Compendium of Abstracts

NYC Watershed/Tifft Science & Technical Symposium

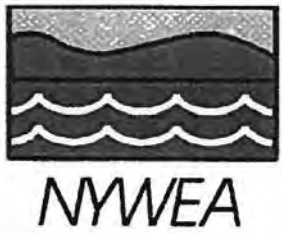
September 18–19, 2013 Thayer Hotel, West Point

NYWEA
LEADING THE WAY IN WATER QUALITY MANAGEMENT

New York Section
American Water Works Association

New York State DOS Department of State

Sponsored by:



Other Conference Sponsors:

The New York State Department of Health
The New York State Department of Environmental Conservation
The New York State Environmental Facilities Corporation
The New York City Department of Environmental Protection
The Catskill Watershed Corporation
The Watershed Agricultural Council
The United States Geological Survey

TABLE OF CONTENTS

Introduction and Acknowledgements 1

Freshwater Bryozoan Pectinatella Magnifica and Other Potential Biofouling Organisms in New York City's Kensico Reservoir—*Kerri Alderisio,* NYC Department of Environmental Protection..... 2

Advances in UV Technology and the Option to use UV for 4-Log Virus Disinfection During Primary Disinfection of Groundwater—*Scott Bindner, Adam Festger, Terry Keep,* Trojan Technologies..... 2

Use of Calcite Beds for Iron and Manganese Removal—*Tim Bradley,* Omya 2

Use of Water Chemistry and Geochemical Modeling to Identify Sources of Groundwater Flooding, Wawarsing, NY—*Craig Brown, Ph.D., Frederick Stumm, Anthony Chu,* U.S. Geological Survey; *William Richardson,* NYC Department of Environmental Protection..... 3

Investigation of Alternative On-Site Sewage Disposal Systems Capable of Meeting Effluent Total Nitrogen Requirement of 10 mg/L or Less—*Eliora Bujari,* H2M Group 3

Proposed Nutrient Criteria for Drinking Water Lakes and Reservoirs—*Clifford Callinan, P.E., Ron Entringer,* NYS Department of Environmental Conservation; *Jim Hyde,* NYS Department of Health; *John Hassett,* State University of New York, Environmental Science and Forestry 4

UV Disinfection for Unfiltered Surface Water Regulatory Compliance—*Kevin Castro, P.E.,* GHD Inc. 4

Effective Use Of Filter Pilot Testing And Chlorine Dioxide Demonstration Testing To Optimize Treatment Plant Performance—*John Civardi, P.E., Mark Tompeck,* Hatch Mott MacDonald*; Marc Lucca,* Aqua Pennsylvania 4

Innovative Strategies for Removing Emerging Contaminants for Indirect Potable Water Reuse; Oak Bluffs, MA Case Study—*Marc Drainville, P.E.,* GHD Inc. 5

NYSDEC Programmatic and Regulatory Implementation of Numeric Nutrient Criteria for Drinking Water—*Ronald Entringer, P.E., Clifford Callinan,* NYS Department of Environmental Conservation..... 5

Life-Cycle Project Management: EIS and Permit Integration—*Jennifer Farmwald,* NYC Department of Environmental Protection 6

Linking Air Quality Protection to Watershed Protection—*Lorraine Farrell, P.E.,* NYC Department of Environmental Protection..... 6

Volute Press Application on Water Treatment Plant Residuals—*Richard Gell, P.E.,* O'Brien & Gere 6

Numeric Endpoints and Adaptive Management: New York's First Stream Nutrient TMDL— *Steve Gladding, Ph.D., Brian Duffy,* NYS Department of Environmental Conservation; *Tammo Steenhuis, Steve Pacenka,* Cornell University, Biological and Environmental Engineering 7

Navigating Hydrofracking In New York State - Review of Local Impact Concerns— *Paul Granger, P.E.,* H2M – Water 7

HABs in NYS: Toxin Occurrence, Suspected Health Impacts, and Development of Response Protocols—*James Hyde, Erin DeConno, Eric Wiegert, Ellen Braun-Howland,* NYS Department of Health; *Scott Kishbaugh,* NYS Department of Environmental Protection 8

Incorporating Affordability in Water & Wastewater Utility Planning—*Sangamithra Iyer, P.E.,* NYC Department of Environmental Protection....8

How Will the Integrated Planning Approach Affect Your Long Term Control Plan—*Vijesh Karatt Vellatt, P.E., Rebecca Schaefer,* Greeley and Hansen....8

Treatment of Emerging Environmental Contaminants in Water—*Terry Keep,* Trojan Technologies; *Adam Festger,* Market Manager Drinking Water and ECT....9

Simplifying Onsite Wastewater Treatment Using Containerized Membrane Bioreactors (MBR)—*Fraser Kent, Ph.D., P.E., Michael Lee,* H2O Innovation....9

A Centralized Approach for Managing Shale Gas Wastewater and Residuals—*Jerry Leone,* Casella Waste Systems, Inc. 10

Sediment Quality Assessment of New York Watersheds—*Stephen Lewandowski,* United States Military Academy....10

Impact of Cold Weather Operations on Nitrogen Removal Performance for Deep Bed Denitrification Filters in the Northeast United States—*Gary Lohse, P.E., Ken Wineberg,* Severn Trent Services....11

Green Stormwater Infrastructure Design: Lessons Learned in Philadelphia—*Stephen Maakestad, P.E.,* Hatch Mott MacDonald....11

Wetland Mitigation for the Route 28A Realignment Project in Ulster County, NY: Results From Three Years of Post-Construction Monitoring—*Laurie Machung, Frank Parisio, Maria Tupper-Goebel, Kristopher Lovelett,* NYC Department of Environmental Protection....11

Total Coliform Issues and Complying with The Revised Total Coliform Rule With Effective Water Well Rehabilitation and Maintenance—*Neil Mansuy,* Subsurface Technoligies Inc. 12

Hydrological impact of Hurricane Irene and Tropical Storm Lee in Historical Context: Is the Frequency and Magnitude of Extreme Hydrological Events Changing in Southern New York State?—*Adao Matonse, Ph.D., Allan Frei, Ph.D.,* City University of New York Institute for Sustainable Cities; *David Laounsbury, Donald C Pierson,* Ph.D., NYC Department of Environmental Protection....12

Ashokan Reservoir Turbidity: 1987-2012—*James Mayfield,* NYC Department of Environmental Protection....13

Orange County, NY Water Supply Development and NYSDOS Grant Funding—*Ginger Modafferi, P.E., Michael Principe, Ph.D.,* HDR Engineering, Inc; *Peter Hammond,* Orange County Planning Department; *David Church,* Orange County Water Authority....13

Cured-in-Place Pipe Rehabilitation for Water Transmission Mains - Roses and Thorns—*Paul Mourt, P.E.,* Hatch Mott MacDonald....13

Comparing Centralized and Decentralized Treatment for Reduction of DBPs through Bench- and Pilot-Scale Studies—*Chandra Mysore, Ph.D., P.E.,* GHD Inc. 14

Commissioning The World's Largest UV Disinfection Facility Overcoming Challenges Through Cooperation—*William Nylic III, P.E., Gary Kroll, P.E., Brian Kearney, P.E.,* CDM Smith; *George Schmitt, P.E., Jasmin Rivera, P.E.,* NYC Department of Environmental Conservation; *Richard Fahey, P.E.,* Hazen and Sawyer....14

Using Historical Data to Assess Potential Fecal Coliform Contribution During Storms at Kensico Reservoir: A Case Study—*Christian Pace, Kerri A. Alderisio,* NYC Department of Environmental Protection 14

Water for the Future Supply Augmentation Need Planning—*Mark Page Jr.,* NYC Department of Environmental Protection..... 15

Snowpack Monitoring in the New York City Water Supply Region: Past, Present, and Future— *James H. Porter, Ph.D., Glenn D. Horton*, NYC Department of Environmental Protection 15

Full-Scale Testing of Innovative High Rate Filter Media for Plant Expansion—*Robert Raczko, P.E., James Mastrokalos*, United Water 16

Full Scale and Pilot Scale Evaluation of EDC Removal through WTP Processes—*Robert Raczko, P.E., John E. Dyksen* , United Water 16

An Enhanced Hydro-Ecological Model (RHESSys) to Explore Climate Change Interactions Between Precipitation Patterns, Topography and Forests in a New York City Water Supply Watershed—*Antoine Randolph,* City University New York, NYC Department of Environmental Protection; *Larry Band Ph.D.,* UNC Chapel Hill; *Christina Tague Ph.D.,* UC Santa Barbara; *Elliot Schneiderman Ph.D.*, NYC Department of Environmental Protection 17

A Tale of Three WWTPs—*Robert Ravallo,* NYC Department of Environmental Protection 17

Use of a Kinetic Dye Adsorption Test for Predicting Granular Activated Carbon Performance— *Adam Redding, Ph.D.*, Siemens Industry, Inc.; *Michael Greenwald, Fred S. Cannon,* Penn State University; *Joseph Roccaro*, Suffolk County Water Authority 17

Extreme Events in the Major Rivers of New York State—*Nicholas Rossi, Richard Palmer*, UMass Amherst..... 18

Ice Cover in New York City Drinking Water Reservoirs: Modeling Simulations and Observations— *Nihar Samal, Ph.D.*, Institute for Sustainable Cities, Hunter College of City University of New York; *Donald C. Pierson, Mark S. Zion,* NYC Department of Environmental Protection; *Klaus D. Joehnk,* CSIRO Land and Water..... 18

NYC's Waterborne Disease Risk Assessment Program - 20 Years Later: Program Implementation and Data Findings—*Anne Seeley, David Lipsky,* NYC Department of Environmental Protection; *Sharon Balter, Daniel Cimini, Lisa Alleyne*, NYC Department of Health and Mental Hygiene 18

The Effect of Temperature on the Formation of Disinfection By-Products—*Vladimir SotoSanchez,* United States Military Academy..... 19

Major Changes in the Phase I ESA Standard: Implications for Watershed Protection?— *Stuart Spiegel,* O'Brien & Gere Engineers, Inc. 19

Hydrologic Effects of the Rondout-West Branch Water Tunnel on the Groundwater-Flow System in Wawarsing, New York—*Frederick Stumm, Ph.D., Anthony Chu,* U.S. Geological Survey; *Ira Stern,* NYC Department of Environmental Protection..... 20

DBP Control Strategies: Source Water, Treatment, and Distribution System—*Philip Tangorra, Connie K. Schreppel,* Mohawk Valley Water Authority..... 20

Rapid Response to a Swallow-Wort Infestation at the Pepacton Reservoir—*Meredith Taylor, Barbara Dibeler*, (Retired), NYC Department of Environmental Protection; *Chris Zimmerman, Amanda Czechowski*, The Nature Conservancy 21

Land Acquisition: Quality and Quantity Considerations- Strategic Evolution in NYC's Watershed Land Acquisition Program—*David Tobias*, NYC Department of Environmental Protection..... 21

Don't We all Need Validation? An Overview of UV Disinfection Testing Requirements—*Matthew Valade, P.E.*, Hazen and Sawyer 21

Recent Storm Activity and its Effect on Turbidity Levels in Neversink Reservoir—*Richard Van Dreason*, NYC Department of Environmental Protection..... 22

Westchester County GIS Products and Services for Collaborative Watershed and Land Use Planning—*Sam Wear*, Westchester County 22

Coagulation and Microfiltration for Disinfection Byproduct Control on Low SUVA and Low Turbidity Delaware Aqueduct Water—*Andrew Weiss, P.E., Kevin Castro, P.E.*, GHD Inc.; *James Osborne, P.E.* Town of Newburgh 22

Advanced Techniques for Monitoring NOM and Controlling DBPs—*Ben Wright, P.E., Bill Becker*, Hazen and Sawyer; *Dave Reckhow*, University of Massachusetts; *Steve Schindler*, NYC Department of Environmental Protection 23

Air Bubble Column Dynamics in Water and Wastewater Treatment Process- A Review of Recent Advances in CFD Application—*Sean Zhang, Ph.D., P.E., Julie Herzner, Bill Becker*, Hazen and Sawyer, P.C. 23

Water Quality Modeling used to Inform Operational Decisions for the NYC Water Supply: A Ten Year Retrospective—*Mark Zion, Donald C. Pierson, Elliot M. Schneiderman*, NYC Department of Environmental; *Adao Matonse*, City University of New York, Institute for Sustainable Cities 23

INTRODUCTION AND ACKNOWLEDGMENTS

Dear Conference Participants,

In 1997, the signatories to the historic New York City Watershed Agreement formed an enduring partnership to protect and enhance the City's Watershed and the scores of communities living within it. Underlying this complex social and political undertaking has been an unprecedented technical initiative among scores of local, State and Federal agencies with one common goal: to advance the science of watershed protection.

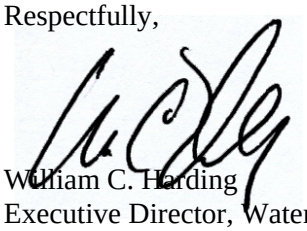
The Watershed Science and Technical Conference was created more than a decade ago as an annual opportunity to bring scientists, professionals, and other experts together with watershed stakeholders and the public, to technically inform, exchange ideas, and unveil new information regarding the protection of the nation's largest unfiltered surface water supply.

For 2013, along with the usual presentation of the most current scientific trends and data regarding the New York City Watershed and other water supplies across the country, the conference acquires a new and esteemed partner, the New York Section of the American Water Works Association (NYSAWWA). NYSAWWA brings expertise in the areas of water treatment, supply, infrastructure, and many other aspects of clean water. Its professional membership is a welcome addition to this conference, and will undoubtedly add to our attendee's experience. This new partnership gives rise to the new conference name: The NYC/Tifft Watershed Science and Technical Symposium, in honor of Edwin C. Tifft, a founding father of NYSAWWA's annual technical gathering.

This year's symposium continues the theme of flood recovery, community resilience, and the technical challenges posed to water supply professionals by more frequent and severe storm events. We are still recovering from storms Irene, Lee, and Sandy, and while we have come far, much remains to be done – and learned. Thus, the 2013 conference will showcase some of the data and information developed concerning the magnitude of these past disasters, the technical aspects of current recovery efforts, and what we have learned about the realities of readiness for future flood events.

In addition to our esteemed presenters and all those who submitted their scientific endeavors, we wish to thank the many agencies, professional organizations, and individuals who contributed to the success of this conference. It is our hope that all who attend will be edified by the scientific data presented, and inspired by the dedication and hard work of those who, each day, advance our insight into the science of protecting the drinking water for 9 million New Yorkers.

Respectfully,



William C. Harding
Executive Director, Watershed Protection and Partnership Council

For the Conference Organizers and Sponsors:

The Watershed Protection and Partnership Council
The New York Water Environment Association, Inc.
The New York Section, American Water Works Association
The New York Water Environment Association, Inc.
The New York State Department of State
The New York State Department of Environmental Conservation
The New York State Department of Health
The New York City Department of Environmental Protection
The Catskill Watershed Corporation
The Watershed Agricultural Council
The United States Geological Survey
The New York State Environmental Facilities Corporation

Freshwater Bryozoan Pectinatella magnifica and other Potential Biofouling Organisms in New York City's Kensico Reservoir

Kerri Alderisio, NYC Department of Environmental Protection

It is not uncommon for untreated waterways to become inhabited by invertebrate animals such as those in the Class Phylactolaemata of the Phylum Bryozoa. There are both salt water and fresh water species of bryozoans, and Phylactoaemata is comprised of exclusively freshwater types such as those we see in our reservoir system. Bryozoans are organisms that thrive in relatively clean standing or flowing water, and feed on select small plankton, bacteria and flagellates. They grow on submerged logs and rocks, and *Pectinatella magnifica* can also produce floating colonies. *P. magnifica* is the most easily observed and identified species in some New York City reservoirs since it is present from spring through fall, and, as its name implies, it can grow to significant size with the gelatinous colonial masses reaching several feet in diameter. The colonial form of this organism is mostly made of water and is home to hundreds of zooids that filter the reservoir water.

Bryozoan colonies have been seen in the Catskill and Delaware system reservoirs (West of the Hudson River) as well as Kensico Reservoir (East of the Hudson River) for many years. Positive identification of *P. magnifica* in Kensico Reservoir dates back to 1990, and there are verbal reports by operators noting the presence of this organism even earlier; however, no deleterious effects from these organisms had been observed. In the fall of 2012, NYC experienced Hurricane Sandy and also began operation of its Ultra-Violet Treatment Plant just downstream of Kensico Reservoir. Ultimately, the gelatinous material from the bryozoan colonies was observed within the Kensico intake facility and piping at the UV plant. This presentation will provide a summary of that event and an update on the status of bryozoa, and other biofouling organisms, found in the reservoir.

Kerri Alderisio
NYC Department of Environmental Protection
465 Columbus Avenue
Valhalla, NY 10595
Phone: (914) 773-4423
Email: *kalderisio@dep.nyc.gov*

Advances in UV Technology and the Option to use UV for 4-Log Virus Disinfection During Primary Disinfection of Groundwater

Scott Bindner, Adam Festger, Terry Keep, Trojan Technologies

Groundwater is an important source of municipal drinking water in New York State where nearly 5000 public water systems (PWS) treat over 600 million gallons of groundwater each day. Due to its "natural" filtration, water from groundwater aquifers is generally considered to contain fewer pathogens than from surface waters. However, there are concerns that groundwater supplies are becoming increasingly exposed to pathogens including bacteria and viruses due to aging and expanding wastewater collection systems as well as failing septic systems. As a result of these concerns as well as federal guidelines including the United States Environmental Protection Agency's Groundwater Rule which in many cases requires 4-log (99.99%) disinfection of enteric viruses, some PWS facilities have enhanced the level of primary disinfection before treated groundwater water enters distribution systems.

Primary disinfection of groundwater, in particular virus disinfection, is often carried out with chlorine. However, recent advances in UV technology have resulted in third-party-validated UV systems designed for 4-log inactivation of virus (including adenovirus) with a single low-pressure high-output (LPHO) UV system. Several small communities that depend on groundwater for their drinking water supply have evaluated UV to be the best approach to primary disinfection at their respective facilities for a number of reasons. First, UV provides a low-cost approach to virus treatment that requires minimum footprint and avoids excessive doses of chlorine and/or costly infrastructure improvements such as contact tanks that may be required to maintain appropriate chlorine contact time. Secondly, decreased dependence on chemicals for disinfection reduces the potential for harmful chemical by-products such as trihalomethanes (THM) and haloacetic acids (HAA), to be generated during distribution. This presentation discusses the benefits of using UV to meet guidelines for groundwater disinfection as well as highlights UV performance at particular PWS sites where UV is installed for 4-log virus inactivation.

Scott Bindner
Trojan Technologies
3020 Gore Road
London, Ontario N5V4T7
Phone: (519) 763-1032
Email: *sbindner@trojanuv.com*

Use of Calcite Beds for Iron and Manganese Removal

Tim Bradley, Omya

The use of Calcite Contactors for the removal of Iron and Manganese.

Calcite Contactors are used extensively throughout Europe for the removal of Iron and Manganese. This paper will describe the system configuration which has been successfully utilized for decades. A case will be made that Calcite Contactors offer a cost effective means for the treatment of low pH waters containing Iron and Manganese. The fresh water in Northern Germany is low in pH and high in Fe and Mg. A two stage Calcite bed system is utilized to

raise the pH, precipitate and capture the Fe and Mg which is caught in the calcite bed and removed by back flushing. The captured Fe is reused in a Waste Treatment application.

In the paper I will provide specifics on the following:

- System Configuration
- Water Quality specifics, incoming and treated
- Calcite granule properties including sizing, mineralogy, morphology, handling and usage will be reviewed.

Operating experience over the past three decades will be shared.

Tim Bradley
Omya
14 Roberts Lane
Saratoga Springs, NY 12866
Phone: (802) 558-1038
Email: *tim.bradley@omya.com*

Use of Water Chemistry and Geochemical Modeling to Identify Sources of Groundwater Flooding, Wawarsing, NY

Craig Brown, Ph.D., Frederick Stumm, Anthony Chu, U.S. Geological Survey; William Richardson, NYC Department of Environmental Protection

Groundwater flooding of basements in the Rondout Valley near the Town of Wawarsing, Ulster County, NY, was studied by the U.S. Geological Survey, in cooperation with the NYCDEP, to characterize the groundwater-flow system of the area. The study also helped address community concerns regarding flooding-related issues in the Town of Wawarsing; programming and support was adjusted based on the results of these studies and plans for repairing the Rondout-West Branch Tunnel. Water chemistry, stable isotopes, and age tracers were interpreted with hydrogeologic data to help identify and distinguish between water sources, including stormwater and a leaking segment of a NYC water tunnel, that may contribute to the groundwater flooding. A leaking segment of the Rondout-West Branch water tunnel passes about 700 feet beneath Wawarsing and carries pressurized water from the Catskill Mountains to New York City.

Water samples from bedrock wells in the study area generally had higher concentrations of SO_4^{2-} and Cl^- and lower concentrations of Ca, HCO_3^-, and CO_3^{2-} compared to samples from most wells screened in the unconsolidated aquifer, and from springs. Stable-isotope ratios among $\delta^{18}O$, δD, $\delta^{34}S$ of SO_4^{2-}, and $^{87}Sr/^{86}Sr$ were used to help distinguish water tunnel from native groundwater. Sr concentrations and $^{87}Sr/^{86}Sr$ ratios, for example, are distinctly different among samples from most bedrock wells and samples from tunnel water. Age-tracer data for chlorofluorocarbons and sulfur hexafluoride provided some useful information about pathways of the groundwater-flow system, but were limited by inherent problems with dissolved gas data from bedrock wells caused by excess air and degassing from high concentrations of H^2S and CH4. Water chemistry data and mixing models were used together with hydrogeologic data to assess the relative contribution of tunnel water and native groundwater to local groundwater and springs related to flooding.

Craig Brown, Ph.D.
U.S. Geological Survey
101 Pitkin Street
East Hartford, CT 06108
Phone: (860) 291-6766
Email: *cjbrown@usgs.gov*

Investigation of Alternative On-Site Sewage Disposal Systems Capable of Meeting Effluent Total Nitrogen Requirement of 10 mg/L or Less

Eliora Bujari, H2M Group

The Suffolk County Department of Health Services on Long Island has retained the services of Holzmacher, McLendon, and Murrell (H2M) to investigate the ability of alternative on-site sewage disposal system (AOSSDS) technologies to meet the effluent requirement for total nitrogen of 10 mg/L or less. Upon evaluation and approval by SCDHS, these systems could be implemented in place of current on site treatment systems in residential and commercial applications. The technologies that were evaluated fall into two different flow categories. The first category is defined as single-family residential dwellings with flows from 300 to 1,000 gallons per day (GPD); the second category is considered as commercial applications with flows from 1,000 GPD to 30,000 GPD.

This investigation of AOSSDS is broken down into nine (9) separate tasks consisting of reports and progress meetings. Over 60 websites were used to construct a list of viable technologies capable of consistently achieving a total nitrogen (TN) effluent concentration 10 mg/L or less. The information obtained from the research was in the form of standards, regulations, codes, product brochures, operations manuals, case study reports, research papers, demonstration project studies, college reports, testing data, and technical drawings and specifications. A comprehensive investigation was undertaken to select, sample, and evaluate the technologies that deserve further consideration for achieving the TN discharge requirement.

As part of the final task a cost analysis was prepared for SCDHS to outline which systems would be cost effective to install in Suffolk County.

Eliora Bujari
H2M Group
175 Pinelawn Road
Melville, NY 11747
Phone: (631) 756-8000 ext. 1418
Email: *ebujari@h2m.com*

Proposed Nutrient Criteria for Drinking Water Lakes and Reservoirs

Clifford Callinan, P.E., Ron Entringer, NYS Department of Environmental Conservation; Jim Hyde, NYS Department of Health; John Hassett, State University of New York, Environmental Science and Forestry

Nutrient enrichment of lakes and reservoirs used for a potable water supply can lead to a broad array of adverse effects ranging from operational problems to potential increases in certain human health-related risks. Human health risks that may be exacerbated by nutrient enrichment stem from increases in disinfection by-products, cyanotoxins, and arsenic. New York state is developing numeric nutrient criteria for the protection of water supply lakes and reservoirs by establishing relationships between nutrients, algal abundance, dissolved organic carbon, and trihalomethanes, and then targeting established regulatory endpoints to set appropriate numeric nutrient criteria thresholds. This approach represents a much-needed bridge between the Safe Drinking Water Act and the Clean Water Act by defining source water protection goals. Findings to date from the investigation of 21 systems indicate that a mean chlorophyll a threshold of 4-6 µg/L would likely be protective of potable water supply lakes and reservoirs.

Clifford Callinan, P.E.
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233-3502
Phone: (518) 402-8135
Email: *cwcallin@gw.dec.state.ny.us*

UV Disinfection for Unfiltered Surface Water Regulatory Compliance

Kevin Castro, P.E., GHD Inc.

The Village of Skaneateles, NY owns and operates a water supply system that utilizes Skaneateles Lake as its' drinking water source. Skaneateles Lake is one of the Finger Lakes, is of exceptional quality, and is an unfiltered supply. The Village has a filtration avoidance determination from the NYS Department of Health that previously allowed them to supply drinking water utilizing only 3 log inactivation of giardia and 4 log inactivation of viruses through chlorination. With the promulgation of the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), the Village was required to install ultraviolet disinfection to provide 2 log inactivation of cryptosporidium.

The Village designed, constructed and commissioned a 2.0 MGD UV disinfection system for their unfiltered supply at their booster pumping station to meet the regulatory requirements of the LT2ESWTR. This presentation will detail the design approach for the system and present some of the unique aspects of the design and controls to meet regulations, reduce energy consumption, and enhance fire protection within the water distribution system. The UV design was provided to achieve 3 log giardia inactivation (higher dose requirement than for cryptosporidium) such that chlorination requirements for their supply could be reduced. This allowed the previously dedicated transmission main for chlorine contact to be made available to the distribution system to improve fire protection. In addition, VFDs were installed on the booster pumps for electrical demand reduction and a reduced pumping rate to minimize the number of starts on the UV disinfection units. Pre-selection of the UV disinfection equipment was provided through a competitive bidding process and a medium pressure system was selected. A summary of the experience of the first year of operation will also be provided.

Kevin Castro, P.E.
GHD Inc.
One Remington Park Drive
Cazenovia, NY 13035
Phone: (315) 679-5800
Email: *kevin.castro@ghd.com*

Effective Use Of Filter Pilot Testing And Chlorine Dioxide Demonstration Testing To Optimize Treatment Plant Performance

John Civardi, P.E., Mark Tompeck, Hatch Mott MacDonald; Marc Lucca, Aqua Pennsylvania

Aqua Pennsylvania's Shenango Water Treatment Plant has a capacity of 16 MGD and obtains raw water from the Shenango River. Treatment includes ballasted flocculation, dual media filtration, chlorine for primary disinfection, and chloramination. Since the plant was constructed in the late 1990s, changes have occurred in water quality and the safe drinking water regulations that increased operational challenges, including seasonally high algae counts, taste and odors, low unit filter run volumes, and less than optimal distribution system disinfection by-products. Seasonally, raw water manganese can exceed the SMCL. Chlorine is added to the top of the filters to control manganese, however, the elevated chlorine dose increased disinfection by-products. Aqua has conducted several studies on the performance and operation of the plant and made adjustments to process components. These efforts have had marginal success, and in 2011, Aqua embarked on a bench, pilot and demonstration test program consisting of the following:

- Bench scale testing of chlorine dioxide and ozone as pre-oxidants
- Demonstration Testing of chlorine dioxide pre-oxidation
- Pilot testing of alternate filter media configurations to increase UFRV

In 2011, bench scale testing chlorine dioxide and ozone was performed. The testing found that chlorine dioxide would oxidize the raw water manganese and would allow for a significant reduction in filter top chlorine usage. Based on these results, a demonstration test was performed from July 2012 through November 2012 to assess the full scale

impacts of chlorine dioxide on plant and distribution system performance. In parallel with the chlorine dioxide testing program, the filters were evaluated. It was found that the existing filters could not be sufficiently cleaned and that the media required replacement. In order to determine the optimal filter media configuration a pilot test was performed. This presentation will discuss the key aspects of the chlorine dioxide and filter media testing.

John Civardi, P.E,
Hatch Mott MacDonald
27 Bleeker Street
Millburn, NJ 07041
Phone: (973) 912-2418
Email: *john.civardi@hatchmott.com*

Innovative Strategies for Removing Emerging Contaminants for Indirect Potable Water Reuse; Oak Bluffs, MA Case Study

Marc Drainville, P.E., GHD Inc.

The Town of Oak Bluffs, Massachusetts operates a wastewater treatment plant (WWTP) on Martha's Vineyard. Treated effluent is discharged to subsurface leaching fields and the effluent percolates to a groundwater aquifer (indirect potable reuse.)

In 2009 the state's revised Groundwater Discharge Permit Program instituted a requirement that treated water discharging to a zone II water protection area must meet a 3 mg/L total organic carbon (TOC) effluent limit. While TOC itself is not a contaminant, it is used as a surrogate for contaminants of emerging concern (CEC's) including endocrine disrupting compounds, pharmaceuticals and personal care products. The new sand beds fall within the boundaries of a Zone II area and are subject to the stringent new TOC limits.

Data which the Town started collecting in 2009 shows a wide range of TOC concentrations in the effluent flow ranging from 5.7 mg/L to 36 mg/L (average 13 mg/L). In order to treat TOC down to 3 mg/L, a pre-treatment step will be needed to reduce the highly variable effluent before final treatment.

Testing at the facility began with a detailed characterization of the wastewater influent and plant effluent. Natural organic matter (NOM) in the influent and effluent was characterized by XAD8/XAD4 resin fractionation (hydrophobic, hydrophilic and transphilic) and molecular weight by high performance size exclusion chromatography (HPSEC). The analysis showed that the plant effluent contained high molecular weight hydrophobic fractions of TOC.

As a result, the following three coagulation processes were bench tested by manufacturers with WWTP effluent.

- Actiflo® by Kreuger
- MIEX® by Orica
- Ferrate by Ferrate Treatment Technologies

The presentation will discuss results obtained from the three rounds of bench testing and their implications in designing a pre-treatment step to reduce the high molecular weight hydrophobic fraction in the effluent before final treatment.

Marc Drainville, P.E.
GHD Inc.
1545 Iyannough Road
Hyannis, MA 02601
Phone: (774) 470-1634
Email: *marc.drainville@ghd.com*

NYSDEC Programmatic and Regulatory Implementation of Numeric Nutrient Criteria for Drinking Water

Ronald Entringer, P.E., Clifford Callinan, NYS Department of Environmental Conservation

The development of Numeric Nutrient Criteria protective of source waters used for public water supply will assure Clean Water Act program support for Safe Drinking Water Act goals through NYSDEC water quality management programs, where it has been specifically lacking. NYSDEC will use the criteria to implement regulatory and non-regulatory programs, including water quality based effluent limits in SPDES permits protective of the drinking water use. NYSDEC will use the criteria as targets for source water protection and anti-degredation policy, as well as for watershed plans and Total Maximum Daily Loads to restore waters to the drinking water designated use. NYSDEC will provide a history of how the historical phosphorus guidance values have been used and how the criteria being developed could potentially affect both protection and restoration programs. The presentation will discuss the changes to NYSDEC policy under consideration and provide case studies and implications for issuing SPDES permits, and direction of source water protection programs. The criteria for protection of flowing waters are not as far along as for lakes and reservoirs, but the implication could be much greater. The presentation will describe how these renewed efforts to protect drinking water use are playing out in the context of existing TMDLs and development of numeric nutrient criteria protective of the aquatic life and recreational uses.

Ronald Entringer, P.E.
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233-3502
Phone: (518) 402-8176
Email: *raentrin@gw.dec.state.ny.us*

Life-Cycle Project Management: EIS and Permit Integration

Jennifer Farmwald, NYC Department of Environmental Protection

Preparing an environmental assessment is a complex and nuanced exercise in timing and coordination. By integrating the environmental assessment and permits into life-cycle project management, risk and cost can be managed more effectively. DEP's plan to repair the Delaware Aqueduct is a case study in how effective coordination can facilitate a smooth transition from design through procurement and to construction.

The NYC Department of Environmental Protection (DEP) is currently undertaking a plan to bypass known leaks in a 45-mile section of the Delaware Aqueduct that currently conveys more than 50 percent of the daily drinking water for New York City. The plan requires the Aqueduct to be taken out of service for up to 10 months. During this time, additional sources of water are required and design is currently underway on several augmentation projects. To bridge the gap in water supply during the shutdown, DEP will rely on conservation, a repair and rehabilitation of the Catskill Aqueduct and reactivation of groundwater wells.

To that end, the environmental review must incorporate the full host of projects and other potential impacts into the environmental impact statement (EIS). They include: conservation efforts, repairs to the Catskill Aqueduct, groundwater reactivation, the effects of increased releases from reservoirs not available during the shutdown, increased drawdowns in reservoirs relied upon during the shutdown, and possible loss of habitat created by the leaks in the Delaware Aqueduct.

Incorporating the environmental assessment and permitting into the life-cycle of the program will limit delays and costly change orders, and result in a reliable program schedule and more accurate cost estimates going forward.

Jennifer Farmwald
NYC Department of Environmental Protection
5917 Junction Boulevard
11th Floor
Elmhurst, NY 11373
Phone: (718) 595-3287
Email: *jfarmwald@dep.nyc.gov*

Linking Air Quality Protection to Watershed Protection

Lorraine Farrell, P.E., NYC Department of Environmental Protection

The New York City watershed covers approximately 1,900 square miles of reservoirs and waterways in the Catskill Mountains and the Hudson River Valley. The New York City Department of Environmental Protection (DEP) is tasked with protecting the watershed to ensure delivery of approximately 1.4 billion gallons of high quality drinking water each day to nearly nine million water consumers in New York City and Westchester, Orange, Putnam, and Ulster counties.

Watershed protection is a complex yet important task entailing more than just protection of the water supply, but includes the various aquatic and vegetative species that inhabit the watershed. These interdependent natural resources are the most sensitive species that are easily disrupted by activities which can threaten the watershed. Understanding the threats upon a watershed and its natural resources is important for ensuring their protection. For example, air quality pollution is a significant environmental threat which in turn can lead to a threat on the watershed, specifically air pollution which occurs as a result of urban development.

Urban development remains an important agent of environmental change. As such, urbanization often increases the potential for air quality pollution, through increased traffic, construction impacts, industrial uses, increased residential population, all of which can have a significant effect on the surrounding air quality. This in turn leads to degraded water quality potential, such as sedimentation, increased temperature, habitat changes, and loss of fish population.

Many air quality activities and watershed activities are subject to City Environmental Quality Review (CEQR) and/or State Environmental Quality Review (SEQR), which is a process by which significant adverse environmental impacts are evaluated for a specified activity. Typically a project is assessed through preparation of an Environmental Assessment Statement.

This presentation focuses on protecting and enhancing air quality in support of watershed management. Understanding the relationship between air quality and watershed management is fundamental to effectively protect the water supply system and its natural resources. This presentation will focus on the following:

- Air quality concerns and their potential effect on the watershed
- The environmental assessment process
- Additional tools and resources available for evaluating air quality impacts on the watershed

Lorraine Farrell, P.E.
NYC Department of Environmental Protection
5917 Junction Boulevard
11th Floor
Elmhurst, NY 11373
Phone: (718) 595-4542
Email: *lofarrell@dep.nyc.gov*

Volute Press Application on Water Treatment Plant Residuals

Richard Gell, P.E., O'Brien & Gere

The dewatering of water treatment plant residuals are challenging and often require high energy, labor intensive or

large land areas solutions. As an alternative, an innovative volute or screw press technology is evolving that is compact, energy efficient, and easily automated. The City of Ithaca, as part of its planning for the Ithaca Water Supply Project, considered the environmental impacts of each of the water supply components. The metrics used included electrical energy usage, fossil fuel usage, noise, labor, and construction impacts. Currently the City uses a lagoon system to thicken the residuals generated from the treatment process. The partially dewatered material is removed from the lagoons on a seasonal basis with conventional earth moving equipment and trucked about five miles to a secondary handling site. At the secondary site the residuals are allowed to dry and are then blended with compost and spoils from municipal excavations to create a manufactured soil. This process is labor and energy intensive.
The volute press includes a mechanical press offers similar performance to conventional belt or plate and frame presses but with less energy input and requires less space. Two manufactures' products were successfully piloted and the Owner ultimate decided to incorporate the volute press into its overall water supply project to reduce its energy and labor footprint. The presses were able to achieve greater than 20% solids under adverse operating conditions and solids concentrations approached 40% under normal operating conditions. The press will avoid the manual cleaning of the lagoon, and reduce the truck traffic associated with hauling partially dewatered sludge.

Richard Gell, P.E.
O'Brien & Gere
333 West Washington Street
P.O. Box 4873
Syracuse, NY 13221
Phone: (315) 956-6100
Email: *Rick.Gell@obg.com*

Numeric Endpoints and Adaptive Management: New York's First Stream Nutrient TMDL

Steve Gladding, Ph.D., Brian Duffy, NYS Department of Environmental Conservation; Tammo Steenhuis, Steve Pacenka, Cornell University, Biological and Environmental Engineering

More than fifty percent of assessed river miles in the US have been identified as impaired directly or indirectly by nutrients. Many states, including New York, have only narrative standards governing nutrient concentrations in streams. The development of stream nutrient TMDLs by NYSDEC, however, requires a numeric endpoint which would be protective of all the best uses of the water body. Upper Black Creek (UBC) in Genesee County, NY, is listed on the 303(d) list as impaired by phosphorus due to loading from both point and nonpoint sources. In order to develop a TMDL, the first stream nutrient TMDL undertaken by NYSDEC, field work was conducted during the growing season of 2012 to develop a numeric nutrient endpoint for UBC. Samples were collected at eleven sites within UBC and at two sites in neighboring Little Tonawanda Creek, which served as a local best attainable reference watershed. Water chemistry was sampled every two weeks from May to September. Macroinvertebrate samples were collected and a habitat assessment conducted in September. A multiple regression model was developed using soluble reactive phosphorus (SRP) concentration, riparian width, and percentage of fine sediment in the riffle area to predict impairment of the macroinvertebrate community. A simplified distributed parameter watershed model was used to estimate SRP and fine sediment loads to UBC. The TMDL outlines an implementation plan that incorporates adaptive management to include a holistic, more cost effective approach to stream management than phosphorus reductions alone.

Steve Gladding, Ph.D.
NYS Department of Environmental Conservation
625 Broadway
Water Resource Management, 4th Floor
Albany, NY 12233-3508
Phone: (518) 402-8207
Email: *smgladdi@gw.dec.state.ny.us*

Navigating Hydrofracking In New York State - Review of Local Impact Concerns

Paul Granger, P.E., H2M - Water

HVHF is a large scale construction and industrial process that requires a complete understanding of the process so that an integrated and comprhensive approach can be impleted to protect surface and groundwater resouces used for potable water. Project proponents state that drilling for natural gas within the Marcellus shale region will have significant potential positive economic impacts for New York State; however, this must be balanced with the need to protect local resources and infrastructure. The "science" is still evolving on HVHF, particularly in New York State where geological and other environmental factors may differ from other areas of the country where hydrofracking has been undertaken and impacts documented. Local municipalities need to be actively involved in the regulatory process and be aware of potential impacts related to water supply, wastewater disposal, air resources, transportation infrastructure (including roads and air travel), zoning, economy, social services, housing demand, commercial support services (*e.g.*, hospitality and food services), real estate development and emergency services. Municipalities located outside of the Marcellus shale area must also be vigilant since drilling operations can have indirect impacts to water resources, roads and infrastructure. Along with well installation and development come the challenges associated with transport and treatment of the HVHF wastewater and natural gas product. This presentation will review and discuss the following areas that can have direct and indirect impacts to our drinking water resources that include: Water resources; Wastewater Treatment and Waste Disposal; Stormwater Management; Land Use/Zoning; Storage of hazardous materials; Emergency Services/Public Safety;

Compliance Oversight; Local Economy; Well Close-out and Site Legacy; Terrestrial and Aquatic Ecosystems New Gas Pipeline Infrastructure and Seismic Risks.

Paul Granger, P.E.
H2M - Water
575 Broad Hollow Road
Melville, NY 11747
Phone: (631) 756-8000 ext 1419
Email: *pgranger@h2m.com*

HABs in NYS: Toxin Occurrence, Suspected Health Impacts, and Development of Response Protocols

James Hyde, Erin DeConno, Eric Wiegert, Ellen Braun-Howland, NYS Department of Health; Scott Kishbaugh, NYS Department of Environmental Protection

New York was one of ten states to receive a CDC Cooperative Agreement Grant to investigate the occurrence of harmful algae blooms (HABs) and potentially associated illnesses. Other specific goals in NY include: improve HAB toxin laboratory capabilities, improve outreach and education, and develop recreational and drinking water HAB response protocols. A long-term volunteer monitoring program (CSLAP) was utilized to monitor microcystin in deep-hole, open water samples and shallow water sites with observed blooms. Lakes were selected with bloom histories, elevated total phosphorus levels, or if they were mesotrophic and classified as a drinking water source. Microcystin (and limited other toxins) data were also collected in other locations with HAB exposure concerns such as: beaches, other recreational illness report locations, and drinking water evaluation sites (*e.g.* near intakes, raw and finished water). Elevated microcystin levels (>10-20 ug/L) were fairly common in shallow water bloom samples but rare in the regularly monitored open waters, and open waters only showed elevated microcystin during visually apparent blooms. All the reported potentially HAB related illness in NY has been associated with recreational exposures. While many symptoms are consistent with microcystin exposure (*e.g.* nausea diarrhea, jaundice), mild to severe contact irritation is also common in reports, and these symptoms are not attributable to any of the normally measured HAB toxins. Therefore, the developed protocol closes beaches based on the presence of blooms, rather than toxin levels. A literature review indicates conventional treatment is largely effective in removing HAB toxins, and they have not been detected in finished drinking water in NYS to date. However, fairly low levels of microcystin have been detected in raw water in limited sampling, and treatment difficulties associated with HABs (*e.g.* filter clogging) have been noted. A HAB drinking water response protocol is under development.

James Hyde
NYS Department of Health
Center for Environmental Health
Bureau of Water Supply Protection
Corning Tower, Room 1198
Empire State Plaza
Albany, NY 12237
Phone: (518) 402-7654
Email: *jbh01@health.state.ny.us*

Incorporating Affordability in Water and Wastewater Utility Planning

Sangamithra Iyer, P.E., NYC Department of Environmental Protection

This presentation will explore how affordability concerns can be incorporated into integrated planning for water supply and wastewater utilities. It will explore the challenges and opportunities utilities face to meet clean and drinking water goals while operating on limited resources, and the importance examining the environmental, social, and financial benefits of all water-related obligations to develop priorities and schedules for spending. Using New York City as an example, the presentation will look at historic trends in spending, consumption, and water and sewer rates, and as we look to the future, the presentation will explore how assessing financial capability in light of all water-related obligations can be used to focus resources where the community will get the most environmental benefit.

Sangamithra Iyer, P.E.
NYC Department of Environmental Protection
59-17 Junction Boulevard
11th Floor
Flushing, NY 11373
Phone: (718) 595-3585
Email: *siyer@dep.nyc.gov*

How Will the Integrated Planning Approach Affect Your Long Term Control Plan?

Vijesh Karatt Vellatt, P.E., Rebecca Schaefer, Greeley and Hansen

In October of 2011 the US EPA issued a memo acknowledging the challenge that municipalities face to fully consider all water quality obligations, including wastewater, storm water and other water quality improvement needs, together holistically. The purpose of the memo was to introduce the concept of “integrated planning”.

Typically water quality issues such as wastewater treatment, storm water and sewer overflows, are managed through National Pollutant Discharge Elimination System (NPDES) permits, however the needs have often been addressed through different planning documents.

The concept of integrated planning is to coordinate and prioritize water quality improvements to get the maximum benefit for the dollars being invested by evaluating the cost and impact of a broader range of water quality improvement projects together instead of separately. If a project to

eliminate street flooding has a more positive impact on water quality than a combined sewer overflow storage tank project, the street flooding project may move up on the priority list and the tank project may be delayed. If the benefits of a project are clearer and more easily quantified, the project will be have a higher potential to move up on the priority list.

Integrated planning is intended to be a process with close communication between a municipality, local public, the state, and US EPA. The intent of the integrated planning is not to produce another report, it is intended to effect a dialog that leads to how the available local resources best would be spent in terms of environmental and public health benefits.

With the integrated approach, the financial burden of a more broad range of water quality projects can be taken into consideration in the Financial Capability Assessment. For example, previously the cost of achieving a new phosphorous limit for a Water Resource and Recovery Facility might not have been considered in the LTCP Financial Capability Assessment. The integrated approach should encourage a inclusion of the other water quality needs, such as the cost of achieving a new phosphorous limits. Both WEF (in association with the US Conference of Mayors) and US EPA plan to release updated Financial Capability Assessment guidance in an attempt to better frame the factors that more fully characterize a community's level of affordability.

A simplified list of the impacts of an integrated plan on a LTCP are shown below.

An integrated plan will not:

- Replace a LTCP
- Reduce the overall financial investment in water quality
- Change end point level of control

An integrated plan may impact:

- The financial capability assessment
- The prioritization of projects and the types of projects used to improve water quality
- Implementation schedule duration

The presentation will focus on the next steps for a municipality to consider before embarking on the integrated planning approach.

Vijesh Karatt Vellatt, P.E.
Greeley and Hansen
111 Broadway, Suite 2101
New York, NY 10006
Phone: (212) 693-9567
Email: *vkarattvellatt@greeley-hansen.com*

Treatment of Emerging Environmental Contaminants in Water

Terry Keep, Trojan Technologies; Adam Festger, Market Manager Drinking Water and ECT

There is a growing awareness of chemicals in the world's water supply. Recent research has shown that a wide variety of environmental contaminants exist at trace concentrations in streams, lakes, rivers, and groundwater throughout the world. These contaminants include industrial byproducts, fuel additives, pesticides, and pharmaceuticals. Many of these chemicals have both carcinogenic and endocrine-disrupting effects at extremely low concentrations.

In broad terms, the term "environmental contaminants" refers to harmful chemicals present in soil, in air, and in water. These compounds may come directly from human sources such as industrial manufacturing, agricultural run-off, and wastewater discharge; or they may originate from natural sources, such as the taste and odor-causing chemicals in water generated by algae and bacteria blooms. Some are highly mobile in water, resistant to biodegradation, and are difficult to treat by conventional technologies such as carbon adsorption or air stripping. Examples such compounds include N-nitrosodimethylamine (NDMA), 1,4-dioxane, methyl tertiary-butyl ether (MTBE), pesticides, pharmaceuticals, volatile organic compounds (VOCs) such as trichloroethylene (TCE).

UV, alone and in conjunction with hydrogen peroxide, is effective for the treatment of many environmental contaminants. UV oxidation is a destructive treatment technology that breaks up environmental contaminants. Other technologies merely transfer the contaminant from one medium to another (air stripping for example, transfers contaminants to the vapor phase).

UV oxidation also has the added benefit of disinfection, including inactivation of Cryptosporidium and Giardia. Current applications of UV for environmental contaminant treatment include treatment of drinking water, treatment of wastewater for discharge and reuse, groundwater remediation, and treatment of contaminated industrial discharge water.

This presentation will review some of the installations in the United States that make use of this technology to treat contaminants in water. The focus will be on groundwater remediation treatment from a UV oxidation point of view in California and Long Island New York.

Terry Keep
Trojan Technologies
3020 Gore Road
London, Ontario N5V4T7
Phone: (519) 457-3400
Email: *tkeep@trojanuv.com*

Simplifying Onsite Wastewater Treatment Using Containerized Membrane Bioreactors (MBR)

Fraser Kent, Ph.D., P.E., Michael Lee, H2O Innovation

The need for onsite wastewater treatment systems has been growing in the past decade. High costs of developing the required infrastructure for remote wastewater flows and the

vast non-urban land area in the State are the key drivers behind this. There are however, some inherent inefficiencies in the provision of onsite wastewater treatment plants that can be overcome through careful design.

The key requirements of onsite wastewater treatment facilities are often superior effluent quality since these systems are often installed near sensitive receiving bodies and simple operation since low maintenance requirements is an important aspect of small systems to reduce overall life-cycle costs.

In the past, Membrane Bioreactors (MBR) have been seen as a novel and complex wastewater treatment technology requiring highly skilled operators and consistent maintenance - this is, however, no longer the case. For large systems where the cost of membranes has historically been a large percentage of the overall plant capital costs, minimizing membrane area has been a critical issue. This led to complex maintenance strategies including daily or weekly maintenance cleans and careful, continuous monitoring of the trans-membrane pressure and flux. However, for small decentralized systems, where the cost of membranes is often less than 10% of the overall capital costs, conservative membrane fluxes can be used to minimize operator involvement and simplify the process.

Since MBRs reduce plant footprint, provide extremely high effluent quality and can now be designed with minimal operator involvement, this technology is very well-suited for onsite/decentralized wastewater treatment. In this paper, an MBR system is presented that is designed to be contained within a standard shipping container. Low cost, simple design, minimal operator involvement and superior effluent quality make this and ideal candidate for decentralized wastewater treatment applications.

Fraser Kent, Ph.D., P.E.
H2O Innovation
5100 South Service Road, Unit 17
Burlington, Ontario L7L 6A5
Phone: (289) 835-5533 x103
Email: *fraser.kent@h2oinnovation.com*

A Centralized Approach for Managing Shale Gas Wastewater and Residuals

Jerry Leone, Casella Waste Systems, Inc.

The Pennsylvania oil and gas industry produces hundreds of millions of gallons of flowback water, brine, and produced water each year. With limited local solutions available, this material is often transported by tanker truck over long distances to out-of-state deep injection wells.

The CARES water treatment, recycling, and disposal (TRD) facility, located in Sergeant Township near Mt Jewett, has been built to provide a safe, reliable, cost-effective, and local treatment solution for water from drilling activity in northern Pennsylvania. The new CARES facility employs a unique water treatment technology called AltelaRain®. Designed after nature's process for making rain, the system operates at low temperatures and uses low-grade steam. The resulting clean distilled water product can be returned to the environment, or recycled back to drillers, reducing demands on local freshwater. The AltelaRain® Modules are made from polypropylene plastic which eliminates risk of fouling or scaling. Fueled by landfill gas from the adjacent McKean County Landfill, the low temperature and low pressure system means higher efficiency at lower treatment cost thereby reducing costs and putting a wasted resource to beneficial use.

The CARES facility serves Oil & Gas operators as well as oil service companies that haul water for disposal. The CARES facility is capable of treating 500,000 gallons per day for suspended solids and 100,000 gallons per day for dissolved solids.

Jerry Leone
Casella Waste Systems, Inc.
1879 Route 5 & 20
Stanley, NY 14561
Phone: (607) 435-9996
Email: *jerry.leone@casella.com*

Sediment Quality Assessment of New York Watersheds

Stephen Lewandowski, United States Military Academy

Sediments represent an important and dynamic compartment in aquatic ecosystems due to their ability to serve as a sink of many chemical contaminants. Toxic and bioaccumulative chemicals, including some metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and organochlorine pesticides, may partition to particles and accumulate to elevated levels in sediments even though they may only be found in trace amounts in water. The chemicals exist in a dynamic equilibrium where they can be transferred back to the water column or undergo uptake by benthic organisms. However, the complex physical and chemical properties of sediments make them difficult to assess. There is currently no single recommended sediment assessment approach or regulatory framework available to evaluate potential adverse effects from exposure to sediment composites. This study includes a background summary of existing sediment quality guidelines (SQGs) which follow mechanistic, empirical, and aggregated consensus approaches and assess their relevance to watershed protection strategies.

This study also examines U.S. EPA National Sediment Inventory (NSI) data for a historical perspective on sediment quality in the Catskill/Delaware and Croton watersheds. This extensive database contains surface and subsurface sediment chemistry, fish tissue residue, and bioassay toxicity results from more than 50,000 stations throughout the United States. Key findings on sediment contaminants and toxicity in the watershed regions will be presented.

Stephen Lewandowski
United States Military Academy
306A Alexander Place

West Point, NY 10996
Phone: (845) 938-3124
Email: *stephen.lewandowski@usma.edu*

Impact of Cold Weather Operations on Nitrogen Removal Performance for Deep Bed Denitrification Filters in the Northeast United States

Gary Lohse, P.E., Ken Wineberg, Severn Trent Services

DeepBed down flow filters have proven reliable as tertiary treatment to remove suspended solids while achieving lower effluent nitrogen levels. Two of the Northeastern facilities which are operating in year around denitrification mode with excellent performance during cold weather temperatures are examined in this presentation.

Scituate, Massachusetts: Data was obtained from the 2.0 MGD Scituate WWTP during a period from November 2003 to January 2004 with operation of Down flow denitrification filters. Wastewater temperatures varied from 17 degree C in November to less than 8 degree C (the design temperature) in January, with an average temperature of 11.7 degree C for the testing period. Influent nitrate concentrations averaged about 10 mg/L and effluent nitrate levels were typically below 0.5 mg/L which is about 95% removal. The hydraulic loading rate was 0.6-1.0 gpm/ft2 resulting in empty bed detention times (EBDT) greater than 50 minutes and a relatively low NOx-N loading rate of 15-20 lbs/1,000 ft3/day.

Warrenton, Virginia: Four down flow denitrification filters were installed and placed in service in the fall of 2009 at the 2.5 MGD Town of Warrenton WWTP, Virginia. Fully nitrified effluent from the plant's rotating biological contactors (fixed-film process) is pumped to the new denitrification filters. Operating data for January 2010 indicate a hydraulic loading rate of 1.4 gpm/ft2 with 3 filters in service and influent nitrate concentrations ranging from 12 to 18 mg/L with an average of 14 mg/L. The average nitrate loading rate was 43 lbs /1,000 ft3/day and the system produced an effluent nitrate concentration of less than 1 mg/L which results in more than 90% removal efficiency. Wastewater temperatures averaged 13 degree C.

In summary, the cold weather operation of these systems demonstrated the system's ability to achieve the effluent objectives for nitrate removal.

Gary Lohse, P.E.
Severn Trent Services
3000 Advance Lane
Colmar, PA 18915
Phone: (215) 859-3814
Email: *glohse@severntrentservices.com*

Green Stormwater Infrastructure Design: Lessons Learned in Philadelphia

Stephen Maakestad, P.E., Hatch Mott MacDonald

In 2010, the Philadelphia Water Department (PWD) embarked on a 25-year plan to improve water quality in local rivers and streams, primarily through reduction in combined sewer overflows. This $2.4 Billion program, known as "Green City, Clean Waters", highlights Green Stormwater Infrastructure (GSI) as the primary solution with a plan to develop 9,564 "Green Acres" in an effort to significantly reduce the annual CSO volume. PWD has also completed a Triple-Bottom-Line analysis in order to understand the social and economic benefits that go beyond water quality improvement.

Green Streets is the most prominent of the multiple Green Stormwater Infrastructure (GSI) programs that are in progress by PWD. This presentation discusses the development process for Green Streets Contracts in Philadelphia as well as the formation of the program including site evaluation and selection, standardization of design details and specifications, and future plans for maintenance and monitoring. It will also discuss the variables and constraints that go into stormwater system design for projects in city streets and public property. The overall goals of the Long Term Control Program will be presented and the lessons learned in the initial phase of the GSI program will be discussed including site selection, differences in tested versus actual infiltration, community outreach, and utility coordination.

Case studies are examined to explain GSI tools that can be used and the variables and constraints that factor into selection of these technologies are discussed. Integration of GSI projects with other infrastructure projects such as water main relay projects and sewer reconstruction projects will be revealed with case studies and the various benefits of these types of projects will be presented. In addition, the provisions that have been incorporated for evaluation and monitoring of system performance will be reviewed. Future initiatives that are underway at PWD will also be discussed.

Stephen Maakestad, P.E.
Hatch Mott MacDonald
The Public Ledger Building, Suite 1040
150 South Independence Mall West
Philadelphia, PA 19106
Phone: (215) 399-1161
Email: *stephen.maakestad@hatchmott.com*

Wetland Mitigation for the Route 28A Realignment Project in Ulster County, NY: Results From Three Years of Post-Construction Monitoring

Laurie Machung, Frank Parisio, Maria Tupper-Goebel, Kristopher Levelett, NYC Department of Environmental Protection

In 2009, DEP constructed a wetland as mitigation for 0.81 acres of wetland impacts authorized by the U.S. Army Corps of Engineers for the realignment and improvement of approximately 2.5 miles of Route 28A in the Town of Olive, Ulster County, NY. Post-construction monitoring of

vegetation, soils, and hydrologic characteristics commenced in the 2010 growing season to assess conformance with project goals and U.S. Army Permit requirements. 1.1 acres of habitat were created, including 0.3 acre of open water, 0.5 acre if emergent wetland, and 0.3 acre of successional meadow. The acreage of emergent wetland increased slightly after the first year, and is consistent with the design goals. The extent of open water is higher than planned, but has provided wildlife habitat functions. The successional meadow habitat lacks wetland hydrology, but provides a buffer to the wetland areas, and is consistent with the project goals of creating a variety of early successional habitats. Species richness has increased, while percent cover by exotic species has decreased in both cover types since year 1, likely due to the decline in the temporary seed mix species as native species from the permanent mix become established, and to DEP's ongoing effort towards manual removal of purple loosestrife (Lythrum salicaria). Survival of woody plantings is slightly lower than permit requirements, and DEP has actively monitored and replaced failed plantings with species suitable to as-built soil and hydrologic characteristics. DEP will continue to monitor this site and remediate noted deficiencies to help ensure compliance with project goals. This project has also provided DEP with important information on designing, monitoring, and managing wetland mitigation areas that will undoubtedly benefit future projects.

Laurie Machung
NYC Department of Environmental Protection
71 Smith Avenue
Kingston, NY 12477
Phone: (845)340-7849
Email: *LMachung@dep.nyc.gov*

Total Coliform Issues and Complying with The Revised Total Coliform Rule With Effective Water Well Rehabilitation and Maintenance

Neil Mansuy, Subsurface Technoligies Inc.

Lost capacity problems and associated water quality problems including total coliform problems will be described and methods of rehabilitation will be discussed. Complying with the Revised Total Coliform Rule (RTCR) is often not as simple as disinfection of wells but more importantly requires that the well be cleaned and kept clean on a periodic basis. The occurrence of Total Coliforms most often do not suggest contamination of water wells but can suggest that the well needs to be cleaned. Novel ideas and understanding about well problems and solutions will be presented based on many years of experience. With ever increasing energy costs there is increasing pressure to look at ways to reduce cost. New effective and economical method of well maintenance will be presented with case studies of cost savings. Case studies will also be presented on solving difficult Total Coliform issues on wells in New York.

Neil Mansuy
Subsurface Technoligies Inc
40 Stone Castle Road
Rock Tavern, NY 12575
Phone: (816) 221-7770
Email: *nmansuy@subsurfacetech.com*

Hydrological impact of Hurricane Irene and Tropical Storm Lee in Historical Context: Is the Frequency and Magnitude of Extreme Hydrological Events Changing in Southern New York State?

Adao Matonse,Ph.D., Allan Frei, Ph.D., City University of New York Institute for Sustainable Cities; David Laounsbury, Donald C Pierson, Ph.D., NYC Department of Environmental Protection

In August and September of 2011 Hurricane Irene and Tropical Storm Lee precipitated large amounts of rain across various parts of the eastern US. Anecdotally, these were among the historically largest precipitation events in this region, and were associated with wet antecedent soil moisture conditions. These storms resulted in unprecedented flooding accompanied by significant material damage in a number of regions including our study area, the Catskill Mountains and Hudson River Valley in southern New York State. In this study we analyze (1) how large these events were in historical context; (2) whether this region has experienced a change in the frequency of extreme events in recent years; and (3) whether this region has experienced a change in the magnitude of extreme events in recent years. Application of the standard hydrological frequency analyses indicates that for most sites these events were not unprecedented, revealing a discrepancy between public perception and quantitative results. However, when the analysis is performed on a seasonal basis, and a more varied set of statistics is considered, we find that despite a spatially heterogeneous impact, each event individually was in fact among the most extreme on record in some portions of the study region.

Moreover, there has been a marked increase in the frequency of extreme hydrologic events during the last two decades. This increasing trend is evident during the late summer and early fall (the "warm season"), rather than during the snow melt season. Most precipitation and streamflow gauge records display an increasing warm season trend in the frequency of extreme events since 1985 with an accelerated rate of increase since the mid-1990s. This presentation will also discuss ways to improve extreme events analysis in our region of study and tie results to water resources planning.

Adao Matonse, Ph.D.
NYC DEP - GIS/Water Quality Modeling Group
71 Smith Avenue
Kingston, NY 12401
Phone: (845) 340-7793
Email: *amatonse@hunter.cuny.edu*

Ashokan Reservoir Turbidity: 1987-2012

James Mayfield, NYC Department of Environmental Protection

Over the last 25 years (1987-2012) there have been several large runoff events that have led to extended periods of elevated turbidity levels in the Ashokan watershed. Major storms in April 1987, January 1996, April 2005, the fall of 2010, and Tropical Storms Irene and Lee in 2011, required DEP to treat the Catskill Aqueduct with alum in order to maintain compliance with the Surface Water Treatment Rule source water turbidity limits. In addition to looking at the impacts and duration of these elevated turbidity levels in the Ashokan Reservoir, turbidity data from DEP's fixed-frequency sampling program will also be examined for trends at sites from the mainstem of the upper Esopus Creek, along with sites located on selected tributaries of the Esopus, including Broadstreet Hollow, Woodland Valley, Stony Clove, Beaver Kill, and Little Beaver Kill. Turbidity data collected from the lower Esopus Creek over the past two years will also be presented. These data are collected in conjunction with the interim protocol for operating the Ashokan Release Channel by DEP, which was issued by NYS DEC in October 2011. Finally, more recent data from DEP's robotic monitoring system, which can provide much more frequently collected data, will be presented and compared to fixed-frequency turbidity data.

James Mayfield
NYC Department of Environmental Protection
71 Smith Avenue
Kingston, NY 12401
Phone: (845) 340-7709
Email: *jmayfield@dep.nyc.gov*

Orange County, NY Water Supply Development and NYSDOS Grant Funding

Ginger Modafferi, P.E., Michael Principe, Ph.D., HDR Engineering, Inc; Peter Hammond, Orange County Planning Department; David Church, Orange County Water Authority

As part of the January 2012 Mid-County Water Supply Feasibility Study, the Orange County Department of Planning and Orange County Water Authority, in conjunction with a New York State Department of State (NYSDOS) Shared Municipal Service Incentive Grant (Project C-078842), had funded the preliminary testing of wells at the Dwaar Kill well field and the development of a conceptual design of a water supply, treatment, and conveyance system. The ultimate goal of the project was to develop the wells to provide sufficient additional supply to meet the projected 2020 average demand for the Village of Pine Bush. The Village's current utilizes groundwater as its potable water source. However, due to water quality issues, the Village would prefer to switch their groundwater source entirely over to the Dwaar Kill well field and utilize the current supply only for emergencies. A water treatment plant (WTP) and booster pump station will be required at the Dwaar Kill well field to remove Iron (Fe) and Manganese (Mn), chlorinate the treated groundwater, and convey it to the existing Pine Bush distribution system. In order to confirm sufficient water supply, HDR reviewed a previous safe yield study and performed a preliminary analysis of well drawdown during the water quality testing of the wells. Green sand filtration was proposed for the Iron and Manganese removal, which required an in depth study of potential disposal options for 6,000 gal/day of backwash water it produced. In addition, a routing analysis, including a constructability review and permitting evaluation, was performed for the 2 mile distance between the proposed WTP and Pine Bush distribution system. Following the completion of the facility plan and conceptual design, HDR prepared a NYSDOS Local Government Efficiency Grant to fund up to $800,000 of the engineering design and construction management services for the proposed project.

Ginger Modafferi, P.E.
HDR Engineering
1200 MacArthur Boulevard
Mahwah, NJ 07430
Phone: (201) 469-0571
Email: *virginia.modafferi@hdrinc.com*

Cured-in-Place Pipe Rehabilitation for Water Transmission Mains - Roses and Thorns

Paul Mourt, P.E., Hatch Mott MacDonald

Recent failures have highlighted the vulnerability of our aging infrastructure and the need for repair, replacement or rehabilitation of buried pipelines. Pipeline replacement or spot repairs are not always viable or cost-effective options. An emerging rehabilitation technique for water transmission mains is the use of cured-in-place pipe (CIPP) lining. CIPP is an established technique for the structural rehabilitation of sewers but has not been broadly utilized for the rehabilitation of pressurized pipelines. This paper will examine the reasons for selecting CIPP rehabilitation; differences between CIPP rehabilitation for sewers and water transmission mains; the items which affect thickness calculations; and a review of the installation methodology.

Lessons learned from two recently completed water transmission main rehabilitation projects involving the installation of CIPP liners in a 24-inch cast iron pipeline and a 36-inch prestressed concrete cylinder pipe (PCCP) in Monmouth and Somerset Counties, New Jersey, will be presented. Alternative rehabilitation techniques considered will be identified as well as the limitations of the selected CIPP. Construction cost, construction issues and the manner in which issues were overcome will also be discussed.

Paul Mourt, P.E.
Hatch Mott MacDonald
27 Bleeker Street
Millburn, NJ 07041
Phone: (973) 912-2633
Email: *paul.mourt@hatchmott.com*

Comparing Centralized and Decentralized Treatment for Reduction of DBPs through Bench- and Pilot-Scale Studies

Chandra Mysore, Ph.D., P.E., GHD Inc.

BACKGROUND. The City of Scottsdale uses Central Arizona Project as the source water and uses granular activated carbon (GAC) treatment for reduction of DBPs. As the cost of this centralized treatment increased over time, the City wanted to consider localized or decentralized treatment at the point of non-compliance in the distribution system.

OBJECTIVES. The objective of this project was to compare and contrast the merits and demerits of centralized versus decentralized treatment for the reduction of DBPs through bench, pilot- and full-scale studies.

APPROACH AND RESULTS.
Bench-scale studies were conducted to determine various coagulants (*e.g.* alum, PACL) and polymer combinations to maximize TOC removal at the treatment plant. Full-scale studies also focused on optimizing the existing GAC process and operating the GAC as a biologically active carbon (BAC) filter to meet the D/DBPR requirements. The decentralized treatment focused on conducting air stripping pilot studies. Each unit was operated at several air:water ratios in the distribution system including blending of treated and untreated water in treated water:untreated water ratios of 25:75, 50:50, and 75:25. TTHM removal efficiencies for the air stripping units ranged from 78% to 96%. At an air:water ratio of 30:1, a TTHM removal of 78% was observed.

Bench-scale studies results demonstrated that TTHM reformation occurs and the formation levels in some instances exceeded the 80 ppb limit between the 72 hour and 96 hour sampling points. Several blending ratios were tested and reformation potential was the least for a blending ratio of 75:25 (treated:untreated). Several scenarios for DBP reduction were compared: GAC operating for 12 or 6 or 3 months alone or in combination with air stripping.

SIGNIFICANCE TO INDUSTRY. The results from this study provide utilities a comparison of the performance of decentralized and centralized treatment strategies, specifically for complying with the Stage II D/DBPR requirements.

Chandra Mysore, Ph.D., P.E.
GHD Inc.
3714 Lost Oak Drive
Buford, GA 30519
Phone: (303) 275-5770
Email: *chandra.mysore@ghd.com*

Commissioning The World's Largest UV Disinfection Facility Overcoming Challenges Through Cooperation

William Nylic III, P.E., Gary Kroll, P.E., Brian Kearney, P.E., CDM Smith; George Schmitt, P.E., Jasmin Rivera, P.E., NYC Department of Environmental Conservation; Richard Fahey, P.E., Hazen and Sawyer

The New York City Department of Environmental Protection (NYCDEP) has constructed and is in the process of commissioning the world's largest ultraviolet (UV) light disinfection facility to serve a population of more than 9 million people within the city and in nearby upstate communities. The new UV disinfection facility is designed to treat up to 2,400 million gallons per day (mgd) of drinking water from the city's two largest upstate reservoir systems, known as Catskill and Delaware. The plant will provide enhanced disinfection of the Catskill and Delaware supplies as required by the United States Environmental Protection Agency under an Administrative Consent Order that allows the city to employ UV treatment in lieu of more costly filtration. With 56 of the largest UV disinfection chambers ever made in four independent modules, establishing flow and initiating the UV treatment process represented a formidable challenge requiring a concerted team effort to successfully start up this unique facility. To maintain schedule, planning for start-up of the UV facility began well in advance of the actual transfer of flow into the facility, which required a staged series of flow and other transitions to enable New York City to begin the disinfection process while maintaining flows of up to 1,800 mgd to its residents. Handling of gravity flow with sixteen 84-inch diameter wafer-type pressure control valves, the largest yet made, one of the principal features of the facility, was also a major factor in the need for careful planning in order to not lose capacity in the City's transmission and delivery system during the start-up process. Additionally, the paper will address process used to select the UV system supplier and units, the use of 3D computer-aided design and drafting in controlling quality, and the role of the designer in the 3rd party CM position.

William Nylic III, P.E.
CDM Smith
60 Crossways Park Drive West, Suite 330
Woodbury, NY 11797
Phone: (516) 496-8400
Email: *nylicwj@cdmsmith.com*

Using Historical Data to Assess Potential Fecal Coliform Contribution During Storms at Kensico Reservoir: A Case Study

Christian Pace, Kerri A. Alderisio, NYC Department of Environmental Protection

Under normal reservoir operations, Kensico Reservoir provides the final Catskill and Delaware source water prior to disinfection, making it a vital component of New York City's water supply. The New York City Department of Environmental Protection (DEP) has maintained a monitoring program for total and fecal coliforms at the Kensico influent and effluent sites for more than fifty years. Monthly sampling at perennial streams in the Kensico

watershed has been conducted for more than ten years to help monitor water quality. The aqueduct influents provide greater than 99% of flow to the reservoir during dry weather; however, during large storm events the eight gauged perennial streams have been estimated to provide roughly 4% or more of the influent flow. Ungauged portions of Kensico's watershed (54% by land area) are also a source of storm flow but are not monitored. During major storms it is believed that Kensico's watershed (gauged and ungauged) likely provides enough fecal coliform bacteria (FC) to increase concentrations at the reservoir effluents.

Case Study: On August 27 - 28 and September 5 - 8, 2011, Tropical Storms Irene and Lee brought more than a total of 13 inches of rain to the Kensico watershed. In the following days and weeks, the reservoir effluents experienced elevated FC levels. It is intuitive that the combined effect of the two tropical storms on the local watershed caused some of these increases; however, since water samples were not able to be collected during the peak of hydrologic stream flow, the impact could only be qualitatively assessed. This analysis utilizes historical data to supplement information collected from August to October 2011 to estimate potential FC contributions from the watershed during these tropical storm conditions.

Christian Pace
NYC Department of Environmental Protection
465 Columbus Avenue
Valhalla, NY 10595
Phone: (914) 773-4585
Email: *cpace@dep.nyc.gov*

Water for the Future Supply Augmentation Need Planning

Mark Page Jr., NYC Department of Environmental Protection

Water for the Future program is a $1.5 billion initiative to ensure clean, reliable, and safe drinking water for nine million New Yorkers for decades to come. The program has two main elements: repairing leaks in the Delaware Aqueduct-which supplies roughly half of the city's daily drinking water needs-and supplementing the city's water supply during the temporary shutdown of the aqueduct. In November 2010, DEP outlined a design and timeline to address leaks in the Delaware Aqueduct and will break ground on a bypass tunnel this year. The repairs will require the temporary shutdown of the Aqueduct between 2021 and 2022. The New York City Department of Environmental Protection, Bureau of Environmental Planning and Analysis will present on the decision-making and modeling that went into determining the augmentation need for New York City during the shutdown of the Rondout West Branch section of the Delaware Aqueduct to repair known leaks in the tunnel. The presentation will include efforts completed by DEP and progression of the modeling and inputs that brought DEP from a water supply shortfall of upwards of 300 mgd to a greater than 90 percent probability that the repair could be completed in less than a year of work with less than 100 mgd of additional supply. Additional discussions about the progression of the RWBT repair project design, the modeling and analyses changes in approach, and the interrelationship between the two activities will also be presented.

Mark Page Jr.
NYC Department of Environmental Protection
59-17 Junction Boulevard
11th Floor
Flushing, NY 11373
Phone: (718) 595-4395
Email: *mpage@dep.nyc.gov*

Snowpack Monitoring in the New York City Water Supply Region: Past, Present, and Future

James H. Porter, Ph.D., Glenn D. Horton, NYC Department of Environmental Protection

Since the 1930's, the NYCDEP has operated a snowpack monitoring program throughout the water supply region. The purpose of the program is to measure the amount of water stored in the snowpack, which in turn helps guide reservoir operations. For decades, the program consisted solely of manual surveys in which staff traveled to over 100 measurement points spread over nearly 2,000 square miles and directly measured the amount of snow water present. Given the amount of labor, time, and travel expense, measurements were made infrequently, yet snowpack water content can change daily due to snowmelt, snow accumulation, and assimilation of rain into the snowpack. More frequent measurements were desirable. In the early 2000's, DEP began investigating new methods for making automated, near-real-time (NRT) snowpack measurements. This talk will describe DEP's experience developing new techniques for snowpack monitoring, including several types of snow pillows, natural gamma measurements from terrestrial and aerial platforms, and satellite observations and modeling. It will also describe how snowpack monitoring helps DEP meet seasonal storage objectives designed to reduce spill volumes and further enhance the flood protection provided by the dams to downstream communities. Finally, it will discuss the cooperative program in which DEP provides NRT snowpack and reservoir data to the National Weather Service (NWS) to help them improve streamflow and flood forecasts, and the pending new generation of NWS forecasts that will be used by DEP's Operations Support Tool (OST). OST is a decision-support system that links water quality and water quantity models of the reservoirs, integrates current reservoir and other environmental data, ingests NWS streamflow forecasts, and outputs guidance to DEP managers making reservoir operating decisions.

James H. Porter, Ph.D.
NYC Department of Environmental Protection
P.O. Box 358
7870 Route 42

Grahamsville, NY 12740
Phone: (845) 334-7196
Email: *jporter@dep.nyc.gov*

Full-Scale Testing of Innovative High Rate Filter Media for Plant Expansion

Robert Raczko, P.E., James Mastrokalos, United Water

In an effort to improve the filter performance and potentially increase the throughput through the existing filters, United Water Matchaponix (UWMX) is conducting a demonstration test by modify two of the six filters at its water treatment plant to evaluate two new media configurations and retrofit the existing underdrains with "gravel less" nozzles that will allow the elimination of a portion of the support gravel and provide additional media depth for filtration.

Filtralite media are an expanded clay media that has a higher surface area for particle capture and as a result, this media can provide longer filter runs and/or operate at higher loading rates than traditional media. United Water pilot tested Filtralite media at its Haworth, NJ WTP from the Fall 2009 to Spring 2010. For this pilot test, DAF effluent water was pumped to two 1 ft square filter columns, one with anthracite/sand media and the second with the two layered Filtralite (2.0 mm/1.0 mm). The results were very impressive:

- Filtralite developed headloss at about half the rate of the anthracite/sand media, resulting in filter runs that are at least twice as long as the anthracite/sand media.
- Excellent turbidities were obtained with Filtralite
- Filtralite was able to operate at a significantly higher loading rate (7.5 gpm/sf vs 5.0 gpm/sf for anthracite/sand) and maintain equivalent performance in terms of headloss and effluent quality.

This demonstration project at the Matchaponix WTP, will provide a full-scale side by side comparison of the new anthracite/sand media with the Filtralite media, as well as the unmodified existing media.

Initially, the filters would be run at the existing loading rates of 3 gpm/sf to develop baseline data and then increased up to 5 gpm/sf for the anthracite/sand media and 7 gpm/sf for the Filtralite media.

Robert Raczko, P.E.
United Water
700 Kinderkamack Road
Oradell, NJ 07649
Phone: (201) 986-4990
Email: *bob.raczko@unitedwater.com*

Full Scale and Pilot Scale Evaluation of EDC Removal through WTP Processes

Robert Raczko, P.E., John E. Dyksen , United Water

*U*nited Water completed two projects to evaluate the removal of Endocrine Disrupting Compounds (EDCs) through surface water treatment plants:

- Water RF Project 4221- Removal of Unregulated Organic Chemicals in Full-Scale Water Treatment Processes
- A Suez Environnement R+I Alliance sponsored project - Removal of Spiked Concentrations of EDCs through the Haworth Pilot Plant

The Water RF project involved looking at removal of EDCs through four operating surface water treatment plants in New Jersey once each season, each with different degrees of treatment (two with ozone, one with granular activated carbon (GAC) and one conventional treatment plant) and varying source water qualities (two river supplies with significant upstream contributions from wastewater treatment plants and/or industrial discharges, one reservoir source and one relatively clean river supply).

Low levels of EDCs have been detected in the source waters as would be expected (more found in the less protected watersheds) and also there seems to be a seasonal variation in the types of EDCs found during the course of the year. In general, conventional treatment (coagulation/clarification/ filtration) alone does not provide significant removal of these compounds, while the plants using ozone or GAC generally achieved higher removals of EDCs.

For the pilot plant project, United Water spiked a mixture of about 17 EDCs that are somewhat representative of the various classes of EDCs found in the full-scale work and other studies. Raw water to the pilot plant was spiked at higher levels than seen in actual surface waters in order to better assess removals through the various treatment processes being evaluated:

- Preozonation (with and without hydrogen peroxide)
- Intermediate ozonation (with and without hydrogen peroxide)
- Coagulation/DAF Clarification
- Intermediate Chlorination
- Anthracite/Sand Filtration
- Virgin GAC
- Spent GAC
- UV/Peroxide

The results are very promising, indicating significant removal of EDCs through preozonation, intermediate ozonation, UV/Peroxide and virgin GAC.

Robert Raczko, P.E.
United Water
700 Kinderkamack Road
Oradell, NJ 07649
Phone: (201) 986-4990
Email: *bob.raczko@unitedwater.com*

An Enhanced Hydro-Ecological Model (RHESSys) to Explore Climate Change Interactions Between Precipitation Patterns, Topography and Forests in a New York City Water Supply Watershed

Antoine Randolph, City University New York, NYC Department of Environmental Protection; Larry Band Ph.D., UNC Chapel Hill; Christina Tague Ph.D, UC Santa Barbara; Elliot Schneiderman Ph.D., NYC Department of Environmental Protection

Current theory suggests that climate change may manifest itself in the form of changes in the temporal sequencing of storm events and changes in the characteristics of storm events (*e.g.*, storm depth, inter-storm period, rainfall intensity, etc). As a consequence, the partitioning of rainfall between interception, throughfall, runoff, infiltration, evaporative loss and stream discharge will change. Collectively, these changes in the surface water budget can be expected to have differential impacts on forested watersheds because of differential sensitivity to water stress across tree species and due to interactions between landscape, vegetation and climate.

The hydro-ecological model RHESSys operates at regional or local scales and can explicitly model the spatio-temporal variability in precipitation (*i.e.*, storm sequence) associated with particular weather patterns, thus capturing the full range of natural variability associated with storms and storm sequence. Vegetation modeling in the presently described enhanced version of RHESSys also considers forest structure and composition and models the processes that define interactions between landscape, vegetation and climate. Additionally, topographic effects (*e.g.*, shadowing) and topology (*e.g.*, the effect of landscape structure on redistribution of water) are modeled at a scale fine enough to capture (potential) species-specific impacts of climate change on watershed dynamics.

This presentation provides an overview of the above described enhancements to RHESSys. The enhancements are designed to expand the model's ability to downscale and investigate the potential effects of global climate change scenarios on individual catchments and hillslopes. In particular, this version of RHESSys emphasizes modeling changes in forest structure, composition and spatial distribution and changes in surface water budget. We present initial results of RHESSys simulations of the Biscuit Brook watershed, which is part of drainage to the Neversink reservoir.

Antoine Randolph
City University New York
71 Smith Avenue
Kingston, NY 12477
Phone: (845)340-7268
Email: *ARandolph@dep.nyc.gov*

A Tale of Three WWTPs

Robert Ravallo, NYC Department of Environmental Protection

A Tale of Three WWTPs - How the City, Local Government and the Private Sector Worked Together to Protect the Environment: As part of the MOA, the City agreed to fund the eligible costs of designing, permitting and constructing upgrades of all existing non-City-owned wastewater treatment plants (WWTPs) in the watershed. In addition the City agreed to fund eligible upgrades to new or expanded WWTPs. "Upgrades" mean equipment and methods of operation that are required solely by the WR&R, and not by federal or State law. The City further agreed to pay the annual costs of operation and maintenance of the upgraded facilities.

The presentation will cover how a plan was developed and implemented to consolidate three possible WWTPs into one, eliminate failing septic systems and benefit the local business community served by these septic systems.

Robert Ravallo
NYC Department of Environmental Protection
465 Columbus Avenue
Valhalla, NY 10595
Phone: (914) 742-2004
Email: *RRavallo@dep.nyc.gov*

Use of a Kinetic Dye Adsorption Test for Predicting Granular Activated Carbon Performance

Adam Redding, Ph.D., Siemens Industry, Inc.; Michael Greenwald, Fred S. Cannon, Penn State University; Joseph Roccaro, Suffolk County Water Authority

No standardized activated carbon test method exists that quickly determines the relative ease of mass transport into the carbon structure. As such end users cannot readily specify an activated carbon with both the adsorption capacity and mass transport ability that meets the demands of their application. To this end, a simple and inexpensive kinetic dye test method has been developed which provides the relative Intraparticle Diffusion Constant, or "Dye Number" for an activated carbon. The method uses a small sample of activated carbon, ground and sieved to a defined size, and then measures the adsorption of a dye from solution over a timed interval. Several dyes were tested as the target adsorbate and one dye was selected on the basis of stability and ease of use. The utility of the Dye Number was then compared against pilot-scale data for groundwater treatment of six (6) chlorinated organics with six (6) activated carbons, and rapid small-scale column tests (RSSCTs) for removal of 2-methylisoborneol with twelve (12) activated carbons from three (3) surface waters. This breakthrough data was fit to a two-variable linear model with the Dye Number as a measure of mass transport ability and the Iodine Number (ASTM D4607) as measure of adsorption capacity. In all cases, regardless of background

organic concentration or source water, the two-variable model produced correlations with a coefficient of determination (R-squared) generally greater than 0.9 and regularly approaching unity. Several other activated carbon characterization methods, BET surface area, micropore volume, molasses number, etc. were also compared to the data sets; none were identified as statistically significant ($p>0.05$). A second pilot test (due to finish in Fall 2013) using six activated carbons for groundwater treatment of six chlorinated organics is underway and the method/model discussed herein will also be used to predict the outcome of those tests.

Adam Redding, Ph.D.
Siemens Industry, Inc.
428 E Waring Avenue
State College, PA 16801

Extreme Events in the Major Rivers of New York State

Nicholas Rossi, Richard Palmer, UMass Amherst

The increase in climate variability currently expected Earth's atmosphere poses a number of challenges for how water is managed. The deeply complicated nature of the Earth's climate has left the timing, magnitude, and variability of climate change generally unknown. Global climate models have been used to predict the effects but the uncertainty associated with these predictions is often too large to be the basis for important and costly decisions to be made. An alternative approach to preparing for climate change would be to look to the past in order to learn everything we can about the way our water systems operated, and continue to operate now.

Of particular interest to water managers in regards to climate change are droughts and floods, or "extreme events". Extreme events have the ability to cause significant problems for water systems and often occur without adequate warning or a definitive length. As such, they need to be managed with the utmost care in order to avoid potential catastrophe. Impending climate change is expected to impact the variability and magnitude of extreme events in the Northeast United States, but the correct course of action for water managers is not clear.

This study aims to investigate the potential impacts of climate change on extreme hydrologic events in the major rivers of New York by comparing historic events to the antecedent weather conditions that caused them. The study will categorize historic droughts and floods on the Mohawk, Delaware, and Hudson Rivers based on severity and search for any apparent trends in the distribution of events. Weather regimes that preceded particular categorizes of events can be analyzed to create a taxonomy detailing cause-and-effect of extreme events on these rivers. This taxonomy can help water managers prepare for likely scenarios based on the most probable forecast at the time.

Nicholas Rossi
UMass Amherst
90 Arcadia Avenue
Reading, MA 01867
Phone: (781) 249-9856
Email: *njrossi@student.umass.edu*

Ice Cover in New York City Drinking Water Reservoirs: Modeling Simulations and Observations

Nihar Samal, Ph.D., Institute for Sustainable Cities,Hunter College of City University of New York; Donald C. Pierson, Mark S. Zion, NYC Department Environmental Protection; Klaus D. Joehnk, CSIRO Land and Water

The timing of ice formation and loss in lakes and reservoirs will modulate the impact of regional weather conditions on lake thermal structure and mixing, since heat and momentum transfer into the water column are greatly reduced by the presence of ice cover. Changes in the duration and timing of ice cover are well documented effects of climate change that are expected to continue into the future. In the present study, a simple model that predicts the onset, loss and duration of ice cover is applied to New York City drinking water reservoirs, as well as nearby lakes with long ice cover records. The model is driven by daily or hourly air temperature and wind speed as these are the most important factors influencing ice breakup and formation.

The simple model was tested by comparing simulated ice cover to 8 years of observed ice-on and off data for Ashokan and Rondout reservoirs. Further, these 8 years of observed data are compared to 163 years Otsego lake ice phenology. The long-term observed ice phenology of Otsego Lake, when translated to hindcast the Ashokan reservoir's ice conditions, can provide a powerful, integrative description of long-term wintertime and springtime climatic conditions for the region. Long-term simulations of ice conditions/duration are essential to understand the mechanics through which ice cover mediates the effects of climate on lake thermal structure and mixing, and how changing ice cover may ultimately influence phytoplankton succession and trophic status of lakes and reservoirs.

Nihar Samal, Ph.D.
Institute for Sustainable Cities
Hunter College of City University of New York
71 Smith Avenue
Kingston, NY 12477
Phone: (845)340-7272
Email: *nsamal@hunter.cuny.edu*

NYC's Waterborne Disease Risk Assessment Program - 20 Years Later: Program Implementation and Data Findings

Anne Seeley, David Lipsky, NYC Department of Environmental Protection; Sharon Balter, Daniel Cimini, Lisa Alleyne, NYC Department of Health and Mental Hygiene

NYC implemented the first elements of its Waterborne Disease Risk Assessment Program (WDRAP) in 1993. The program is an inter-agency program involving the NYC Department of Environmental Protection and the NYC Department of Health and Mental Hygiene. A public health monitoring program designed to provide assurance of the microbial safety of the City's water supply, WDRAP specifically focuses on the microbial agents addressed by the Federal Surface Water Treatment Rule - *i.e.*, Giardia and Cryptosporidium. Ongoing operation of the program is a requirement under NYC's Filtration Avoidance Determination. Over the 20 years since program inception, WDRAP has been expanded and modified based upon enhanced knowledge, data availability shifts, companion program opportunities, and other factors. This presentation will provide an overview of the program components, including a description of how components have evolved over the program's 20-year history. Also, key data findings will be provided from the WDRAP disease surveillance components (*i.e.*, including rates, demographics, and risk factor findings for giardiasis and cryptosporidiosis) and from the outbreak detection (aka "syndromic surveillance") components. Finally, integration of the WDRAP data into NYC's newly-created spatial dashboard, developed under a Water Security Initiative funded by EPA, will be described.

Anne Seeley
NYC Environmental Protection
59-17 Junction Boulevard, 20th Floor
Flushing, NY 11373-5108
Phone: (718) 595-5346
Email: *aseeley@dep.nyc.gov*

The Effect of Temperature on the Formation of Disinfection By-Products

Vladimir SotoSanchez, United States Military Academy

Chlorination has been recognized as an effective public health measure for removal of pathogens and preventing microbial growth in water distribution systems. Chlorine reacts with natural organic matter (NOM) to form carbonaceous disinfection by-products (C-DBPs) during water disinfection. Trihalomethanes (THMs and haloacetic acids (HAAs) are the predominant C-DBPs identified in chlorinated waters. These C-DBPs have important adverse health effects that resulted in regulations being enacted to control their concentration in drinking water.

Chloramination has gained popularity as an alternative to chlorination for water disinfection. Chloramine is a weaker disinfectant than chlorine, and requires a longer contact time for disinfection. However, chloramine significantly forms a lower amount of THMs and HAAs than chlorine, and can last longer in distribution systems due to its low reactivity.

Monochloramine is the dominant chloramine found in drinking water treatment, and react with dissolved organic nitrogen (DON) to form nitrogenous disinfection by-products (N-DBPs) like nitrosamines. Nitrosamines are classified as a probable human carcinogen at the ng/L level by the EPA. N-nitrosodimethylamine (NDMA) is the main nitrosamine identified in chloraminated waters.

A series of experiments were conducted at 4, 20 and 40 degrees Celsius to evaluate the formation of THMs and HAAs from chlorinates surface waters, and NDMA and HAAs from chloraminated surface waters. The results from these experiments showed that formation of THMs significantly increases, and formation of HAAs and NDMA increases as the temperature increases. Source specific and seasonal effect patterns are significant factors for NDMA formation than for formation of THMs and HAAs. The residual chlorine and monochloramine trend do not provide a representation of the temperature effects on C-DBP and N-DBP formation.

Vladimir SotoSanchez
Department of Geography and Environmental Engineering
United States Military Academy
745 Brewerton Road, Room 5400
West Point, NY 10996
Phone: (845) 938-4658
Email: *vladimir.sotosanchez@usma.edu*

Major Changes in the Phase I ESA Standard: Implications for Watershed Protection?

Stuart Spiegel, O'Brien & Gere Engineers, Inc.

The ASTM Standard Practice for Environmental Assessments (ESAs) (E 1527-05) has been used to evaluate the environmental quality of properties for watershed protection purposes since the 1990s. New York City has had a major program for the review and acquisition of properties in its watershed for watershed protection that is part of a strategy of watershed protection that has prevented the need for costly filtration. Phase I ESAs also have been used to evaluate the implications of land use and commercial/industrial development in the preparation of watershed protection planning. The standard has undergone a required review, and a significant revised version issued in 2013. The major modifications will alter the long understood definition of "recognized environmental conditions," the basis for findings in the assessment. These changes likely will cause some uncertainty, and possibly objection, on the part of users, as well as the practitioners who perform the assessments. The major modifications will: (1) alter the long understood definition of "recognized environmental conditions," or REC, the basis for findings in the assessment, with some of the changes intended for greater consistency with Superfund or to provide a definition where one has been lacking, and adding a new concept, that of the controlled REC, or "CREC"; (2) address vapor migration more explicitly than in the past; and (3) revise the scope of regulatory file reviews. These changes likely will cause some uncertainty, and possibly objection, on the part of users, such as campuses, as well as the practitioners who perform the assessments. Lesser changes deal with User responsibilities, the manner in which

industrial and manufacturing land use is addressed, the report format, and a new appendix to the standard also have pertinence. The revisions, the rationale for them, and their potential implications will be presented.

Stuart Spiegel
O'Brien & Gere Engineers, Inc.
333 West Washington Street
Syracuse, NY 13221
Phone: (315) 657-6402
Email: *stu.spiegel@obg.com*

Hydrologic Effects of the Rondout-West Branch Water Tunnel on the Groundwater-Flow System in Wawarsing, NY

Frederick Stumm, Ph.D., Anthony Chu, U.S. Geological Survey; Ira Stern, NYC Department of Environmental Protection

Groundwater flooding of basements and bacterial contamination of private-supply wells are recurring problems in the Town of Wawarsing, NY. Leakage from the Rondout-West Branch Water Tunnel and above-normal precipitation has been suspected of causing elevated groundwater levels and basement flooding. A network of wells was used to monitor the effects of tunnel shutdowns. The area is underlain by a sequence of northeast-striking sedimentary bedrock that contains dissolution features, fractures, and faults. Inflows of 1 to more than 9,000 gallons per minute from the fractured bedrock were documented during construction of the water tunnel, located more than 700 feet beneath the town. Glacial deposits infill the valley above the bedrock.

The groundwater-flow system in the valley consists of both fractured-rock and unconsolidated aquifers. Groundwater in the bedrock flows from the surrounding hills on the east and west sides of the valley toward the center of the valley. Water levels in the bedrock and unconsolidated aquifers fluctuated about 5 feet seasonally.

The range in bedrock-response to tunnel leakage was from 1.5 to 12 ft, and delay times ranged from 0.5 to 60 hours, at distances up to 7,000 ft from the tunnel. Tunnel-influence response of the bedrock aquifer is consistent with a discrete high-transmissivity network along fractured limestone bedding strike that have undergone dissolution.

Some unconsolidated aquifer wells responded to tunnel-leakage from the bedrock with water-level changes as much as 2.5 ft within 18 hours of tunnel shutdowns, but water-level changes in other unconsolidated-aquifer wells were smaller or nonexistent.

This study was done in cooperation with the NYCDEP to address community concerns regarding flooding-related issues in Wawarsing. Program support was adjusted based upon the results of these studies and plans for repairing the tunnel. NYCDEP programs were developed to assist homeowners with high groundwater impacts to homes and water supply.

Frederick Stumm, Ph.D.
U.S. Geological Survey
Coram Program Office, New York Water Science Center
2045 Route 112
Coram, NY 11727
Phone: (631)736-0783
Email: *fstumm@usgs.gov*

DBP Control Strategies: Source Water, Treatment, and Distribution System

Philip Tangorra, Connie K. Schreppel, Mohawk Valley Water Authority

Mohawk Valley Water Authority (MVWA) has developed an annual replacement program for Granular Activated Carbon (GAC) as an effective alternative for achieving Stage 2 compliance. Per the Stage 2 Rule, large utilities began compliance monitoring in April 2012 and MVWA, with a long history of elevated TTHMs in its distribution system, has been successful in lowering DBP levels through the use of GAC. Several other practices at both the filtration plant and in the distribution system have been implemented based on prior studies to also control DBP formation. Previous work has been presented to demonstrate MVWA's path to GAC selection (Tangorra, NYSAWWA 2010 Tifft Symposium).

This presentation guides the audience through the filter media swap out challenges and successes. It then focuses on several of MVWA's recent studies to more efficiently remove source water organics, assess GAC filtration performance on a pilot scale, and to assess changes in distribution system corrosion chemistry and pH to help in suppressing DBP formation.

MVWA has utilized bench and full scale testing to evaluate alternative coagulants to increase organics removal and continues to run a pilot scale filtration system with several carbon types to optimize organics removal. The pilots have also been utilized to test in situ regeneration of spent carbon material yielding promising results. A brief discussion of the next steps and method refinement is offered.

MVWA currently utilizes elevating the finished water pH to ~ 9.2 and boosting alkalinity to >40mg CaCO3/L as its corrosion control practices. Bench scale SDS testing has identified that TTHM formation is attenuated at a lower finished water pH. MVWA has recently completed two assessments of the effectiveness of a lower pH and the use of phosphates as a corrosion control strategy in lieu of an elevated pH to comply with distribution system regulations and to facilitate suppression of THMs.

Philip Tangorra
Mohawk Valley Water Authority
One Kennedy Plaza
Utica, NY 13502
Phone: (315) 792-5201
Email: *ptangorra@mvwa.us*

Rapid Response to a Swallow-Wort Infestation at the Pepacton Reservoir

Meredith Taylor, Barbara Dibeler, (Retired) NYC Department of Environmental Protection; Chris Zimmerman, Amanda Czechowski, The Nature Conservancy

An infestation of black and pale swallow-wort (Cynanchum louiseae, C. rossicum) was detected on New York City Department of Environmental Protection (DEP) property near the Pepacton Reservoir in Margaretville, NY in the summer of 2005 during the course of an invasive plant inventory by The Nature Conservancy (TNC). As one of two known swallow-wort occurrences in the Catskill region, the Pepacton infestation was considered an early detection warranting a rapid response. Concern for the potential impacts of the swallow-worts on forest regeneration, water quality and the local economy, led TNC and DEP to initiate a five-year pilot control program to determine feasibility of swallow-wort eradication at the Pepacton Reservoir, with an objective of eradication by 2012. Funding for the pilot was provided by the New York State Department of Environmental Conservation Terrestrial Invasive Species Eradication Grant Program.

After five yearly treatments (2007-2011), swallow-wort stem density in 12 one meter circular monitoring plots decreased by 100% and < 200 stems were detected over the 20 acres infestation; however, the objective of total eradication has not yet been achieved. Rapid responses to early detections of species that are difficult to detect at low levels may require a greater investment of time and effort to achieve eradication. Work will continue through 2015 to continue to monitor and control remaining stems until the seed bank has been exhausted. If eradication is achieved, this will be the first such success for the Catskill Region.

Meredith Taylor
NYC Department of Environmental Protection
71 Smith Avenue
Kingston, NY 12477
Phone: (845) 340-7856
Email: *metaylor@dep.nyc.gov*

Land Acquisition: Quality and Quantity Considerations- Strategic Evolution in NYC's Watershed Land Acquisition Program

David Tobias, NYC Department of Environmental Protection

New York City's watershed is one of the most expansive surface water supply systems in the world. At about 1 million acres (2,000 square miles or 5,180 square kilometers), the watershed is larger than about 65 of the world's 238 countries, and supplies water to 9 million people, which includes the largest metropolitan area in the US (which by population ranks about 15th in the world). Since, unlike many other surface water supplies, land within the City's watershed is principally in private ownership, the City has a special and difficult charge: to maintain high quality drinking water in a working landscape, to do so cost-effectively and over the long term, and to recognize that local communities still need room to grow. To do this, and to avoid the much higher costs of building a filtration plant, the City has implemented a suite of programs, including the Land Acquisition Program ("LAP"). As one of the key components to the City's source water protection strategy, LAP's goal is to acquire lands that, if developed, would be more likely to rapidly convey pollutants into watercourses. Achieving this goal is expected to skew future development toward properties that can accommodate such intensive land uses with less compromise of water quality. LAP does very little to improve existing water, quality but rather seeks to reduce or avoid future degradation. As more land is acquired in various basins and priority areas, LAP's acquisition strategy changes in response to our best forecasts about how to avoid such future degradation. The major factors that inform LAP's evolving strategy include the following: changes in levels of protected land within sub-basins, revisions by local towns to minimum zoning requirements, fluctuating real estate markets, landowner perceptions and responses, and costs related to short- and long-term acquisition and management of land and water supplies. This presentation offers an inside view of how LAP strategy evolves in response to those various forces.

David Tobias
NYC Department of Environmental Protection
71 Smith Avenue
Kingston, NY 12477
Phone: (845) 340-7837
Email: *dtobias@dep.nyc.gov*

Don't We all Need Validation? An Overview of UV Disinfection Testing Requirements

Matthew Valade, P.E., Hazen and Sawyer

Over the past 10 years, UV disinfection has been increasingly used to achieve enhanced disinfection targeting Cryptosporidium, as well as providing a potential means for reducing disinfection by-product formation. In order to properly design and operate a UV disinfection facility, complete performance testing of UV reactors is required. This testing is referred to as equipment validation and is required by the LT2ESWTR. The UV Disinfection Guidance Manual (USEPA, 2006) provides guidelines for conducting validations. This presentation discusses the various approaches and challenges to performing validation. In addition, three case studies are presented to exhibit how validation was performed for a new large-scale facility, retrofit into an existing plant in order to increase the plant capacity, and retrofit into a constrained pumping station in order to meet the treatment requirements of the LT2ESWTR. In addition, an update will be provided on

how the UV community is addressing the recently identified challenges of validating medium pressure UV equipment.

Matthew Valade, P.E.
Hazen and Sawyer
498 Seventh Avenue
11th floor
New York, NY 10018
Phone: (917) 685-8738
Email: *mvalade@hazenandsawyer.com*

Recent Storm Activity and its Effect on Turbidity Levels in Neversink Reservoir

Richard Van Dreason, NYC Department of Environmental Protection

Neversink Reservoir is located in the south, central Catskill Mountains of New York State. It is the smallest NYC water supply reservoir in the Catskills, comprising about 7.7% of the total Catskill/Delaware System. The Neversink Reservoir watershed is largely forested with minimal development. Water quality is typically excellent as characterized by Neversink's oligotrophic status and high water clarity. However, since October 1, 2010 several large rain events, including Tropical Storm Irene in late August 2011, have resulted in damage to stream banks within the watershed, creating locations of active erosion. As a result Neversink Reservoir has experienced extended periods of elevated turbidity, and recovery from the most recent storm on September 18, 2012 has been slower than expected.

In this presentation, we will evaluate the effect of recent storms by examining temporal and seasonal trends of turbidity, stream flow and rainfall in the Neversink basin and by comparing recovery rates of past and recent storms.

Richard Van Dreason
NYC Department of Environmental Protection
71 Smith Avenue
Kingston, NY 12477
Phone: (845) 340-7745
Email: *rvandreason@dep.nyc.gov*

Westchester County GIS Products and Services for Collaborative Watershed and Land Use Planning

Sam Wear, Westchester County

In its 25th year of operation, Westchester County GIS continues to lead development of government geospatial products and services throughout southeastern New York State. Recent work has focused on the publishing of data-rich map services which can be used by external government and industry agencies involved in land use and natural resources planning.

The County's web-based map services can be used with a wide range of GIS software packages and include high accuracy countywide planimetric datasets, both digital terrain and surface models, historical aerial photography, and tax parcel boundaries. Other larger datasets such as contours and LiDAR are also available for download from the county. A list of map services from Westchester County GIS is available at:

http://giswww.westchestergov.com/arcgis/rest/services.

This presentation will highlight how Westchester County's online GIS serves as a model for the sharing of government funded geospatial products and services - particularly in support of watershed or water supply program areas which typically have large geographic footprints.

Sam Wear
Westchester County GIS
148 Martine Avenue, Room 214
White Plains, NY 10601
Phone: (914) 995-3047
Email: *stw1@westchestergov.com*

Coagulation and Microfiltration for Disinfection Byproduct Control on Low SUVA and Low Turbidity Delaware Aqueduct Water

Andrew Weiss, P.E., Kevin Castro, P.E., GHD Inc.; James Osborne, P.E. Town of Newburgh

Historically the Town utilized the Chadwick Lake Water Filtration Plant to supply the residents of the consolidated water district. Over time the Town's population and demand increased and the quality of Chadwick Lake raw water declined. In 1991 the Town constructed a pumping station, finished water chemical feed facility, and chlorine contact tank on New York City property over the Delaware Aqueduct. Since 1991 the Town has supplemented its Chadwick Lake supply with unfiltered water from the Aqueduct. In 2005, while operating exclusively on Delaware water, the Town exceeded the maximum contaminant level for haloacetic acids in their distribution system. The result was the Town's filtration avoidance determination was rescinded by the NYSDOH and the Town was required to filter or abandon the source. The Town needed the Delaware supply and chose to pursue filtration. The high quality of the water and the low specific ultraviolet light absorbance of the water ultimately drove the selection of a direct-filtration approach with membrane microfilters. The low alkalinity, low pH, and low total organic carbon in the water made it difficult to coagulate, corrosive, and challenging to remove the predominantly hydrophilic organics. This paper will focus on the development of the treatment approach including jar testing results that determined a viable coagulation approach and practical organic carbon removal levels, the benefits and drawbacks of pre-procurement of microfiltration equipment, challenges during design and construction, the use of computational fluid dynamic modeling to maximize reuse of

existing facilities, and ultimately operation and performance of the new treatment facility (completion scheduled for June 2013) with a specific focus on organic carbon removal and disinfection byproduct reduction performance.

Andrew Weiss, P.E.
GHD Inc.
One Remington Park Drive
Cazenovia, NY 13035
Phone: (315) 679-5725
Email: *andrew.weiss@ghd.com*

Advanced Techniques for Monitoring NOM and Controlling DBPs

Ben Wright, P.E., Bill Becker, Hazen and Sawyer; Dave Reckhow, University of Massachusetts; Steve Schindler, NYC Department of Environmental Protection

New York State has many high quality water supplies, and water utilities throughout the state have historically had the luxury of treating water with relatively simple, low energy treatment systems. However, increased regulation of disinfection byproducts (DBPs) and changing weather and hydrology, which changes the concentration, character, and seasonality of natural organic matter (NOM) in water supplies, is leading utilities to employ more advanced treatment to maintain compliance. Treatment techniques for controlling NOM, the primary precursor to disinfection byproducts, include optimized coagulation, oxidative processes, adsorbents and membrane filtration, and are typically expensive. Further complicating matters is the fact that not all NOM leads to the same concentrations or types of DBPs, but current monitoring technology cannot detect specific types of NOM. As such utilities are unnecessarily removing a broad spectrum of NOM at great expense.

In order to improve the ability of utilities to target treatment processes or management strategies (*e.g.* blending or selective withdrawals) to minimize costs of compliance, we are pursuing a project to analyze the causal structure of NOM as it relates to DBP formation. Laboratory and field investigations are being conducted to explore how NOM, turbidity, and algal growth depend on temperature and concentration loadings, so that mathematical models for changing conditions can be developed. Additionally, improved online monitoring technology is being pursued in order to enable utilities to better target specific NOM constituents. This presentation will provide an overview of the project approach and present details of the lab and field analytical procedures.

Ben Wright, P.E.
Hazen and Sawyer
One South Street
Suite 1150
Baltimore, MD 21202
Phone: (410) 539-7681
Email: *bwright@hazenandsawyer.com*

Air Bubble Column Dynamics in Water and Wastewater Treatment Process- A Review of Recent Advances in CFD Application

Sean Zhang, Ph.D., P.E., Julie Herzner, Bill Becker, Hazen and Sawyer, P.C.

CFD (Computational Fluid Dynamics) has been successfully used in various water and wastewater treatment processes including clarification, aeration, rapid mixing and flocculation, disinfection and many others. One set of CFD applications involve air bubble column, where one liquid in gas phase is introduced to another liquid in water phase, usually at bottom of the tank. Lighter air bubbles rise in water column due to buoyancy and create desired flow pattern, either as a means to promote mixing or as a gradient of treatment process. Examples of air-bubble column are aerated grit setting tanks, activated sludge tanks, ozone contactors, and dissolved air floatation (DAF) tanks.

Modeling air-bubble column using CFD presents several unique challenges. First, it requires air-water two-phased flow different modeling techniques that air bubbles can be treated as discrete particles interacting with continuous water phase, as a mixture of particles in water, or a separate continuous phase. A more practical population balance model divides air bubbles into a bin of different size groups and allows coalescence and breakup of air bubbles. Second, air bubble columns are usually highly turbulent and unstable, selection of appropriate turbulent closure model and theories to characterize the air bubble dynamics are often based on individual's experience.

Despite its success in simulating batch and continuous reactors in chemical, pharmaceutical, petroleum, food processing and other industries, there have been limited air bubble column CFD applications in water and wastewater treatment processes. In this paper we will briefly review the fundamentals of the air bubble dynamics, flow regime classification, and also present several recently completed advanced CFD applications. With the knowledge and experiences we have accumulated and lessons learned from other industries, we are steps closer to use CFD model as design and optimize tools.

Sean Zhang, Ph.D., P.E.
Hazen and Sawyer, P.C.
498 Seventh Avenue, 11th Floor
New York, NY 10018
Phone: (212) 539-7114
Email: *szhang@hazenandsawyer.com*

Water Quality Modeling used to Inform Operational Decisions for the NYC Water Supply: A Ten Year Retrospective

Mark Zion, Donald C. Pierson, Elliot M. Schneiderman, NYC Department of Environmental Protection; Adao Matonse, City University of New York, Institute for Sustainable Cities

Turbidity is the primary factor that potentially limits use of the Catskill System portion of the New York City Water Supply. During periods of elevated turbidity daily decisions are carefully taken to optimize system operations for turbidity control, while ensuring adequate water storage levels within the entire water supply system. To support these decisions, a combination of watershed, reservoir water quality and water system simulation models are used to evaluate alternative operational scenarios within a probabilistic framework. These simulation models form the basis for the Operational Support Tool (OST) currently under development by DEP.

During the last ten years a number of storm events caused elevated levels of turbidity in Catskill System reservoirs. As these storm events occurred, various model simulations were used to analyze the effects of alternative operational strategies on reservoir effluent water quality. Operational strategies that were investigated included use of the Ashokan Reservoir Release Channel, installation of stop shutters in the Catskill Aqueduct to limit flow of turbid water into Kensico Reservoir, and the blending of Catskill and Delaware System waters to maintain adequate water quality at Kensico Reservoir effluents. This presentation describes the different types of model simulations which helped to inform system operation decisions during these periods of elevated Catskill System turbidity.

Mark Zion
NYC Department of Environmental
71 Smith Avenue
Kingston, NY 12477
Phone: (845) 340-7792
Email: *mzion@dep.nyc.gov*