engineer with 24 years of varied water-quality engineering experience. He holds a B.S. in Civil Engineering from Penn State and an M.S. in Water Resources Engineering from UNC-Chapel Hill. Victor has nationally-recognized expertise in innovative wastewater infrastructure planning and implementation, including the use of distributed and decentralized systems. He also has extensive experience reducing nutrient pollution at multiple scales ranging from individual treatment systems to large watersheds, including the Chesapeake Bay watershed.
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John J. Dano, P.E. works as HRSD's Chief of Planning and Analysis. He is also currently serving as the Program Manager for HRSD's Sustainable Water Initiative for Tomorrow. John is a Professional Engineer, a project management professional, and an Envision Sustainability Professional. He has a passion for water; he enjoys water-related activities such as surfing, kayaking, fishing and snowboarding, and has been working in the water industry for over 20 years. John has a Bachelor's and Master's degrees in Civil Engineering from Virginia Tech, and a Master's degree in Management and Leadership from the Catholic University of America
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Kevin Demosky is the Director of the Division of Utilities and Solid Waste Management for Frederick County. He was appointed as Director in December 2010 and preceding that was the Deputy Director for five years. The Division is responsible for two enterprise funds: Water and Sewer, and Solid Waste Management, which is divided into seven areas of responsibility: Accounting & Finance Support, Engineering & Planning, Regulatory Compliance, Solid Waste Management, Wastewater Treatment/Disposal, Water Purification/Distribution, and Water & Wastewater Maintenance. Kevin received a B.S. in Civil Engineering from the West Virginia Institute of Technology (now WVU Tech). He began his 29-year career with Frederick County as a Design Engineer, became the Department Head of Engineering and Planning in 2000 and has been largely involved in the planning, engineering and construction of various capital water, sewer and solid waste projects.
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Elaine Dietz is Chief of the Maryland Water Quality Financing Administration's Capital Planning and Financing Division for the Maryland Department of the Environment. She is responsible for capital project selection, capital budget preparation, and program management of the two State Revolving Fund programs, as well as Maryland's Water Supply Grant and the Bay Restoration Fund programs. Ms. Dietz has a B.S. in Marine Biology from Fairleigh Dickinson University (Madison, New Jersey, and St. Croix, U.S.V.I., campuses) and an M.S. in Biology from Wright State University (Ohio).
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Aaron W. Duke, P.E., BCEE is an Associate Vice President with Hazen and Sawyer and has been working in the water industry for 18 years. He received his Bachelor's and Master's degrees in Environmental Engineering from the University of Michigan. Mr. Duke is Hazen and Sawyer's Mid-Atlantic Drinking Water Practice leader, is the Corporate Lead for Water Treatment Residuals, and is active on the AWWA WTP Residuals Management Committee. A Professional Engineer registered in MD, DC, VA and NY, and a Board Certified Environmental Engineer, he specializes in drinking-water treatment and water reuse studies and design.
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Mark W. Eisner, P.G. possesses more than 30 years of professional hydrogeological experience and is the founder and President of Advanced Land and Water, Inc. Mr. Eisner's foremost technical expertise is in matters relating to water resources, including the occurrence, movement, use and management of groundwater methods for its safe and sustainable development, and its susceptibility to contamination. Mr. Eisner has testified as an expert on matters related to groundwater and surface water resources. Specific areas of his technical expertise include mathematical modeling of hydrogeologic systems, pumping tests, and groundwater contamination investigation. He holds Bachelor's and Master's degrees in Geology from the Universities of Maryland and Delaware and holds active Professional Geologist licenses in Delaware, Pennsylvania and Virginia.
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Jonathan Feid is an intern/volunteer with the St. Mary's County Health Department and a senior attending the STEM Academy at Great Mills High School. Jonathan's career interests include environmental engineering.
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Brandon Friedland is a graduate of the University of Delaware where he studied Business Sciences with a focus in Marketing and Product Development. He was hired as the Marketing Manager for Kershner Environmental Technologies, LLC's Aftermarket Program in 2014. He later transferred to ITP, LLC as the Director of Sales & Marketing in early 2015. There, he developed business systems and marketing materials for ITP, LLC. He has been instrumental in product development, system integration and vendor communications. As a recent graduate, he brings a new entrepreneurial approach to a thriving industry.
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James (Jim) George, Ph.D. is employed by the Maryland Department of the Environment, Water and Science Administration. He received his B.S. in Physics from the University of California at Santa Barbara in 1985 and his Ph.D. from the Johns Hopkins University's Department of Geography and Environmental Engineering in 1997. He worked in environmental consulting during the late 1980s.

Jim began with the Department of the Environment in 1990 conducting research and practical applications of Stormwater Management Financing. This work culminated in the implementation of Maryland's first Stormwater Management Utility in Takoma Park, MD. He established the State's first stormwater control tracking database, which is a precursor to the current tracking system used to report progress on Chesapeake Bay restoration.

Jim was involved in developing Maryland's 1995 Tributary Strategies for reducing nutrients and served as staff to the Blue Ribbon Panel on Financing the Tributary Strategies. He served as the Department's Growth Management Coordinator prior to being tasked with leading a program to conduct total maximum daily load (TMDL) analyses for Maryland.

Jim developed the State's TMDL program during the late 1990s and early 2000s. This was during a period of litigation initiated across the country by environmental organizations who were challenging EPA's oversight of state TMDL programs. In 2005, after briefly serving as technical advisor to the Director of the Department's Science Services Administration, Jim was tasked with managing the newly-established Water Quality Protection and Restoration Program responsible for the State's Nonpoint Source Program and coordinating TMDL implementation. From 2009 to the present, his program led the development of Maryland's Watershed Implementation Plans for restoring the Chesapeake Bay.
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Barry Glotfelty, LEHS is a licensed Environmental Health Specialist who has been working in the fields of environmental health and the protection of groundwater for 35 years. He received his Bachelor of Science degree in Agronomy from the University of Maryland in 1980 and began his career at the Frederick County Health Department in 1982. Subsequently, he worked for MDE for 27 years, most notably as the Chief of the Wastewater Permits Program's Onsite Systems Division. He returned to the Frederick County Health Department in 2014 as the agency's Director of Environmental Health. A lifelong Maryland resident, he is a past President of the Mid-Atlantic Association of Soil Scientists and will be serving as the President of the Maryland Association of Environmental Health Directors in 2018.
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John Grace serves as the Division Chief of the Source Water Protection and Appropriations Division within the Water Supply Program in the Maryland Department of the Environment. This Division works to protect drinking water supply sources and to ensure that the water resources of Maryland are conserved and managed in the best interest of the people of Maryland. This Division is responsible for evaluating water withdrawal requests and developing permits for all types of water uses within Maryland. The Division provides ongoing assistance to local governments to protect sources of drinking water. John strives for collaboration within the Department, other State agencies, local governments and interested persons to achieve the mission of ensuring safe and adequate water supplies. John has worked for Maryland for the past 32 years, and within the Water Supply Program since 1989, after several years of working in Rhode Island in environmental consulting and for Rhode Island DEM. John received a B.S. from Allegheny College (Meadville, PA) in 1978 and a M.S. in Civil and Environmental Engineering from the University of Rhode Island in 1981.
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Eliza Gross is a Physical Scientist with the U.S. Geological Survey Pennsylvania Water Science Center in New Cumberland, PA. Since joining the Pennsylvania Water Science Center in 2007, she has worked on multiple groundwater water-quality projects involving geospatial and statistical analysis of groundwater-quality data and the relation of groundwater-quality concentrations to human health standards. Some of her most recent projects include evaluating radon occurrence in groundwater and indoor air in Pennsylvania. She graduated with a M.S. in Geoenvironmental Studies from Shippensburg University and a B.A. in Geography from Millersville University.
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Gary Lucas has over 16 years of industry experience with water and wastewater treatment systems with the use of UF membranes. Before being hired as the Director of Engineering for ITP, LLC, Gary worked for Dynatec Systems, Inc. There he was instrumental in the development, design and production of the Dynalift UF Membrane systems. Gary brings a wealth of experience and knowledge to the table, offering training and developmental foundations to current and future ITP, LLC employees.
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Drew Miller, P.G. is Chief of the Remediation and State-Lead Divisions of the Oil Control Program at the Maryland Department of the Environment (MDE) where he and his staff are responsible for managing the assessment and remediation of over 800 active cases. Mr. Miller received his Bachelor of Science degree in Geology from Colorado State University and spent more than 20 years in the environmental consulting field dealing primarily with petroleum impacted sites prior to joining the MDE in 2012.
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Todd R. Mohn, P.E. was appointed as the Director of the Queen Anne's County Department of Public Works in 2008. He is a registered Professional Engineer in the State of Maryland. Before assuming the position as Director, he served as Deputy Director for nine years, Chief Roads Engineer for six years and as Civil Project Engineer for two years. As Director, Mr. Mohn manages the departmental administrative support functions, for the Engineering & General Services Division, the Roads & Solid Waste Division and the Property Management Group. Mr. Mohn also serves as the Chief Administrative Officer for the County's Sanitary District and their respective Water & Wastewater Divisions. Mr. Mohn holds a Bachelor of Science Degree in Civil Engineering and a Bachelor of Science Degree in Land Surveying from Purdue University and an Associate's Degree in Engineering from Penn State. Mr. Mohn is currently serving as President of the County Engineers Association of Maryland.
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Zachary M. Neal possesses a Bachelor's degree in Environmental Science from the State University of New York College of Environmental Science and Forestry (SUNYESF). His main areas of study included hydrogeology, hydrology, and limnology. His environmental consulting profession began at Advanced Land and Water, Inc., where he has remained since early 2012. His work focuses on aspects of water supply development and contaminant transport and fate analysis. Zachary has been involved in a number of evaluations in which he has studied and characterized paired surface water-groundwater systems using a variety of scientific methods.
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Janice Outen is the Manager of the Water Resources Planning Division for the Maryland Department of the Environment, where she is currently responsible for the review and approval of County Water and Sewerage Plans. She previously worked for Baltimore County and gained extensive experience in water-quality management programs as well as in the environmental review of land development projects. She drafted two major environmental laws for the County: Article 33, Title 3 of the Baltimore County Code - *Protection of Water Quality, Streams, Wetlands and Floodplains* and Article 33, Title 6 - *Forest Conservation*. Janice holds a B.A. in Biological Sciences from Towson University and a M.H.S in Environmental Health Engineering from the Johns Hopkins University. She also attended the University of Maryland School of Law.
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Robert Peoples is a Geologist with the Source Protection and Appropriation Division of the Water Supply Program of the Maryland Department of the Environment. He is responsible for evaluating potential adverse impacts of large water withdrawals from ground and surface water sources in Maryland. He is a member of the Maryland State Board of Well Drillers. He received his Bachelor's in Environmental Studies with a concentration in Resource Management from Shepherd University.
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Aaron Rosenblatt, a *Principal* of Gordon & Rosenblatt, advises healthcare institutions, real estate firms and non-governmental organizations (including NSF International), on matters involving water and public health. His work for NSF International includes the development of education programs on *Disease and Injury associated with Building Water Systems*. He is a member of ASHRAE Standard 188 Committee, *Legionellosis: Risk Management for Building Water Systems* and Vice Chair of NSF Standard 444 Committee, *Prevention of Injury and Disease Associated with Building Water Systems*. He has authored more than twenty issued US patents. He is a graduate of The Johns Hopkins University.
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Amy R. Sapkota, Ph.D., M.P.H is a University of Maryland researcher specializing in environmental microbiology, environmental microbial genomics, exposure assessment and environmental epidemiology. Her projects focus on evaluating the complex relationships between environmental exposures and human infectious diseases. Dr. Sapkota is the Project Director of CONSERVE: A Center of Excellence at the Nexus of Sustainable Water Reuse, Food, and Health. She received a Ph.D. in Environmental Health Sciences from the Johns Hopkins Bloomberg School of Public Health, and an M.P.H in Environmental Health Sciences from the Yale School of Public Health.
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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 to develop regional GIS coverages of the aquifers and confining units of the Coastal Plain. He received his B.A. in Geology and Environmental Studies from Macalester College and his M.S. in Geology from the University of Wisconsin-Madison.
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Travis Sterner received a B.S. in Environmental Resource Management from Penn State University in 1996. He started working for MDE in 1998 in the Source Water Protection division writing Source Water Assessment reports and doing Ground Water Under the Direct Influence investigations. Later he was moved to the Safe Drinking Water Act division where he was the Ground Water Rule manager. As the rule manager, Travis was responsible for writing the regulations and training various entities about the GWR Regulations. He is now working in the Engineering and Technical Assistance Division performing inspections of Transient Water Systems in counties that don't have delegation agreements with MDE to perform those inspections.
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Ching-Tzone Tien, Ph.D., P.E. is a division Chief of the Groundwater Discharge Permits Division, Maryland Department of the Environment (MDE). He received his B.S. in Civil Engineering from the National Taiwan University, and his M.S. and Ph.D. in Civil and Environmental Engineering from the University of Delaware. He has been working in the areas of groundwater hydrology and water quality protection with MDE for the past 40 years. Between 2007 and 2014, he presented two courses in the Professional Master of Engineering (ENPM) Program at the University of Maryland-College Park. He is a Professional Engineer registered in the State of Maryland.
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Tiffany VanDerwerker, P.G., is a Hydrogeologist with the Maryland Geological Survey and a licensed Professional Geologist (NC). Her work at MGS focuses on groundwater quality and chemistry. She attended Virginia Tech, where she received both her Bachelor's and Master's Degrees in Geosciences. During her graduate studies, she created a statistical model to determine geologic units in Virginia that are more likely to have elevated arsenic in groundwater.
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