AWRA DELAWARE SECTION
PRESENTS THE

2007 AMERICAN WATER RESOURCES ASSOCIATION
MID-ATLANTIC CONFERENCE
GREEN OPPORTUNITIES FOR A BLUE RESOURCE:
AN ECONOMIC PERSPECTIVE

SEPTEMBER 19-21, 2007
NEWARK, DELAWARE

CONFERENCE NOTES, ABSTRACTS, AND BIOGRAPHIES

AGENDA

Wednesday, September 19, 2007

12:00 p.m.	**Registration, Poster Session, Exhibitors (Lobby)**
2:30 p.m.	**Session 1 – Economics and Water Resources: Nonprofit, Government, Industrial, Academic, and Water Supplier Perspectives (Room 101B)** *Panelists: Cheryl Hess (Conectiv Energy), Howard Neukrug (City of Philadelphia Water Department), Samuel Reynolds (U.S. Army Corps of Engineers), Brian Richter (The Nature Conservancy), and Dr. Robert Traver (Villanova University)* *Facilitator: Nicholas DiPasquale*
5:30 p.m.	**Dinner and Keynote Presentation (Room 101A)** *Keynote Speaker: Dr. David Tilley, Assistant Professor, Natural Resources Management Program, Department of Environmental Science and Technology, University of Maryland* *Facilitator: Gerald Kauffman*
7:30 p.m.	**Session 2 – Mid-Atlantic Chapters' Meeting (All are welcome to attend) (Room 101B)**

Thursday, September 20, 2007

7:30 a.m.	**Continental Breakfast, Exhibitors, Networking (Lobby)**
8:30 a.m.	**Opening Remarks, Welcome Presentation, Conference Goals (Room 101A)** *Laura Whalen, President DE AWRA* *Kenneth Reid, Executive Vice President, AWRA* *Jane Rowan, President-Elect, AWRA*
9:30 a.m.	**Break, Poster Session, Exhibitors, Networking**
10:00 a.m.	**Session 3 – Concurrent Sessions** **Track 1 (Room 101B)** **Economic Impacts and Solutions** *Facilitator: Martin Wollaston* • The Economic Benefits of the Christina Basin *Gerald Kauffman*

- Willingness to Pay for Sustainable Agricultural Practices in an Urbanizing Region
  Dr. Joshua Duke
- Financial Solutions to Water Issues
  Lee Beetschen
- The Economic Impact of the Environmental Benefits of Green Space
  Nancy Weissman

Track 2 (Room 119)
Restoration/Retrofits I *Facilitator: Chris Bason*

- Green Opportunities of an Urban Watershed "Linking Science, Management, Policy, and Funding to Achieve Goals"
  Jennifer Egan and James Eisenhardt and
- Successful Forested Wetland Restoration/Mitigation Meets Performance Standards in One-Third the Time Using High Performance Native Wetland Plants
  Dr. Janet Hawkes
- Detention Basin Retrofitting
  David Athey
- Economic Impact of Storm Water Best Management Practices; Necessary Evil, or Positive Attribute?
  Albert Demerich

11:15 a.m. **Break**

11:30 a.m. **Session 4 – Concurrent Sessions**

Track 1 (Room 101B)
Watershed Planning *Facilitator: Rick Mickowski*

- The Christina River Basin: the Economics of Implementing a Pollution Control Strategy to meet the TMDLs
  Martha Corrozi
- Development, Redevelopment, and the Protection of Critical Environmental Areas: Opportunities for Watershed Protection and Economic Growth in New Jersey's Urban and Suburban Areas
  Robert O'Neil
- How Much is a Watershed Worth*?*
  Jennifer Volk

Track 2 (Room 119)
Restoration/Retrofits II *Facilitator: Jennifer Campagnini*

- Comparing the Costs and Benefits of Four Stream Restoration Projects Constructed on Mill Creek Between 2004 and 2007 in Lower Merion Township, Pennsylvania
  Megan LeBoon
- Restoration of Ellis Island Seawall; Engineering Innovation and 404 Permitting Experience
  Helen Robinson

- Brandywine Shad Restoration Project
  Robert Lonsdorf

12:30 p.m. **Lunch**

Peter Mitchell, Chairman and Chief Creative Officer, Marketing for Change, Washington, D.C.

Facilitator: Laura Whalen

2:00 p.m. **Session 5 – Concurrent Sessions**

Track 1 (Room 101B)
Drinking Water *Facilitator: Nancy Parker*

- Sustainable Infrastructure: A Delaware Perspective
  Ed Hallock
- Using Resources Wisely: Pumped Storage on the White Clay Creek
  Roy Simonson
- Prioritizing Land Protection to Protect Source Water in the Schuylkill River
  Jennifer Adkins
- Stretching Our Source Water for a Better Return
  Francis Greene

Track 2 (Room 119)
Urban Case Studies I *Facilitator: Ginger North*

- Water Resources Enhancements at the Blue Ball Properties
  Bruce Jones
- Watershed Improvement/Restoration in an Urban Setting
  Peter Mandeville and James Eisenhardt
- CAFO Designs/Environmental Stewardship at Delaware Park: Obtaining Multiple "Green and Blue" Goals on a Wild and Scenic Watercourse"
  Albert Demerich and James Eisenhardt
- Teaneck Creek - Reclaiming Forgotten Urban Lands for a Wetland Eco-Park
  Jeremiah Bergstrom

3:15 p.m. **Break, Poster Session, Exhibitors, Networking**

3:45 p.m. **Session 6 – Concurrent Sessions**

Track 1 (Room 101B)
Tools for Watershed Planning *Facilitator: Kate Anderson*

- Rockaway River Priority Stream Segment Study Evaluating and Implementing TMDLs in an Urban Watershed
  Jeremiah Bergstrom
- Asset Management: Inventory and Inspection
  Bryan Pariseault

- DELMARV Again: Hydrology of Flatland Watersheds
  Greg Paxson

Track 2 (Room 119)
Urban Case Studies II *Facilitator: Thomas McKenna*

- Redevelopment of the Port Reading Coal Terminal; Balancing Brownfield and Greenfield Initiatives
  Mark Gallagher
- The Fiscal and Economic Impact of Wilmington Riverfront Redevelopment
  Dr. Simon Condliffe
- The Chesapeake & Delaware Canal Trail
  Larry Trout

5:30 p.m.	**Leave for dinner at the Chesapeake Inn**
6:30 p.m.	**Dinner at the Chesapeake Inn, Chesapeake City, Maryland**

Friday, September 21, 2007

10:00 a.m.	**Session 7 – Fieldtrips** Vans will be leaving Clayton Hall at 10:00 a.m.
Tour 1:	***Bringing Back Brandywine Shad*** Leaders: Robert Lonsdorf and Zach Stevenson, Brandywine Conservancy
Tour 2:	***BMP Tour*** Leader: James Eisenhardt, Duffield Associates
Tour 3:	***Part 1 - Restoring and Sustaining an Urban Farm – Case Study of Land Use Planning for the University of Delaware's Farmland*** ***Part 2 - Stewards of the Future – New Strategies for Promoting Responsible Farm Management*** Leader: Jenny McDermott and Alyssa Collins, University of Delaware
Tour 4:	***Urban Wildlife Refuge*** Leader: Thomas Moran, DNREC

Wednesday, September 19, 2007

Session 1: Economics and Water Resources: Nonprofit, Government, Industrial, Academic, and Water Supplier Perspectives

Panelists:

Cheryl Hess, Howard Neukrug, Samuel Reynolds, Brian Richter, Dr. Robert Traver
Facilitator: Nicholas DiPasquale

Abstract:

The focus of this panel is the economics of water resources from different points of view and how each area can work together to improve our water resources and the impacts we have on our resources daily by using new technology or design, etc. The panel will begin with each presenter giving an overview of their own experience in their career with economics and water resources. Each panelist will have approximately 10 minutes. During the second hour of the presentation, the panelists can answer questions and then there should be about half an hour for discussion, which will be led by Nick with points that came up during the presentations and questions. One example of discussion on how industry impacts the water resources and economy is that is creates power which affects the water resources, but also creates jobs and is sinking money back into the economy. The main goal of the discussion is to bring about discussion on actions that could be taken by the AWRA to come up with solutions to these issues and bring up topics for future discussion points.

Biographies:

Cheryl Hess

Cheryl Hess is Senior Environmental Coordinator/Project Manager for Conectiv Energy (a Pepco Holdings Incorporated company). Ms. Hess has over 23 years of experience in environmental regulation, consulting, and compliance. Since 1999 Ms. Hess has worked and participated in all facets of the Clean Water Act 316(b) regulations. This includes: 316(b) Phase I rule for new facilities, the 316(b) Phase II for existing steam electric utilities, and overseeing 316(b) studies under the Clean Water Act prior to the 2004 rule. She has participated and overseen 316(b) work in three states and is an active participant in utilities groups and utility water users' group forums on 316(b). Her involvement required the creation and oversight of a multidisciplinary team that thoroughly reviewed EPA's administrative record, reviewed numerous court decisions on 316(b), analyzed the economic implications of the rule, and participated in and provided insight to industry organizations. Ms. Hess has an in-depth working knowledge of the nuances of 316(b) issues. Ms. Hess received a Masters of Science in Biology with an emphasis in aquatic ecology from Old Dominion University and worked for DNREC prior to taking a position in the industry.

Howard Neukrug

Mr. Neukrug directs Philadelphia's Green Cities - Clean Waters Program which is using land, waterway, infrastructure and sustainability practices to find creative solutions to the city's water-environment issues. He is responsible for establishing policies and programs for Southeast Pennsylvania's stream and river network for the protection of water supply for 2 million persons, the propagation and protection of fish and wildlife habitat, and in support of the region's green development practices, recreation, ecotourism and sustainable riverfront re-development efforts.

He oversees a "best in nation" source water protection program for the City of Philadelphia which is currently implementing over 65 restoration and protection projects involving abandoned mine drainage reclamation, agricultural buffers, stormwater management, sewage overflows and public education. He is responsible for Philadelphia's CSO program which is implementing an adaptive watershed management approach to CWA attainment goals using coordinated outreach, education and stakeholder support throughout the planning and implementation stages of watershed programming, comprehensive watershed monitoring, hydrologic/hydraulic engineering, green development and infrastructure and stream enhancements. His office recently implemented new stormwater regulations for Philadelphia which encourage green development, and is responsible for the review of development plans for the City of Philadelphia for compliance with the stormwater requirements.

Mr. Neukrug is an advisor on regional and national water quality and water resource boards for the USEPA, the State of Pennsylvania and the Delaware River Basin Commission. He has served as a trustee of the American Water Works Association (AWWA) Research Foundation, vice-chair of the Partnership for the Delaware Estuary, and the immediate past chair of the AWWA Water Utility Council. He is currently the Chair of the Water Infrastructure Committee for the National Advisory Council on Environmental Policy and Technology.

Mr. Neukrug has over 25 years experience in utility planning and management and is an expert in drinking water quality and treatment. He is a Professional Engineer, a graduate in Civil and Urban Engineering from the University of Pennsylvania. Mr. Neukrug has often been asked to testify before Congress and the USEPA on environmental, financial, infrastructure and other utility management issues, and to speak before hundreds of local, national and international forums.

Samuel Reynolds

Originally from New Albany, Indiana, Sam Reynolds received a BA in Biology in 1978 from Indiana University, and a MS in Biological Science in 1980 from Marshall University. Sam started his career with the Corps by working as a project manager in a summer position with the Regulatory Branch, Memphis District USACE in 1981, and later as a full time project manager from August 1985 until February 1987. At that time Sam transferred to the Philadelphia District working as a project manager in the

Surveillance and Enforcement Section. From December 1987 until August 1992 Sam was the Acting Chief of that section. From August 1992 until today Sam has been the Chief of Application Section II.

Brian Richter

Brian Richter has been involved in river science and conservation for more than 20 years. He is the director of The Nature Conservancy's *Global Freshwater Initiative*, an international program that is supporting conservation projects across the Americas, Asia, and the Pacific Region. Brian's work is focused on the global challenges of meeting human needs for water while keeping river and lake ecosystems healthy. He works with public agencies, academic institutions, and other private organizations, and leads a staff that includes hydrologists, aquatic ecologists, policy specialists, educators and communicators. Brian has developed numerous scientific tools and methods to support river restoration efforts, including the *Indicators of Hydrologic Alteration* software that is being used by water managers and ecologists worldwide. He has published many scientific papers on the importance of ecologically sustainable water management in international science journals, and co-authored a new book with Sandra Postel entitled *"Rivers for Life: Managing Water for People and Nature*" (Island Press, 2003).

Brian has provided scientific or technical consultation on more than 90 river projects worldwide. His travels have taken him to the Yangtze River in China, the Paraguay River in Brazil, and the Sabie River in Africa, but the Moormans River in Virginia is "home."

Dr. Robert G. Traver

Dr. Robert G. Traver has been a member of the Water Resources and Environmental Engineering Program at Villanova since 1988. Dr. Traver is a registered professional engineer, and a Diplomat of the American Academy of Water Resource Engineers. He was honored as the Water Resources Engineer of the Year (2004) by the Philadelphia Section of ASCE. He teaches graduate courses in hydrology, hydraulics, urban storm water management, and undergraduate courses in all facets of water resources, and was awarded the Schuylkill Action Network Education Award and the Water Resources Association of the Delaware River Basin Ruth Patrick Education Award (2006).

While at Villanova, Dr. Traver has conducted research on topics that include modeling of stream hydraulics, urban hydrology, water quality, and measures to mitigate stormwater effects of urbanization. Most recently he has been the main force in creating a Stormwater Best Management Practice Demonstration and Research Park on the Villanova Campus. To enable continuing study into advancing research in these areas, Dr. Traver founded the *Villanova Urban Stormwater Partnership,* and serves as its director.

Recognizing the link between policy and engineering, Dr. Traver continues to be involved with the implementation of stormwater policy. He has participated with a team study (sponsored by PaDER) to review the effects of Pennsylvania's water regulation from a watershed sustainability viewpoint, acted as a reviewer for Pennsylvania's 1995 BMP Handbook, and has served as Chair for the 1998, 1999, 2001, 2003, and 2005 Pennsylvania Stormwater Management Symposium's held at Villanova. He frequently speaks to gatherings that include both engineers and municipal officials. As of August 2003 he has been appointed by the Commonwealth to the oversight committee for Pennsylvania's "new" BMP manual. More recently he was selected to serve on ASCE's External Review Panel of the Corps investigation of Hurricane Katrina and was awarded the Outstanding Civilian Service Medal for his commitment and contribution as a member of the American Society of Civil Engineers External Review Panel (ERP) on February 12, 2007 by Assistant Secretary of the U.S. Army Corps of Civil Works Paul Woodley, Jr. and Lt. Gen. Carl A. Strock, Chief of the U.S. Army Corps of Engineers.

Nicholas DiPasquale

Mr. DiPasquale has over twenty years of experience in environmental and natural resource protection. Prior to joining Duffield Associates in 2005, Mr. DiPasquale served as Deputy Secretary for Air, Recycling & Radiation Protection for the Pennsylvania Department of Environmental Protection. From April 1999 to October 2002, he served as Cabinet Secretary for the Delaware Department of Natural Resources & Environmental Control where he was responsible for the management and administration of the state and federally-delegated environmental protection and natural resource management activities.

Mr. DiPasquale serves on numerous boards and committees. He is the Conservation Chair for Delaware Audubon, President and founding member of the Kent County Conservancy, Board member for the Mid-Atlantic Chapter of the Society for Ecological Restoration, Chairman of the Dover-Kent County Metropolitan Planning Organization (MPO) Public Advisory Committee (PAC), member of Kent County Comprehensive Plan Working Group and member of the Citizen & Technical Advisory Committee (CTAC) for the state Source Water Assessment and Protection Program (SWAPP).

Introduction **- Nicholas DiPasquale**

Mr. DiPasquale opened the 2007 AWRA Mid-Atlantic Conference by welcoming the conference attendees and thanking the panelists for participating. Mr. DiPasquale noted that this panel brings together some very different perspectives and it is the intent of the conference planning committee to obtain and share good ideas and insights focusing on water resources and the economics of water resources—specifically using examples of what the panelists are currently facing in his or her sector.

Mr. DiPasquale noted that before introducing the panelists he would he would like to share a few thoughts with the group. Mr. DiPasquale noted, "All the water we currently have is all the water we are ever going to have." It is important to understand that what we have is what we have; but if we do not use it properly, we will be in terrible straights. Every dollar spent on water preservation equals $8 in productivity gained. Water shortages are one of the most troubling problems of the twenty-first century. These water shortages can be weather-related, but the real problem is more closely tied to cost management than water scarcity.

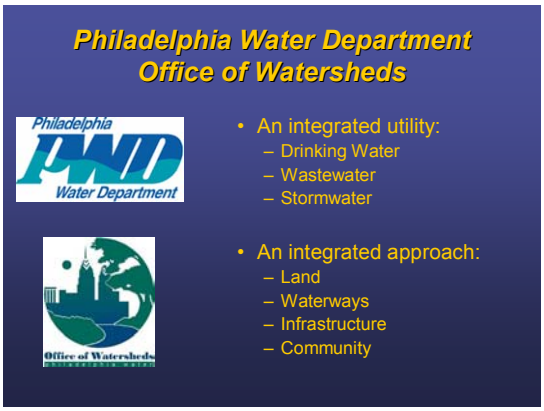
This region is considered a water-rich area, but there really are water problems—land use, for example. On a whole, the proper attention has not been given to water in the way land use practices are exercised, and meanwhile flooding, erosion, and impervious cover have all increased. It is important to use water for recharge—get it back into the ground. Mr. DiPasquale pointed out land use and stormwater management are still at the forefront of the things managers need to address. One example of this is the Glenville community, a subdivision at the confluence of Red Clay and White Clay Creeks. It would not be possible to build like that today but currently $65 million is being spent on demolition—demolishing homes, reconstruction wetlands, etc. and this is going to continue to happen as the disconnect between land use planning and stormwater management continue to occur. It is a huge cost and paying these costs will have to continue.

Another major water resource topic to consider for this region is the main channel deepening of the Delaware River. Do the costs of the project outweigh the benefits? Additionally, industry along the Delaware River is an important consideration. The 316b requirements of the federal Clean Water Act (CWA)—use of water for cooling systems, on their intake systems, for fish—has the potential to increase costs substantially if old power plants have to install cooling systems.

Water is essential for drinking water systems. Some of the world's greatest rivers don't make it to the sea anymore. When considering the volume of water that goes through the system, that does not reach the sea anymore—consider that over 60 percent of water used for agriculture does not make it into the system—some of the major aquifers are being drawn down very rapidly. Locally there is still an active deficit in Delaware. Consider that the Army Corps of Engineers' (ACE) current groundwater withdrawals are having an impact on water systems. Fortunately New Castle County has stepped up to the plate by adopting water resource rules that require replenishment of the aquifer. A large water supply crisis is coming. The utilities have done a great job, but in the future, there is a need to look at reducing usage or increasing supply. This will be on the horizon for years to come.

Panelist 1: Howard Neukrug, Director Philadelphia Office of Watersheds

"Green Cities - Clean Waters Program"



Mr. Neukrug began by noting the challenges of managing a water utility in a highly urbanized area. There are 176 combined sewer overflow points in the City of Philadelphia. The big challenge? It's different for everyone. For example, along the Tacony Creek there are abandoned cars and junk everywhere. Elsewhere in the city there are major stormwater runoff problems. Water resources are becoming a bigger and bigger problem. Mr. Neukrug noted that his presentation will mainly address the City of Philadelphia and the Schuylkill River watershed, which provides over half of the water supply for the city, the other half of the water supply comes from the Delaware River. There are 6,300 acres of prioritized land—water supply/economic ground—that must be preserved within the Schuylkill watershed. The City of Philadelphia will need to invest $5 billion over the next 20 years.

The Philadelphia Water Department is an integrated system—drinking water, wastewater and storm water. The Office of Watersheds was created in 2000 and it is intended to integrate the programs that involve using land, waterways, infrastructure, and communities. The role of their group is to look at all of the problems and their possible solutions and try to come up with ways to solve the problems. Water, wastewater and stormwater have shared resources and there are a certain set of drivers which include:

- Integrating water resources and economics.
- Monitoring infrastructure costs.
- Treating stormwater management as utility industry.

Drinking water utilities took a proactive approach years ago by emphasizing source water protection. The rest of us are just now discovering the need for source protection.

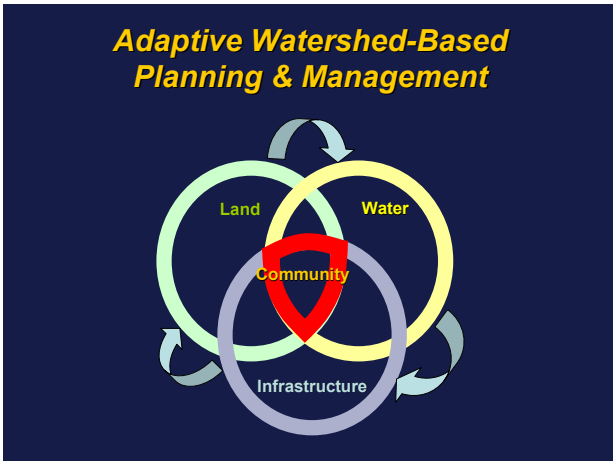
There is a need to move towards regional and operational interdependency in watersheds. Everyone is using different strategies and priorities. Fortunately, recently the USEPA, NRDC, and NACWA have come together. They agree "green" is cost effective, environmentally preferable, and an acceptable approach for reaching CWA goals. "Green" links the power and environmental mandates to the money. There is a need for

enduring green solutions. Green architecture is beginning to happen everywhere but there needs to be a greater push for it and it needs to be embraced.

How we got here? In Philadelphia, the city's watersheds have been turned into sewersheds. The problem is that when it is dry the massive pipes that have been built to control the flows are only ⅛ full and when it rains they fill up. In Philadelphia, and throughout the country, many of the watersheds have been lost. (Map-pre development watersheds of Philadelphia.)

Currently, what is left is being charged with combined sewer overflows (CSO's). It has become a common practice to think, there's a tank solution. Unfortunately using big tanks (big infrastructure) is just building on the big infrastructure mistakes we made 100 years ago.

Mr. Neukrug posed the question, how many problems can you solve for $3 billion? CSO tunnels reduce sewage overflows to our rivers but are very costly. Land-based strategies reduce sewerage to our rivers; let's consider adaptive watershed-based planning and management. So do we continue with the costly tanks and infrastructure or is there a system that is more sustainable? Land-based strategies create green open space, solve global climate change, support green development, improve quality of life, conserve water and energy, support education and recreation, create riparian buffers, improve flood control, create trails and access-ways, provide fish habitat, repair impaired streams, etc. and are far less costly.



How can changes happen in the way water resources are managed? Mr. Neukrug noted the following ideas that are being implemented in Philadelphia:

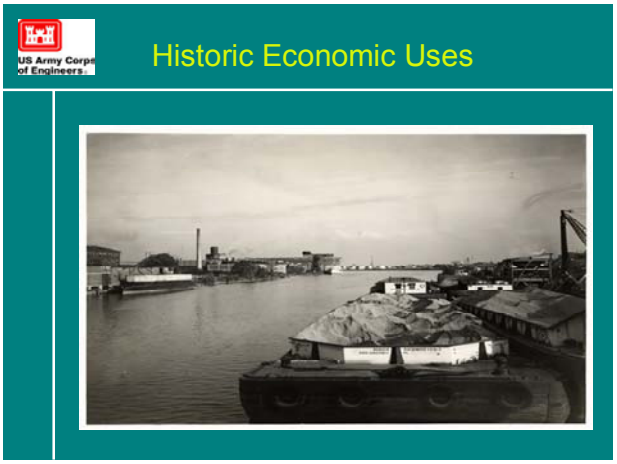
- *Require stormwater capture* – When redevelopment occurs, require stormwater capture.
- *Initiate green streets program* – Aim for 40 percent more green space over the next 40 years for the City of Philadelphia—parks, schools, etc.
- *Reclaim the urban fabric* – Penn's Landing, consider getting rid of I-95. Why is that important? Because if we are going to spend $3 billion to clean up the river, we want people to be able to get there. Tunnels under the Delaware River will solve both transportation problems and water utility problems at the same time—smart stormwater management and road tunnel.

- *Take back the land* – Work with planners and visionaries.
- *Capture runoff* – Capturing 17 million gallons results in savings that are estimated at $34 million in 10 years.
- *Other ways*? – Connect stormwater requirements with Leadership in Energy and Environmental Design (LEED) projects—building green roofs, beautiful parks, etc. Offer green permits—if you come in with a green roof, expedite the permitting process.
- *Tree trenches* – Make sure communities have trees and ensure that they are plant properly.
- *Stream bank restoration* – The City of Philadelphia plans to do this for every foot of stream in Philadelphia to bring back our streams.
- *Wetlands sites* – Promote wetland sites.
- *Playgrounds* – Kids can't play on pavement. Think about putting porous pavement down. It works great. Kids can play even when it rains!

It will be a long road, but what's the alternative? It will take us 40-50 years to fix the problem.

Panelist 2: Sam Reynolds, US Army Corps of Engineers

"Economics and Water Resources"



Mr. Reynolds provided the group the Army Corps of Engineers' perspective on water resources and economics. Mr. Reynolds discussed a specific site in Northern New Jersey—the Paulins Kill River, just outside Newton. The issue in the area is looking at the functions and values of aquatic resources. The parties that the Corps deals with look at it from a much different perspective. From an economic resource perspective, the Paulins Kill typically meandered, but was channelized through the Corps of Engineers. So the first thing that needed to be done was to dredge to enhance the aquatic use. Later on the area began to be used for peat mining—an economic value. As a result of environmental action, the Corps is trying to restore the site. The property was sold to the State of New Jersey and is now the Paulins Kill Wildlife Management Area. Mr. Reynolds noted, you never quite know who you will be dealing with. When he started working on this in the early 90's, he never thought it would go back to the state. But it is because the Corps continued to work with the stakeholders and kept talking that they wound up with this solution. This area provides an enormous benefit for birding and other natural uses in addition to recreational uses.

Historically waterways have had significant economic uses. For example, in Delaware in the early-to-mid 1900's the Christina River in Wilmington played a major role in industry. Currently waterways continue to provide economic uses. For example, the Delaware River is used for industry, recreation, fishing, and a variety of other uses. What occurred in the past is somewhat the same as today.

How might economic issues manifest themselves in the USEPA area? Clearly when someone comes to the Corps for a permit, the project itself has an economic value—the economic cost of permitting, economic cost of mitigation for project impacts, aquatic resources functions and values, these are all economic values and components of the water resources. Aquatic resource functions—when the Corps is in the permitting process, it is an independent process (environmental assessment or EIS). The Corps is looking at various alternatives that will try to avoid those impacts as much as possible. The attempt to place monetary values on environmental impacts is a way to determine the appropriate enforcement. For example, NEPA review, EA/EIS Section 404(b)(1) guidelines, public interest review, etc. Mr. Reynolds discussed a few examples of projects that the Corps has been involved in that relate to this topic:

- *General permits* – Minimal impact determination; avoid, minimize, compensate. In looking at functions and values to make minimum impact determinations, functional values must be compared to the costs of the project. On a daily basis, the Corps is trying to look at values in a timely perspective. As you drive down I-95, consider that Churchmans Marsh and the Christina River were areas (wetlands) that were designated to be impounded for water storage. Currently, Airport Road has to address flooding issues. The Corps recently processed a permit for the New Castle Airport. In this area you have various aquatic impacts and function values. The Corps must not only consider economic values, but they are also interested in flood mitigation in New Castle County.

- *Glenville* – The Corps was involved when there were other issues, for example sewer trunk line and other concerns. There was quite a bit of development in the neighboring area, a number of projects occurring in the same area. The Corps tries to balance all of these issues. The Corps did not get involved with the economics, but there are other groups that consider this a major problem with this project.

- *Sussex County* – A significant amount of activity took place before the USEPA permitting process took effect, for example a lot of lagoon developments. Currently the Assawoman Canal dredging is on the table.

There is a lot going on in watersheds in the aquatic resources systems. What the Corps is looking at one day can be one person's issue one day and another person's issue the next. The Corps (the regulators) are actually finding a much greater involvement in the real planning issues. The big program step is to get the Corps involved earlier.

For example, an item that arose after Katrina was the degradation and loss of wetlands. There was a similar situation in southern New Jersey in Meadow Banks, Clomnell Creek, Gloucester County. There was a lot of thought to what would happen if a major storm happened there today. From planning perspective, how will we deal with it? The thought process has changed significantly in recent years.

Another example in the Corps planning efforts is the South Wilmington Special Area Management Plan (SAMP) area. The Corps of Engineers gets involved with management plans to work with everyone to come up with just that—SAMPs. The Corps will get involved with the permitting process if there were a lot of water areas involved. There is a planning division of the Corps. People are trying to get money and so the Corps is trying to get involved with economics and resources, there is quite a bit of overlap.

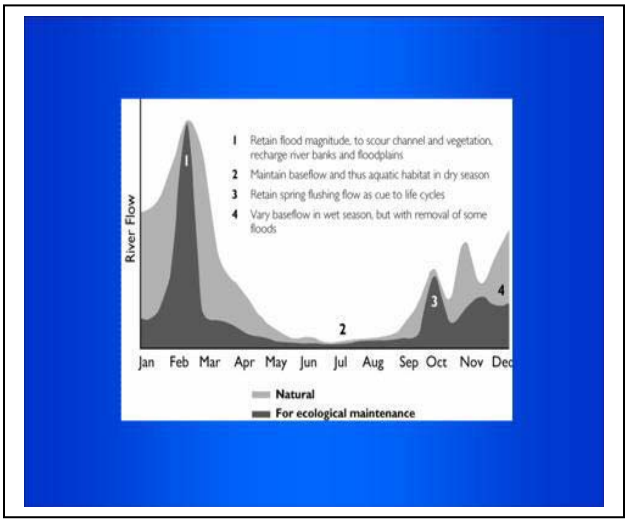
BUT…are there answers? The Corps is now doing something that Mr. Reynolds is surprised they are doing and would have said the Corps wouldn't do 20 years ago. The Corps is trying to work with the applicants. Particularly, the Corps is trying to think about what they are going to do in the next 20-30 years.

Panelist 3: Brian Richter, Co-leader, Global Freshwater Team, The Nature Conservancy

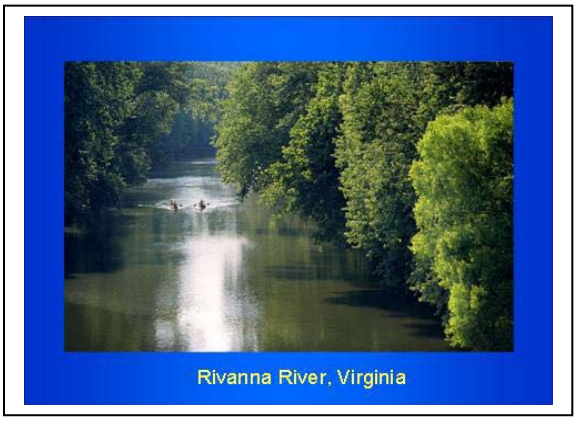
"Integrating Ecosystems Values in Water Resources Developmental Planning"

Dr. Richter spoke about some of the values associated with fresh water ecosystems, how human activities are impacting these ecosystems, and how people around the world are addressing these issues and integrating them into development. There is a growing global challenge in trying to meet increasing demands for water supply of major sectors. We have all been involved with urban, aquatic, industrial and thermoelectric uses and hydropower. Dr. Richter pointed out that these are the different areas that we need to be thinking about when we are thinking about impacts on the natural systems because each of them has

impacts. The values he wanted to share during his presentation were about the productivity of natural systems. Some of these values have very substantial economic impacts.



The first example Dr. Richter gave was the Chesapeake Bay and how many of the projects to help the bay have impacted communities and recreation, as well as tourism. Much is tied to water-based recreation and aesthetics. Maintenance of healthy lake systems can be very, very important. Also, we are beginning to place economic value on the role of wetlands as "cleaning" ecosystems. The value of having an active floodplain and significant reduction in flood risk is being noticed. These values are becoming more quantifiable, but are not widely discussed. Dr. Richter asks, 'Whose responsibility should this be?' From his perspective, governments need to step up and play an important leadership role, which is very difficult to integrate at this point. It is really a role for *state* governments to take on the role of expressing the value of these values, and also to set some development guidelines to better protect them in the future. This is becoming more and more important to us.

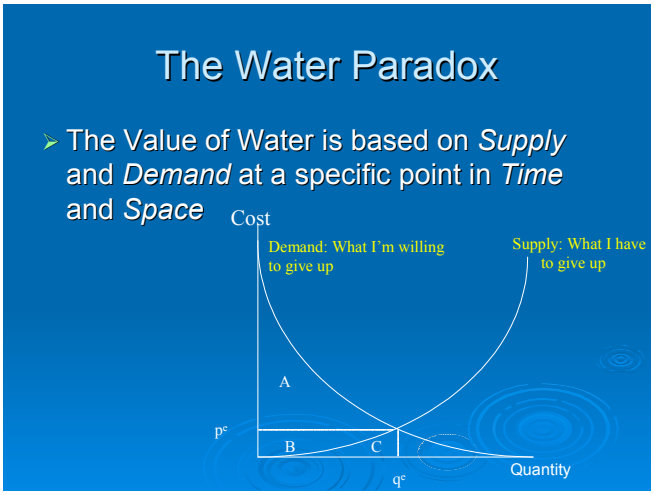


Most of the focus is on water quality issues, but the other issue that will become "the" issue is water quantity. It is popping up in all regions of the world, including the eastern seaboard. Streams are reaching lower and lower levels. The climate situation and superimposing human developmental planning and human usage are becoming increasingly important. Historically this issue has been dealt with in terms of "in-stream" flows, now environmental flows. We now understand that every aspect of river stream hydrograph has significant ecological functions. North Carolina hosted the 2nd Environmental Conference on in-stream flow, which illustrates how important these issues are becoming. Millions of peoples' lifestyles are affected by the health of rivers, such as on the Rivanna River in Charlottesville, Va. As Charlottesville has grown, reservoirs are concurrently constructed, putting strain on water resources both for water supply reliability and the community. For instance, real estate values are connected to health and aesthetics of the river for recreation and other uses. The challenge is figuring out how we should utilize water resources. How do we withdraw water and not impinge upon or modify our natural patterns so that they can continue to support ecological maintenance uses and continue to increase water resources?

A lot of economic value is tied into the health of the river. Over the past couple of decades water released from reservoirs has been voluntary. When our community experienced the droughts of 2001 and 2002, it began very aggressively planning for water supply. (An article on this case study was published in the *AWWA Journal* in the June issue.) We are very engaged in these issues of trying to integrate environmental values into developmental planning. See *www.nature.org/freshwater* for more of these case studies and more tools and information. Also, check out "Rivers for Life: Managing Water for People and Nature" by Sandra Postel and Brian Richter, Island Press.

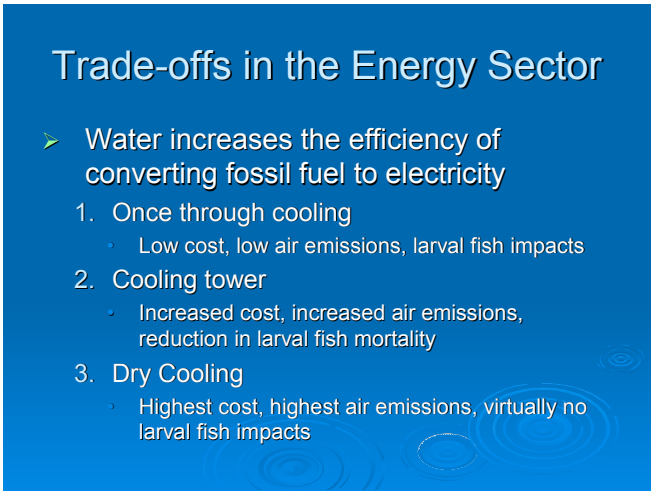
Panelist 4: Cheryl Hess, Delmarva Power

"Water Trade-offs Faced by Industry (or Water Trade-offs Faced by Everybody)"



Ms. Hess pointed out that there is a water paradox, which Ben Franklin said is that, "the value of water is both priceless and worthless." It is all about trade-offs—what am I willing to give up? While supply and demand are associated with specific circumstances, do we see any trends, such as increasing demand in electricity use or water use? What kind of trade offs will we have to make in the future?

Water is in high demand. The per-capita water use in the US is about 1,900 cubic meters per year. Water and energy are very interrelated, and we may face some trade-offs such as an increase in supply through technical innovations or cutbacks. If there are cutbacks, what do we give up? Water is both a public and private good. When water is allocated, many other things are affected (downstream impacts). Water is a renewable natural resource, at least in regards to river flow and rainwater recharge.

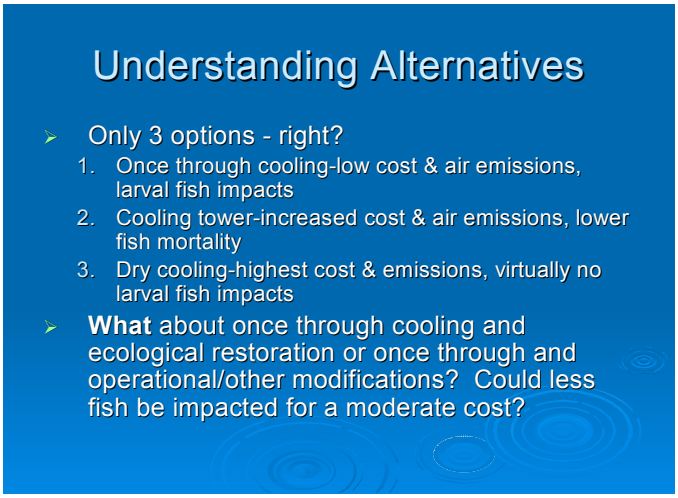


When markets fail, we rely on legal and governmental institutions to evaluate the trade offs, which is easier said than done. Consider the Colorado River: agriculture, industry, recreation, downstream residents (including Mexico), wildlife. There are many user groups with competing demands and interests. Ms. Hess offered some predictions for the future: with growing water demand, we are likely to encounter conflicts. How do we face all the issues we need to address? How do we learn from past experience? In the energy sector, we have increasing needs for water as increased

demands for energy take place. The demand for water in critical facilities goes up. What ways can we conserve the amount of water industries use?

Other issues include conflicting opinions between fishermen, air quality, and elderly persons on fixed income, for instance. We have to take everyone's perspective into consideration.

What should we do? We need to look at governmental regulations and understand all alternatives, evaluate public preferences, make tradeoffs, look at balancing needs, and have greater integration between both water and energy planning. There are lots of options, so the goal is to develop a comprehensive understanding of options and costs involved.

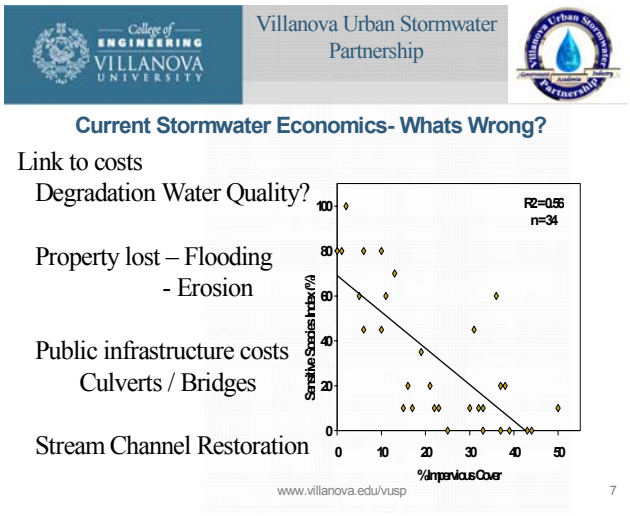


We need to continue evaluating public preferences and people's willingness to pay. As an industry, we should be aware of market-based signals. Regulatory agencies need to be aware of the resources and all the integrated pieces of it. We need to acknowledge that we need to make tradeoffs and need to avoid decisions driven by one resource without considering indirect effects or decisions based on worst case scenarios.

Panelist 5: Dr. Robert Traver, Director Villanova, Stormwater Partnership, Villanova University

"Sustainable Stormwater Economics"

Dr. Traver started by saying, "If you don't get the economics right, you don't get the sustainability right." He asked many questions such as, "What is the objective of stormwater management?" The answer is protecting life, health, safety, risk, and quality of groundwater. Do current stormwater economics support this? What is the cost to build treatment systems? What is the cost of the land it takes? Then there is the cost of the municipality review and inspection. How does that relate to the design? Basically our design is based on what people tell us. We are starting to look at pollutants and volume. Stormwater is a burden to the developer, the homeowner and the municipality.



What's the cost of degradation of water? Flooding and erosion? What are public infrastructure costs—culverts/bridges? Stream channel restoration? If we are going to be looking at the cost to sustainability, we need to design in operation and in inspection, maintenance, and life cycle--design to the problem. Pollutants? We need to look at design from maintenance and economics, and we are not doing that.

So, on the subject of sustainable stormwater economics, we need sustainable design. Do we need to look at the hydrological footprint? We are not there yet.
We need to match hydrologic footprint with hydrology. Single storms—infiltration and evaporation. What incentive is there to design or build to last? There are substantial consequences.

One idea for sustainable "design" is for the first inch of runoff to go to a rain garden. If most rainfall is less than one inch, it will stay in the rain garden and filter through the soil slowly instead of carrying pollutants to the storm drains.

More information can be found at *www.villanova.edu/VUSP*.

Questions and Answers Portion of the Session

NP - Nick DiPasquale
BR - Brian Richter
SR - Sam Reynolds
RT - Dr. Robert Traver
CH - Cheryl Hess
HN - Howard Neukrug

Question 1: Ecosystem services like The Nature Conservancy are looking at obscure species, etc….Do you have any cases where people pay people to preserve your services?

BR: Not specifically, but there are some payments for environmental services regarding water resources. For example, there are studies where there are deals between private agencies and municipalities downstream to take care of preserved areas, such as hydroelectric dam operators paying upstream people to reduce pollution. You are just starting to see it. There are a limited number of private deals more in the forest industry than water industry.

Question 2: (More of a comment) on modified water cycle. It got me thinking about the fuel issue—heat/air conditioning. If we conserve the rivers, water will take some of the

heat out of the city. We talk about partnering. Is there any initiative of bringing these 5-6 areas together?

HN: In the City of Philadelphia, very much so. The Water Department, Street Department, Managing Director's Office are all working together to understand how a number of issues work together. That is where we will be talking in the next 2-4 years. If you plant a tree next to a house, there is a storm water value. There is a benefit to the homeowner. The Storm Water Department has money to pay for that benefit, but how do you get the homeowner to pay for that benefit? This is a very simple example. Everyone wants the benefit, but no one wants to pay for it.

RT: Looking at global change (and we have a president who says you WILL do this), one of the new buildings on campus first said they didn't have enough money to meet sustainability, but now, with the president's mandate, the building will be a LEED certified building.

Question 3 to BR and HN: Are you cleaning water through the initiative? Do you have some kind of public outreach—"Here are the changes" and "Here is how they will benefit you"?

HN: Yes, there is a constant barrage from our water bills and inserts at least 6-12 months out of the year. An example is Fairmount summer camp for kids; *www.PhiladelphiaRiverInfo.org*. There is a CSO long term control plan. There is room for public participation--advisory committee of concerned citizens. How do we take all these things and address them?

Question 4: I think all of you see the big picture, and I think it is great that there are a lot of economic incentives, but do you think economics will drive us to the next level or are laws necessary to get us there?

SR: There were a number of rather high profile environmental cases from the Corps of Engineers. I used to be a strong advocate of penalties for flagrant disobedience of laws. They will get the point. Now the positive influence…. I have found that as I work on permitting, it is a much easier sell to say, "Here's what you have to go through. We are here to work with you." Laws? Yes. You may reach that point, but there is an ever-increasing role for economic incentives. I even see that with developers. When people realize "just tell us what we need to get the permits," they are willing to make certain sacrifices. Regulators need to make sure they know why it is necessary. How do you bring all this together? How many things are all competing for our attention when we go home and read the paper? There are so many things that mean more. I think we need to take more pride in what we do, such as take a full page ad in the paper. Even if only a small percentage of people read it, they then become the next group that hopefully will go to their Planning Board. Then they can see there is an economic benefit. For example, they can say, "we didn't get flooded last year."

NP: NJDEP wanted PSE&G to put in a cooling tower, which would cost $1 billion each. This is quite an expense for old plants. PS&G came back to regulators and asked them to consider an alternative like an environmental enhancement project to return tidal flow. That was a tradeoff. Some people were very upset by this because they did not want to spend money on cooling towers, but they picked up on environmental benefits. Here's a case where overall environmental benefit is greater and the cost to the consumer is reduced. We can find opportunities like that if we are allowed to explore them.

CH: There is talk that the regulations that were out there for electrical utilities have been challenged. EPA suspended the rules. It has been opened up so we can look at alternatives. Unfortunately, it threw out the whole cost benefit aspect. Now everyone can go back and look at things and say, "okay, maybe there is a suite of alternatives that doesn't cost as much as the cooling tower and has environmental benefits as well." It is a good place to be. It is going to lead to a more innovative approach.

SR: This is interesting for us. We knew it was based on an entrainment issue. By mandate, all we were reviewing was marsh restoration. If someone wrote it and we disagreed, we didn't care because we don't regulate. It is interesting because PS&G restoration took place before Katrina, which opened eyes of quite a lot of people, particularly in South Jersey. We are trying to find ways to assist municipalities with this issue of who is going to take care of old meadow banks. It is interesting how entrainment got to marsh restoration which led to "gee, that would be good for fisheries." But how does this affect flooding? Maybe the benefits we are looking at will have secondary benefits down the road. On the one hand, I am very procedural, but I do try to tell project managers that applicants throwing money on the issue might not be the best solution. My guess is maybe with a little less money and more research; you might come up with something better. We are always going to reach our economic endpoint before we reach our environmental endpoint. We will take any chance we have to do something a little cheaper. We are always looking for flexibility, which is something very hard because CWA is very specific.

Question 5: All of what we do is law and regulation based, and a lot of these projects we are trying to think about are with green technology. Permitting, funding, etc.…Do the laws and regulations that are in place need an overhaul? Are there major problems that need addressing?

SR: If you asked anyone in my office with respect to CWA, "What's the biggest thing to be dealt with?" If we could have representatives of EPA here, we could ask them. I wish we got guidelines, but you guys have to quit being so myopic. We have to think more broadly because it impacts people at EPA more than the Corps. We are not a multi-program agency. So for us, it is myopic. We only deal with one aspect. After all the years that have gone by, are there more substantive ideas? I would say yes, but my guess is it will never happen. Personally there may be a will. I think you may see CWA stay like it is, but you may have other new acts, like a federal wetland protection act. One problem is the federal government is based on what's in the constitution. States are different.

RT: It has been interesting watching EPA over the years. A lot of it is not the CWA. It is the interpretation. Now they are looking at flows and saying that can be covered under the CWA. It is the interpretation that is changing. I like the idea of stormwater and economics. In Pennsylvania we have been trying various things along these lines. The solution was tied into the laws, not the goals.

Question 6: Regarding the interrelatedness of water and energy, is Conectiv doing anything to educate the public about that so that when they cut down on water, they can cut down on energy consumption?

CH: I know there are a lot of programs out there, but I don't know if they are looking at it from that specific point of view.

Keynote Address

Keynote Speaker: Dr. David Tilley, Assistant Professor, Natural Resources Management Program, Department of Environmental Science and Technology, University of Maryland
Facilitator: Gerald Kauffman

Biographies:

Dr. David Tilley

Dr. Tilley's professional interest is to advance ecological engineering design, modeling and assessment in an effort to support society's evolution toward a more sustainable and green lifestyle that is better tuned to the energies of the natural environment. Ecological engineering, which is a young discipline that combines natural and applied sciences, especially systems ecology, with the discipline of engineering to design, construct, analyze and manage ecosystems and to develop eco-technologies, strives to develop sustainable ecosystems that integrate human society with its natural environment for the benefit of both. A tenet of ecological engineering is to solve environmental problems by relying heavily on renewable energy and the free services of natural systems while minimizing the use of unsustainable non-renewable energy.

Dr. Tilley's research has included 1) wetland design and assessment, 2) integrated modeling of ecological-economic systems, 3) soil-based eco-technologies for air quality improvement, and most recently, 4) novel, lightweight green roof designs. At the University of Maryland David established the Ecosystem Engineering Design Laboratory in the Department of Biological Resources Engineering, which is now the Dept. of Environmental Science & Technology.

1) Wetland Design and Assessment: Dr. Tilley expanded upon the applications of treatment wetland technology by working with a progressive U.S. shrimp aquaculture farm to design treatment wetlands that cleaned and recycled millions of gallons of waste water daily, which saved money, reduced the discharge of harmful pollutants to nearby coastal bays and provided valuable migratory bird habitat (Tilley et al. *Aquacultural*

Engineering 2002). Other wetland research investigated how to integrate networks of constructed wetlands into urban watersheds as an ecologically-beneficial approach to managing stormwater (Tilley and Brown *Ecological Engineering* 1998). Recently, Dr. Tilley initiated a new area of wetland research focused on employing hyperspectral radiometry to remotely assess the health of wetlands. A hyperspectral radiometer measures the electro-magnetic energy reflected from the top of a wetland in hundreds of narrow spectral bands that are 1 to 10 nanometers wide.

2) Energy Modeling of Ecological-economic Systems: Another challenge of ecological engineering is to understand the linkage between ecosystems and human systems. In this vein, Dr. Tilley's ecological modeling research includes environmental accounting, which quantifies the direct and indirect contribution that nature makes to socioeconomic systems. Dr. Tilley has worked at the international level in advancing a specific model for conducting environmental accounting known as emergy (with an 'm') evaluation. The late H.T. Odum defined emergy as the total amount of energy required to make another form of energy, which makes the concept analogous to embodied energy except that emergy always includes the contribution of environmental energies (e.g., water, wind) and human services, whereas embodied energy may exclude these.

Dr. Tilley's specific research contributions to this field included (1) a comprehensive evaluation of a U.S. Forest Service demonstration of its new philosophy of ecosystem management (Tilley and Swank *J. Environmental Management* 2003), (2) development of a temporally dynamic emergy accounting model for evaluating the benefits of using created wetlands to manage urban stormwater (Tilley and Brown *Ecological Modeling* 2006), (3) collaboration with Dr. Tilley's Brazilian colleague from the State University of Mato Grosso do Sul to develop a simulation model for assessing the long-term ecological effects of Brazil's strategy of investing heavily in natural gas power plants (Tilley and Comar *Population and Environment* 2006), (4) estimation of the energy and environmental resources required to bio-fuels and (5) applied emergy accounting to estimate the contribution of natural capital to the development of the U.S. since 1790 (Tilley *Environment and History* 2006).

3) Design and Testing of Ecological Air Treatment Systems: Dr. Tilley has researched the capability of microbial reactors and soil ecosystems to remove the lethal, priority pollutant carbon monoxide (CO) from the exhaust of gasoline engines. Bacteria and fungi in the bioreactors and soils metabolize CO, which removes it from the air. Along with Dr. Tilley's graduate research assistant, Priti Ganeshan, they found 40 percent removal of CO at highly lethal levels (Ganeshan 2003), which was similar to what he and his undergraduate research assistant, Jeff Mentzer, found for natural soils (Tilley and Mentzer *J Air Waste Mgmt Assoc* 2006).

4) Novel, Lightweight Green Roof Designs: In 2005, Dr. Tilley and his graduate student, Laura Schumann, were determined to find green roof designs that could be easily integrated into existing buildings without heavy structural upgrades. Inspired by nature, they developed and tested a new design that suspended vine plants over buildings. They named this new design the *Green Cloak* because it protected a building from the climate.

They found that the green cloak reduced indoor building temperatures by as much as 8 degrees F during hot Summer days and reduced the peak in storm flow by more than 2 hours when the canopy was fully developed (Schumann 2007). They believe this may be the beginning of a new green technology business.

Dr. Tilley teaches courses in Restoration Ecology (NRMT 444) in the fall, and Energy and Environment (ENST 405) in spring at the University of Maryland, College Park. Professionally, Dr. Tilley is a member of the American Ecological Engineering Society, the American Society for Agricultural and Biological Engineers, the International Society of Industrial Ecology and the International Society for the Advancement of Emergy Research.

Gerald Kauffman

Gerald Kauffman is Director of the Water Resources Agency, a unit of the Institute for Public Administration in the College of Human Services, Education & Public Policy at the University of Delaware. Mr. Kauffman also holds a secondary appointment as Instructor of Water Resources Engineering in the UD Department of Civil and Environmental Engineering. Since 2000, Mr. Kauffman has served as State Water Coordinator, as appointed by the Governor and General Assembly in accordance with the Delaware Water Supply Coordinating Council Act. Mr. Kauffman is responsible for providing water resources assistance to federal, state and local governments in Delaware and the Delaware Valley through the University's public service, education, and research role. Mr. Kauffman's degrees include a Master of Public Administration (MPA) with specialization in watershed policy from the University of Delaware, School of Urban Affairs and Public Policy and a bachelor's of science in civil and environmental engineering from Rutgers University. He is also a Certified Public Manager awarded by the Rutgers University Graduate Program in Public Administration. Mr. Kauffman is a registered Professional Engineer (PE) who has been licensed in four states (New Jersey 1988, Wisconsin and Illinois 1990, and Delaware 2000) and has over 25 year's experience in water resources and watershed management. He is a member of the American Geophysical Union (AGU), American Water Resources Association (AWRA), the Delaware Academy of Sciences, the Universities Council on Water Resources (UCOWR), and the River Network.

Thursday, September 20, 2007

Opening Remarks, Welcome Presentation, Conference Goals

Laura Whalen, President DE AWRA
Ken Reid, Executive Vice President, AWRA
Jane Rowan, President-Elect, AWRA

Biographies:

Laura Whalen

Ms. Whalen received her undergraduate degree in Environmental Science and is completing her graduate degree in Soil Science from the University of Delaware. Ms. Whalen began working in the Delaware Department of Natural Resources and Environmental Control's Watershed Assessment Section as an Environmental Scientist in 2006. She has focused on urban nutrient management planning on a watershed level to reduce non-point source pollution runoff by reducing urban fertilizer use and designing 'green infrastructure' such as rain gardens.

Kenneth D. Reid

Mr. Reid is Executive Vice President and Chief Executive Officer of the American Water Resources Association, a scientific, educational association for men and women involved in water resources research, planning and management. He has served in this capacity since 1981. He was a member of the American Society of Association Executives' (ASAE) first class of Future Leaders and was selected as a Fellow Member of ASAE in 1991. He has been active on numerous committees and is a former member of the ASAE Board of Directors. In 2000 Reid was selected as the recipient of the Key Award, the highest recognition given to an association executive by the American Society of Association Executives. He was a member of the Greater Washington Society of Association Executives (GWSAE) and served on the Board of Directors of the GWSAE Foundation. He is a member of the Council of Engineering and Scientific Society Executives. Reid is Past Chair of the Northeast Board of Regents of the Institute for Organizational Management and is Past Chair of the National Institute for Organizational Management Board of Trustees. He is one of only elected 4 United States Members of the Board of Governors of the World Water Council, an organization, based in Marseilles, France and representing nearly 300 water related groups worldwide. Reid is a member of the International Water Academy. He has a Bachelor of Science degree in Biology and a Master of Science degree in Environmental Studies. He is also Past President of the George Mason University Alumni Association and is a member of the International Water Academy.

Jane O. Rowan

Ms. Rowan is a Senior Associate Scientist with Schnabel Engineering, and the Branch Leader of Schnabel's West Chester, PA Office. Jane received her BS degree in Biology from the University of Massachusetts at Dartmouth, and her MS degree in Environmental Science from SUNY College of Environmental Science and Forestry at Syracuse University, NY. Jane's technical background and experience has focused on wetland ecology and the monitoring, assessment, impact and mitigation of impacts to wetlands as well as coastal, terrestrial, lake and riparian systems. Jane's work also includes permitting activities which was her major focus on the Ellis Island project described here today.

Session 3: Track 1

Economic Impacts and Solutions

Facilitator: Martin Wollaston

The Economic Benefits of the Christina Basin

Gerald Kauffman

Abstract:

In addition to water supply, ecological, and recreational benefits, the waters of the Christina Basin in Delaware, Maryland, and Pennsylvania provide substantial economic value to society. The drinking water supply is worth at least $36 million annually. The worth of the fishery is approximately $25 million per year using plug-in values. The canoe and kayak eco-tourism businesses earn over $1 million annually. The high economic value of the Christina Basin indicates that it is worth continued public and private investment to protect and conserve the quantity and quality of these waters.

Biography:

Gerald Kauffman is Director of the Water Resources Agency, a unit of the Institute for Public Administration in the College of Human Services, Education & Public Policy at the University of Delaware. Jerry also holds a secondary appointment as Instructor of Water Resources Engineering in the University of Delaware Department of Civil and Environmental Engineering. Since 2000, Mr. Kauffman has served as State Water Coordinator, as appointed by the Governor and General Assembly in accordance with the Delaware Water Supply Coordinating Council Act. Mr. Kauffman is responsible for providing water resources assistance to federal, state and local governments in Delaware and the Delaware Valley through the University's public service, education, and research role. Mr. Kauffman's degrees include a Master of Public Administration (MPA) with specialization in watershed policy from the University of Delaware, School of Urban Affairs and Public Policy and a bachelor's of science in civil and environmental engineering from Rutgers University. He is also a Certified Public Manager awarded by the Rutgers University Graduate Program in Public Administration. Mr. Kauffman is a registered Professional Engineer (PE) who has been licensed in four states (New Jersey

1988, Wisconsin and Illinois 1990, and Delaware 2000) and has over 25 year's experience in water resources and watershed management. He is a member of the American Geophysical Union (AGU), American Water Resources Association (AWRA), the Delaware Academy of Sciences, the Universities Council on Water Resources (UCOWR), and the River Network.

Willingness to Pay for Sustainable Agricultural Practices in an Urbanizing Region

Dr. Joshua Duke

Abstract:
Economists have a highly developed toolkit to assess willingness to pay (WTP) through stated preferences for nonmarket goods, particularly environmental goods. This research describes an effort to extend these methods to an application of sustainable agricultural practices in a specific location that is rapidly developing from agricultural to (mainly) residential land use. The objective of this research is to estimate the WTP of residential neighbors to an agricultural operation for the improvement of the agricultural management practices with respect to sustainability. The practices of interest improve water quality and also deliver other environmental benefits.

Economic Theory and Policy- Economic theory suggests that the costs and benefits of agricultural management decisions are not fully borne by producers when residential neighbors are located nearby. Some production decisions result in negative externalities, i.e., the neighbors suffer lower property values and lower utility from such things as noise, smells, and water quality impacts. The Coase Theorem shows that this problem can be seen from a reciprocal perspective; the decision of the neighbors to locate in agricultural areas creates these externalities. In addition, agricultural operations provide positive externalities to residential neighbors in the form of scenic vistas, open spaces, preclusion of additional development, etc.

Both negative and positive externalities are market failures and result in an oversupply and undersupply of land in agriculture, respectively. The sustainable practices described below would attenuate negative externalities or enhance the provision of positive externalities. In both cases such practices would tend to raise the utility and property values of neighboring residents. Hence, these neighbors should be WTP for the adoption of these practices. Producers will not voluntarily adopt these practices because they are costly. The measurement of WTP is critical to designing markets to compensate producers for sustainable management practices or to determine whether regulations will pass a benefit-cost test.

Study Area- This research is one part of a larger agenda to examine the scientific and economic feasibility of sustainable management practices on an urban-influenced farm. This is a cooperative effort between the University of Delaware and St. Andrews' School in Middletown, Delaware. St. Andrews' owns and farms or leases over 1,000 acres of agricultural land in Middletown, which is a rapidly growing community in Southern New

Castle County. There is a significant-sized, impaired water body on this parcel, also. The broader objective of the study is to determine how value-added manure products (from nutrient surplus regions in the southern part of Delaware) can be used to replace commercial fertilizer on this study farm and athletic fields. The rationale is that this will result in no net change in nutrients on the study farm, while helping to create a market for manure products that will help improve water quality in nutrient-surplus watersheds. Among the various other objectives of the study are to improve riparian management, habitat quality, and water quality on the farm.

Empirical Study- The research proposed here involves reporting the results of a population survey of St. Andrews' residential neighbors to adopt sustainable management practices on the farm. This survey will be conducted during the late spring 2007. The method is a choice experiment, using a fractional factorial design. The attributes of the study are under development, but a tentative list includes: (1) riparian buffer (varying by width); (2) habitat provided (varying in terms of forest and other natural lands provided); (3) adoption of manure-based nutrients in production (varying by relative employment vis-à-vis commercial fertilizer); (4) public access for agro-tourism and recreation; and (5) water quality improvement achieved by other means (practices generating clarity changes and nutrient loadings). The survey instrument will be implemented by a mail survey of approximately 800 of the closest neighboring residences. These residents are identified entirely by their proximity to the farm. The choice experiment will require respondents to trade off a set of management practices with a payment (an increase in yearly taxes). Using conditional logic regression analysis, the WTP for a marginal increase in each practice can be estimated.

Biography:
Josh Duke is an associate professor in food and resource economics, legal studies, and economics as the University of Delaware. He earned a Ph.D. in agricultural and applied economics from the University of Wisconsin. Duke also has an M.A. in public policy analysis from the University of Rochester and a B.A. in political science and history from the University of Vermont. Duke's research focuses on evaluating the performance of farmland retention programs, the law and economics of land use, and assessing the effect of land use on environmental outcomes. He has published articles in journals such as *American Journal of Agricultural Economics, Land Economics*, *Ecological Economics*, and *Journal of Soil and Water Conservation*. Duke's research program has received competitive grant support of approximately $900,000. Duke teaches courses in environmental economics, environmental law, agricultural economics and sustainable development.

Financial Solutions to Water Issues

Lee Beetschen

Abstract:
Land development inherently increases the demand for public services, including water supply and storm water management. The traditional method of financing these services

has been through the assumption of long term indebtedness by local government using general obligation and revenue bonds. Another method of payment for these new services included grant and loan funding through federal programs. Impact fees were then introduced in an attempt to shift some of the cost and the risk to the developer side of the equation. None of these approaches significantly reduced the risk that existing taxpayers take on when they accept the role of repaying the debt incurred to provide services for new development. Toward that end, CABE believes there is a clear and elegant solution to this concern. The solution describes the means to accelerate the transfer of private funds to the local government responsible for the construction and operation of public services, thereby significantly reducing the public financial risk.

Biography:
Mr. Beetschen is the President and co-founder of CABE Associates Incorporated. He is a professional engineer and diplomat in the American Academy of Environmental Engineers. He received his Bachelor's degree in Civil Engineering from the University of Delaware and his Master's degree in Environmental Engineering from NJIT. Mr. Beetschen has been a Design Engineer at Black & Veatch and Exxon, a Wastewater Operations Manager at Humble Oil refinery in California, a Manager at Water Resources, Department of Natural Resources & Environmental Control, and the Department Head for Sanitary Engineering Design at Tetra Tech. Mr. Beetschen has written numerous technical papers on the design and regulatory aspects of wastewater treatment and disposal.

The Economic Impact of the Environmental Benefits of Green Space

Nancy Weissman

Abstract:
The intention of this research was to identify what, if any, economic benefits could be associated with the environmental impacts of various green space scenarios. The regulations that influence this topic are the Clean Water Act, the Clean Air Act and Pennsylvania's Municipal Waste Planning, Recycling and Waste Reduction Act. The green space scenarios that were investigated were grass (lawn), trees (urban forest), grass and trees (park), vegetable farm (chemical free, sub-acre, low till, commercial), and green roofs (intensive and extensive).

The environmental benefits from green space are widely acknowledged and information on this topic is readily available. However, data documenting the economic impact of their environmental benefits was harder to come by. For example, economic analyses on greenhouse gases were often conducted on a global or national scale. When there was city-based research it was often performed in cities with vastly different climate and geographic circumstances than Philadelphia. Methodologies and units of measure varied from study to study. Thus, assessing and applying much of this data to Philadelphia's circumstances was beyond the scope of this research. Given these limitations, the economic information presented in this document is drawn mainly from published reports or internet articles that appear reasonably applicable to Philadelphia, the City's direct

experiences, and from interviews with experts in the field. The results indicate that multifaceted and significant economic benefits can be derived from trees, chemical free vegetable farms and green roofs. Grass, as in NTI stabilized lots and parks, was found to produce economic gains mainly in the form of improved real estate values. Real estate value is a topic discussed in another component of the Economic Development Committee's report and is not included in this analysis. The environmental gains of grass, however, were far less significant than the gains associated with trees, farms and green roofs. This paper focuses on the benefits of trees, vegetable farms and green roofs.

It is important to note that significant economic benefits can generally not be gained from small isolated, demonstration projects regardless of which scenario is applied. Significant economic gains will be experienced mainly when green space options, that are acceptable to the regulating agencies, inhabit large numbers of acres at appropriate locations through-out the City.

Biography:
Nancy Weissman is the Director of Economic Development for the Philadelphia Water Department. In this position she has linked the goal of business customer retention and attraction with environmentally sound economic development. She created and ran PWD's nationally acclaimed Somerton Tanks Farm project. This project ultimately demonstrated how chemical free, commercial urban farming can be economically viable. Prior to working for the Water Department Nancy was the Director of Market and Economic Development for the Philadelphia Recycling Office.

Session 3: Track 2

Restoration/Retrofits I

Facilitator: Chris Bason

Green Opportunities for an Urban Watershed "Linking Science, Management, Policy, and Funding to Achieve Goals

Jennifer Egan
James Eisenhardt

Abstract:
This presentation will explore a case study (Glenville Flood Mitigation/Wetlands) for "Ecological Restoration" in an urban watershed. It will focus on how creative project funding/partnering and management made multiple watershed improvement goals achievable for this watershed.

Duffield Associates, Inc. was contracted by the State of Delaware Department of Transportation to create and restore forested wetlands (about 30 acres) and upland riparian floodplains (about 25 acres) within an active floodplain/floodway of the Red

Clay Creek at the fall zone (Piedmont/Coastal Plain regions). The project is actually located in a highly urbanized landscape, within a developed area that was once a neighborhood. The Glenville development was a typical neighborhood constructed during the 1950's which bordered the Red Clay Creek in Northern Delaware, until a series of flood events led to the destruction and eventual buyout of approximately 85 % of the homes.

The initial focus of the project was to serve as a flood mitigation/storage program, and has since evolved into a broader project meeting multiple watershed improvement objectives such as wetlands creation/restoration/preservation. The Red Clay Creek runs adjacent to the west side of the site, while a tributary to Hershey Run borders the east side of the site. The basis of the wetland design was to tie-in with the existing wetlands associated with the tributary without substantially altering the stream morphology. The tie-in to existing adjacent wetlands while still maintaining the current stream hydrology has proven to be a difficult challenge.

The preliminary stage of the project involved razing 162 homes and associated infrastructure within the neighborhood. Approximately 40,000 cubic yards of material was excavated in the creation of a pilot project of six acres of wetlands, connecting to the existing wetland ecosystem. The excavated area was stabilized with native wetland seed mixes and approximately 18,000 native trees, including: sycamore, green ash, silver and red maples, tulip poplar, pin oak, and black willow. Although the persistence of invasive species throughout the constructed wetlands is a concern, the plantings seem to have adopted well during the first growing season. The new ecosystem has even attracted various herons and egrets, as well as a few bald eagle sightings.

Future plans include increasing the initial six acres to upwards of 30+ acres of wetland creation/restoration and 20 acres of preservation, as part of a Wetlands Mitigation Bank, as well as the incorporation of parkland with a potential boardwalk/trail and an interpretive education center.

Biography:
Ms. Egan specializes in surface processes involving fluvial geomorphology, hydrology and sediment transport. Her project experience includes stream morphology studies, wetland delineation, erosion and sediment control projects, surface water hydrology models, drainage improvements, and habitat enhancement.

Successful Forested Wetland Restoration/Mitigation Meets Performance Standards in One-Third the Time Using high Performance Native Wetland Plants

Dr. Janet Hawkes

Abstract:
Mature timber has been removed from virtually all forested wetlands. Many have been drained for timber production, agriculture, mining, urbanization and other activities. The

greatest wetland losses both nationally and in the Midwest and Northeast are occurring in forested wetlands.

The major challenges for restoration of forested wetlands are that restored wetlands can take 50 years or more to reach maturity, hydrological and soil requirements are varied by the type of wetlands, short growing season, low temperatures, narrow window for planting, etc. These factors complicate efforts in determining the success of wetland restoration and impact reduction as well as the timely release of project participants from bonding and other requirements.

This case study presents the successful restoration of a field that had been in soybean production for 60 years back to a functioning forested wetland using high performance native wetland container seedlings.

The study documents the project's success in meeting the established performance standards in one-third the time using high performance native wetland container stock.

This project provides evidence of successful restoration of a forested wetland meeting performance criteria in 5-10 years versus 15-30 years with early restoration of lost functions, acreage and values including; surface water storage, retention of water in soil, nutrient uptake, characteristic native plant community, wildlife habitat structure and habitat interspersion, quality and connectivity.

Detention Basin Retrofitting

David Athey

Abstract:
Numerous older detention basins were designed and constructed without any provisions for water quality management and many simply provide detention for a single event, usually the 100-year frequency storm. Furthermore, basins constructed twenty and thirty years ago typically had few provisions for maintenance and often the party responsible was either unidentified or, if known, did not have the resources or technical wherewithal to properly perform the job. The end result is failed basins that do not provide any water quality benefits and/or attenuate storm flows.

Several options exist for retrofitting basins including providing a multi-stage riser for an extended detention dry pond; over excavation of dry basins to create a wet pond; installation of benches; and the creation of meandering low flow channels, forebays at the inlets, or micropools at the outlet. If ideal soil conditions exist, the basin may have the potential for conversion to an infiltration basin. Failed basins often have resulted in erosion downstream which also may need to be addressed as will future maintenance.

The first step in evaluating options is soils analyses to determine permeability, gauge recharge capabilities, and establish groundwater depths. An as-built survey, including embankments and inflow and outflow pipes, yields the existing basin volume as well as

its potential volume if reconfigured. Unless original design information is available, hydrologic calculations such as runoff rates and volumes for multiple events including the "water quality event" need to be determined.

The biggest challenge is working within the physical constraints of the existing basin and/or its property. This may necessitate a balance between codes or ordinances and practicality. For example, providing safety and aquatic benches as required in Delaware for basins with a permanent pool of water may reduce available volume to the extent that storage requirements cannot also be met. Working with regulatory agencies from the onset of design is vitally important.

Opportunities are fairly limited for stormwater professionals working in areas developed years ago. The successful conversion of existing basins to include water quality benefits is one of the more promising possibilities available and if designed, constructed, and maintained properly can provide a significant return on the investment. Other benefits may include correcting of downstream drainage problems, increases in recharge volumes, and providing a more attractive, functional, and maintainable facility for the community.

Biography:
David J. Athey, P.E. has over 20 years experience working in the private, public, and nonprofit sectors specializing in water resources engineering. He has designed dozens of retention and detention basins; BMP's including bioretention facilities, biofiltration swales, and sand filter inlets; and storm sewer networks and culverts. More recently Mr. Athey has completed the design of several detention basin retrofit projects for New Castle County and his expertise in these types of projects was drawn upon for a presentation at the 2006 Surface Water Quality Conference and Exposition (a.k.a. StormCon) in Denver, Colorado. He is currently a Director in the Delaware Chapter of the American Public Works Association and previously served on the Council of the Delaware Association of Professional Engineers. Mr. Athey has a Bachelor of Civil Engineering degree from Georgia Tech and a Master of Public Administration degree from the University of Delaware.

Economic Impact of Storm Water Management Practices; Necessary Evil, or Positive Attribute?

Albert Demerich

Abstract:
With today's new emphasis on the importance of environmental friendly development, Reviewing Authorities are now looking for and expecting new methods of handling the additional storm water generated by development. The previous acceptable methodologies of handling storm water on site; detention and/or retention basins, underground infiltration or storage systems, while still viable, need to be upgraded and be a part of the new "Green Movement" technology.

Proposed Systems now need to include as many non-structural best management practices as possible to disconnect the treatment of storm water, increase the quality of storm water, and increase the infiltration of water. Smaller micro-systems such as Rain Gardens, Bio-infiltration Swales, Bio-retention Basins, need to be included in the over-all drainage system of a property. These systems can be applied to a variety of situations, not just individual residential properties. Whereas in the past detention or retention basins where regulated to the rear of the property or stuck away in some un-noticed corner, becoming that "necessary evil" which devalues the aesthetic value of a property, the new "Green" approach emphasizes the importance and positive nature of treating storm water in a more naturalistic manner. The treatment of storm water now becomes an attribute of the development. Ecological Landscape Architecture takes the previous geometric shape of basins, and reshapes them to reflect the surrounding natural land forms. This, plus the addition of plant material, blends the basin in with the surrounding land and allows the basin to be a feature in the development. Artificial methods of creating water falls and fountains now allow retention basins to be seen as an attribute, increasing property values. Residential rain gardens, part of an overall developmental system, become part of the landscape adding to the aesthetic value of a property while also functioning to increase infiltration and improve the storm water quality. "Geometric" rain gardens can now become part of the urban streetscape. These systems are designed with the inclusion of curbs, walks, street trees and other urban amenities, becoming an attribute, increasing property values, and show the community's commitment to proper storm water management.

With creative applications, inclusion of a variety of systems, and proper construction techniques, storm water treatment can be both effective and aesthetically pleasing. These systems become a positive attribute of the development, a feature of the community at large, increases the value of properties, and a model for others to follow.

Biography:
Mr. Demerich has over 25 years of experience in Landscape Architecture and the various disciplines associated with the profession. This includes site designs, project management and permitting for residential, corporate and industrial projects. Site investigations for future development, development of concept designs, through client and regulatory approvals and construction implementation have all been a part of his experience. Currently he is investigating the application of non-structural BMP's for the aesthetic treatment of stormwater on site work.

Session 4: Track 1

Watershed Planning

Facilitator: Rick Mickowski

The Christina River Basin: the Economics of Implementing a Pollution Control Strategy to meet the TMDLs

Martha Corrozi

Abstract:

The Christina Basin occupies 565 square miles and includes four major watersheds. The Basin is a diverse, suburbanizing watershed situated in the Delaware River Basin with its streams flowing through three states – Delaware, Pennsylvania, and Maryland. The lower third of the Basin is located in Delaware. The watershed is influential historically as well as culturally, and also serves many ecological and recreational uses. In addition, the streams and wells provide 100 million gallons per day to over 0.5 million people in three states.

The Delaware Department of Natural Resources and Environmental Control (DNREC) and the Water Resources Agency (IPA-WRA), a unit of the University of Delaware's Institute for Public Administration, have been working together since February 2006 to form and facilitate a Tributary Action Team (Team) for the Christina Basin. The IPA-WRA serves as a neutral convening organization for the Team and has lead over a year-long process that will recommend a Pollution Control Strategy (PCS) to DNREC in order to meet the TMDLs which were adopted by the USEPA on April 8, 2005. The PCS includes sector-specific recommendations in which the nonpoint source nutrient and bacteria loadings can be reduced throughout the Delaware portion of the watershed. The final step in the Team process is to submit the final recommendations to DNREC and coordinate these recommendations with the implementation plan for the Pennsylvania portion of the watershed to develop an interstate PCS or Watershed Restoration Action Strategy for both states in the Christina Basin.

A key component of the Christina Basin PCS is the cost-benefit analysis associated with the strategy. Although the group would like to see all of the recommendations in the strategy implemented, the cost-benefit analysis provides a tool to prioritize the most cost-effective BMPs to protect the watershed and improve the water quality in the Christina Basin. With this analysis the strategy will provide information to policymakers and managers that will enable them to make well-informed decisions in regard to watershed management in the Christina Basin.

This presentation will showcase the process of forming the Team, developing the recommendations, and specifically the cost-benefit analysis portion of the PCS.

Biography:

Martha Corrozi is a Watershed Analyst with the University of Delaware, Institute for Public Administration's Water Resources Agency (IPA-WRA). Ms. Corrozi is

responsible for providing regional watershed technical, policy, and research support to state and local governments, IPA staff and non-profit organizations in Delaware and the Delaware Valley. Prior to becoming an IPA staff member, Ms. Corrozi was employed by the Chesapeake Research Consortium at the Chesapeake Bay Program Office in Annapolis, Maryland, the Public Works Department in the City of Wilmington, Del., and the Conservancy of Southwest Florida in Naples, Fla. She is a member of the American Water Resources Association (AWRA), the Delaware Section of AWRA, the American Society for Public Administration (ASPA), the Delaware Association for Public Administration (DAPA), and the River Network. Martha helped establish and served as the charter president of AWRA's Delaware State Section. Ms. Corrozi received her Master of Public Administration (MPA) degree at the University of Delaware where she specialized in water resources. She received her bachelor of science in Biology from Lehigh University.

Development, Redevelopment, and the Protection of the Critical Environmental Areas: Opportunities for Watershed Protection and Economic Growth in New Jersey's Urban and Suburban Areas

Robert O'Neil

Abstract:
The focus of development/redevelopment in specific areas in New Jersey has considerable importance to the northern and western part of New Jersey's Lower Raritan Watershed Management Area, a more populated area with many brownfield sites. Although many standards and requirements have been developed with regard to development in pristine or environmentally sensitive areas, there is a major need to address opportunities for and watershed protection implications of redevelopment within urbanized areas.

The purpose of this study is to create an approach for identifying undeveloped and underutilized non-residential sites near critical water resources (such as drinking water sources), and to determine whether such sites are more appropriate for development/redevelopment, open space preservation or a combination of both. In doing so, the study seeks to develop a model that protects water resources while improving local economic opportunities. GIS based maps of critical open space are presented, as is a comprehensive inventory of priority sites in the Regional Center of Somerset County. Several case studies are offered which illustrate design alternatives on high priority sites within the study area. The study approach and methodology can be used by environmental and open space organizations as well as economic development organizations to help focus their efforts.

The Somerset Regional Center, made up of portions of Bridgewater Township, Raritan Borough and Somerville Borough and located in central New Jersey, was chosen to test the study method due to its existing land use patterns, highly organized public/private partnerships, availability of current GIS data, and proximity to a significant drinking water supply intake (New Jersey American Water-Elizabethtown).

To test the practical application of the study, conceptual site plans were developed for two sites. The project staff initially identified four locations and requested the Somerset Regional Partnership, a progressive NGO, to assist by narrowing the selection to the two highest priority sites. The Partnership quickly came to a consensus on the sites since both had development potential and had been previously identified as key links in the region's greenway plans.

Biography:
Robert A. O'Neil is a Watershed Protection Specialist for the New Jersey Water Supply Authority, a state-owned water supply utility. He joined the Authority in August 2003. He brings to the Authority experience in urban and regional planning as well as a passion for environmental protection. He works with local governments and regional organizations to preserve, protect and enhance the water quality of the Raritan River Basin through sound land use planning and environmental policies.

Prior to joining the Authority, Mr. O'Neil worked for the City of Easton, Pennsylvania for over 18 years. As Director of Planning and Development he was responsible for all land use and redevelopment activities in Easton. Mr. O'Neil also worked for the Bucks County Planning Commission in the early 1980's as a Community Planner.

Mr. O'Neil holds a B.A. in Geography and Regional Planning from Mansfield University and received his Master of Regional Planning from The Pennsylvania State University. He is a Licensed Professional Planner in New Jersey, and a member of the American Planning Association and American Institute of Certified Planners.

Mr. O'Neil's community service activities have included The Boy's and Girl's Club of Easton, Bushkill Creek Conservancy, Leadership Somerset, Southside Civic Association and The United Way of Somerset County. He and his wife Angela have been married for 28 years and have two adult daughters.

How Much is a Watershed Worth?

Jennifer Volk

Abstract:
DNREC has spent the last decade intensively monitoring and modeling the quality of Delaware's impaired waters. These efforts have led to the establishment of Total Maximum Daily Loads (TMDLs) on 93 percent of Delaware's land area. These regulations place limits on the amount of nitrogen, phosphorus, and bacteria that can be discharged from point and nonpoint sources in order to improve water quality for aquatic life and human use. Substantial funds have been expended to collect data (~$1 million/yr) and develop models that quantify pollution sources and establish the TMDLs (~$150,000/yr). These expenses are minimal compared to the long term funds required to implement the reduction goals.

Point sources, such as municipal wastewater treatment plants and industrial dischargers like poultry processing plants, are regulated through the National Pollutant Discharge Elimination System (NPDES) permitting process. Plants undergo costly upgrades to advanced technologies as permits expire in order to achieve reductions in loadings and compliance with TMDLs. Some point sources in the State are struggling to find cost effective means to meet new discharge limits, which in several cases is zero. Options for alternative disposal methods for the Rehoboth Wastewater Treatment Plant start at $40 million. A few facilities are looking to nutrient trading with nonpoint sources as a potential solution.

To achieve nonpoint source reductions, we all must change how we interact with the land to improve the quality of our waters. DNREC has been working with stakeholder groups, called Tributary Action Teams, to develop Pollution Control Strategies. Teams have recommended best management practices (BMPs) that are both voluntary and regulatory. In the Inland Bays watershed, which has the highest reduction requirements in the State, it will cost an estimated $25 million/yr to implement the agriculture, stormwater, and wastewater practices necessary to reach the TMDL targets. Agricultural BMPs are the most cost effective however it is unrealistic to base an entire strategy on reductions from the agriculture sector when these lands are being developed. It is necessary and challenging to find an appropriate mix of BMPs to treat current and future land uses while still weighing the price of these actions.

The costs to quantify impairments and improving water quality must be kept in perspective and compared to the actual value of the resource we are trying to protect. Healthy watersheds currently have no market price, but most certainly have value. How much is a watershed worth?

Biography:

Ms. Volk, a life-long Delawarean, received her undergraduate and graduate degrees from the University of Delaware. In 2000, she earned a Bachelor of Science with a Major in Chemistry, Minor in Biology, and a Concentration in the Environment. In 2003, she earned a Master's Degree in Marine Studies with a concentration in Oceanography. Her thesis research project titled, "The Role of Land Use and Land Cover in the Delivery of Nutrients to Delaware's Inland Bays," concerned the relationships between nutrient discharges with rainfall and surface water discharge patterns and the surrounding land uses of the watershed. A portion of this research was recently published in the Journal of Environmental Quality. Ms. Volk was hired into the Delaware Department of Natural Resources and Environmental Control's Watershed Assessment Section in the summer of 2003 as an Environmental Scientist, where she has continued to work on water quality issues. Ms. Volk has assisted with the development of Total Maximum Daily Loads for nitrogen and phosphorus in several watersheds and works with Tributary Action Teams to develop Pollution Control Strategies to reduce nonpoint source pollution. Ms. Volk recently took on the responsibility of managing Delaware's Chesapeake Bay Program grant, which funds the implementation of best management practices (BMPs) to reduce nitrogen and phosphorus loads in the Delaware watersheds that drain to the Chesapeake Bay.

Session 4: Track 2

Restoration/Retrofits II

Facilitator: Jennifer Campagnini

Comparing the Costs and Benefits of Four Stream Restoration Projects Constructed on Mill Creek between 2004 and 2007 in Lower Merion Township, Pennsylvania

Megan LeBoon

Abstract:

Four stream restoration projects were designed, permitted, and constructed on private properties along Mill Creek near Gladwyne, PA over a three year period. The projects addressed a wide variety of infrastructure and stream stability problems, with a range of bank stabilization and natural channel design techniques. Permitting mechanisms and requirements varied across the projects, and each project was built by a different contractor. Three projects were constructed under a traditional engineer-owner-contractor arrangement. One project was constructed under a full delivery or design-build arrangement. Design and construction costs are compared and contrasted. Design, permitting, and total professional services are presented as a percent of total construction and compared to industry averages for other water resources and stream restoration projects. The project costs are considered against the potential economic benefits associated with the stream restoration measures, infrastructure protection, and property improvements. Differences in costs between the projects are analyzed. Recommendations are given on maximizing the cost-benefit ratio of stream restoration projects on private property. Assessed values of similar properties along Mill Creek with stable and unstable streams are presented to explore the relationship suggested in the literature between stream health and streamside property values. The pros and cons of completing stream restoration projects on a property-by-property basis versus prioritizing and completing stream restoration projects on a watershed basis by public agencies are analyzed from an economic and stream function and values perspective.

Biography:

Megan LeBoon is an Engineering Associate with F.X. Browne, Inc. in Lansdale, PA. She received her B.S. in Civil Engineering from Rensselaer Polytechnic Institute in Troy, NY in 2003 and received her M.S. in Civil Engineering with a concentration in Water Resources from Villanova University in January.

Restoration of Ellis Island Seawall; Engineering Innovation and 404 Permitting Experience

Helen Robinson

Abstract:
Ellis Island is located within the National Park Service's park unit of Statue of Liberty National Monument and Ellis Island, about 2 miles southeast of Jersey City, New Jersey and about 1.4 miles west of the southern tip of Manhattan at the mouth of the Upper New York Bay. The seawall is about 6540 linear feet in length, and shows signs of deterioration in at least 238 different locations. Schnabel Engineering was retained to provide the engineering design for the wall restoration and permitting services to obtain authorization under the Clean Water Act and related regulations to complete the work. This paper will describe the innovative methods used to repair the wall while maintaining its historic fabric and will describe the extent of permitting and mitigation required.

The work proposed at Ellis Island also includes the raising of the sunken vessel, *Ellis Island*, a ferry boat that transported more than 13 million immigrants from New York City to Ellis Island to be processed. Efforts to raise the ferry by the U.S. Navy failed due to its deteriorated condition. Although a historic treasure in and of itself, the ferry causes an impediment to navigation, as well as blocking water access to the seawalls that are in great need of repair. The presentation will also include a review of the planned effort to raise the ferry.

Biography:
Ms. Robinson is a Project Engineer in the Geostructural Group in Schnabel Engineering's West Chester, PA office. She specializes in the design of micropiles, tiebacks and soil nails. She has been with Schnabel for four years and is a registered PE in Pennsylvania. Ms. Robinson received her BS degree and MS degree in Geotechnical Engineering from Penn State University.

Brandywine Shad Restoration Project

Robert Lonsdorf

Abstract:
The Brandywine Conservancy is leading an effort to restore American shad and other migratory fish to the Brandywine River. American shad (*Alosa sapidisimma*) were once an abundant migratory fish found throughout East Coast rivers and streams of North America, including the Brandywine River in Delaware and Pennsylvania. Shad were an important part of Native Americans' and early colonialists' diets, and later, were the basis of an important commercial fishery in larger rivers like the Susquehanna and Delaware. Spring runs of shad comprised a unique and dramatic natural phenomenon, now a lost part of our cultural heritage.

The goal of restoring shad to the Brandywine is to create a self-sustaining population of the fish that is resilient to some recreational fishing pressure. Restoring shad to the

Brandywine River could have important economic, ecological, and cultural benefits for the Brandywine Valley region generally and the Wilmington area specifically. The Conservancy has analyzed the feasibility of restoring American shad to the Brandywine River, initially focusing on the State of Delaware where eleven dams currently block shad from access to upstream habitat.

Partnerships have been established and agreements secured with the owners of nine of the eleven dams as well as with key state and federal agencies. Dam owner-partners include the City of Wilmington; the State of Delaware; the Hagley Museum and Library, located on the grounds of the original DuPont Gunpowder factory; and the DuPont Company. The Brandywine is a very historic and scenic river in Delaware, and the source of the City of Wilmington's drinking water. Several of these partners have agreed to move forward on modifying or removing their dams to allow for migratory fish passage. This presentation will describe the effort, the progress that has been made to date, and future goals and directions. A tour of the river and some of the dams will be offered too.

Biography:
Mr. Lonsdorf has 20 years of professional experience working as a senior staff on a wide variety of conservation planning, education, and advocacy issues, in four regions of the United States - the southern Oregon Siskiyous, the northern California Sierras, the tallgrass prairie region around Chicago, and now the middle Atlantic. Mr. Lonsdorf has written regional open space conservation plans, managed wilderness, wild and scenic river, and greenways projects, conducted natural resource prioritization studies, and served on regional science and land management committees. Mr. Lonsdorf received his Masters in Geography and Environmental Studies (1995) from Northeastern Illinois University. Mr. Lonsdorf is the current project manager for a Brandywine River shad restoration effort, and is the Conservancy's natural resource planning lead on a variety of projects. Mr. Lonsdorf has received a State Senate Award for Watershed projects done in California's northern Sierras. Mr. Lonsdorf is a Member of the Society of Conservation Biology, the Society for Ecological Restoration, and the Pennsylvania Wildlands Recovery Project.

Lunch

Biography:
Peter Mitchell

For a decade, Peter pulled information out of people as a reporter. He is still asking questions. Today he digs through SPSS runs and interview notes to transform audience insights into surprising offers at a social marketing agency called Marketing for Change. Peter is a partner at Marketing for Change, which was formed in 2005 by a group who had met working on the rebellious youth anti-smoking campaign that became known as 'truth.' A former Wall Street Journal reporter who was the founding marketing director of 'truth' campaign, Peter has led or helped lead behavior-change campaigns aimed at

teens, teachers, consumers, college students, married couples, older drivers and others for such clients as the Centers for Disease Control and Prevention, the Environmental Protection Agency, the Florida Department of Health, the Massachusetts Institute of Technology, the Planned Parenthood Federation of America, the United Nations and the U.S. Agency for International Development. He has managed the Buckle Up America campaign, helped the GED Testing Service re-brand its high school equivalency exams, and designed a campaign to reduce fertilizer use that urged homeowners to, in the words of the TV spots, "save the crabs then eat 'em." For more information, go to *www.m4change.com.*

Session 5: Track 1

Drinking Water

Facilitator: Nancy Parker

Sustainable Infrastructure: A Delaware Perspective

Ed Hallock

Abstract:
This talk will cover the new EPA initiative for Sustainable Infrastructure (SI). The SI program revolves around the four pillars of sustainable infrastructure. For a public water system these pillars are Better Management; Full Cost Pricing; Water Efficiency; and, The Watershed Approach. The talk will discuss how the Office of Drinking Water will work with public water systems in Delaware to achieve the goals of this program.

Biography:
Mr. Hallock is currently the Program Administrator for the Division of Public Health's Office of Drinking Water. A life-long resident of Delaware, Mr. Hallock received a Bachelors Degree in Biology from the University of Delaware in 1980 and has worked in the Division of Public Health for 24 years. In 1983, he began his public health career in the Division of Public Health, Office of Food Protection, and in 1986, he accepted a position in the Office of Sanitary Engineering, drinking water program. Mr. Hallock became Program Manager for the Office of Drinking Water in 1991 and the Program Administrator in 1999.

Mr. Hallock has participated on the National Drinking Water Advisory Council workgroup that developed the Consumer Confidence Report Rule, and the workgroup that reviewed the public education requirements for the Lead/Copper Rule short term revisions that have recently been proposed. He has also served on the EPA/State workgroup that revised the Public Notification Requirements of the Safe Drinking Water Act. He is an active member of the Chesapeake Section, American Water Works Association, Chair of the Regulatory Committee for the Association of State Drinking Water Administrators (ASDWA) and member of the Certification Committee for the

Association of Boards of Certification. He currently serves on the Board of Directors for ASDWA representing EPA Region 3 states.

Using Resources Wisely: Pumped Storage on the White Clay Creek

Roy Simonson

Abstract:
With 318 million gallons of storage the Newark Reservoir is designed to supply about 50 percent of the city's water requirements during a 90-day drought, the south well-field provides the remaining supply. When the White Clay Creek's flow is sufficient to provide for down stream users three pumps are available to fill the reservoir. When needed, water flows by gravity to be treated in the water treatment plant. This presentation will address the Reservoir operations and implications for the long-term economic viability of the City of Newark's water system.

Biography:
Roy is a 1981 graduate of Penn State University with a degree in Civil Engineering. He completed a Masters in Public Administration with City University in 1996. After college, Roy was on active duty in the U.S. Navy for 11 years stationed in Virginia, San Diego, and Japan. During this time he was involved in public works, utility operations, and contract management. Leaving active duty, Roy worked with Yakima County in Washington State managing road maintenance, water and sewer utilities, and flood hazard management. Moving farther east, Roy was the director of Public Works for the City of De Pere Wisconsin. His responsibilities included water and sewer utilities, road design, construction and maintenance, and trash collection. Roy also served as the city's representative and president of the Central Brown County Water Authority and was responsible for developing a $125 million water system to provide water from Lake Michigan to the six member communities. Completing his eastward migration, Roy is currently the Director of the Water and Wastewater Department for the City of Newark. Roy is a registered Professional Engineer in Delaware and Pennsylvania.

Prioritizing Land Protection to Protect Source Water in Schuylkill River

Jennifer Adkins

Abstract:
A source of drinking water for over 1.5 million people, the Schuylkill River is impacted by numerous threats to its water quality, including drainage from abandoned mines, runoff from agriculture, and discharges of wastewater. But with point sources largely under control and agriculture losing ground, the future of water quality in the Schuylkill lies in preventing and controlling stormwater runoff from residential development. For some communities in the watershed, prevention is no longer an option – urbanized landscapes require costly retrofits to provide even a fraction of the stormwater

management value they once had. But in less developed areas, using scarce watershed protection dollars to institute protections and good stormwater management makes the best economic sense. Land prioritization efforts currently underway in the Schuylkill River Watershed seek to insure the best possible use of limited watershed protection funds by using sophisticated GIS modeling to identify the areas where protection will provide the greatest return for both source water quality and critical habitat.

The idea behind this project grew out of the Schuylkill Action Network Land Protection Collaborative – one of five work groups of public and private partners collaborating to address a specific threat to water quality in the Schuylkill. The project is implemented through a partnership between the Philadelphia Water Department (PWD), Natural Lands Trust (NLT), and Delaware Valley Regional Planning Commission (DVRPC), guided by other members of the Collaborative, including the Partnership for the Delaware Estuary and other conservation organizations, land trust, and local government representatives. Underway since the winter of 2006 thanks to funding from the Pennsylvania DEP, the project will wrap up by mid-2008.

The project integrates NLT's SmartConservation® model, which identifies and ranks areas in the watershed most important to protect for ecological purposes, with a model developed by PWD that identifies those areas most important to conserve for drinking water purposes. Melded together, the models show high priority areas for both people and habitat. To add a sense of urgency toward protecting these lands, DVRPC developed a model that predicts the spatial location of future development by the year 2020. Overlaying this model onto the priority areas can assist municipalities, counties and land trusts with their land use planning and open space protection efforts. Because actively using the information derived from the model is so critical to its success, the project includes a significant outreach and implementation component.

Biography:

Jennifer Adkins was recently appointed Interim Executive Director of the Partnership for the Delaware Estuary, where she has served as the Schuylkill Watershed Initiative Grant Coordinator since 2005. As chairperson for the Schuylkill Action Network Watershed Land Protection Collaborative, Ms. Adkins works with a diversity of agencies and organizations in the Schuylkill Watershed to prioritize and collaborate on the protection of lands with high value for water quality and habitat. She also has 15 years of conservation experience in the Mid-Atlantic region that includes experience with the Nature Conservancy in Delaware, the Land Trust Alliance Mid-Atlantic Program, and the Brandywine Conservancy in Chadds Ford, Pennsylvania. Ms. Adkins has a M.P.A in Environmental and Energy Management and a B.S. in Economics, both from the University of Delaware.

Sketching our Source Water for a Better Return

Francis Greene

Abstract:

Dry weather water supply shortages have become increasingly acute in Northern New Castle County, Delaware over the last 20 years. One of the County's principal water suppliers, United Water Delaware (UWDE) operates a 30-million-gallon-per-day water treatment plant in Stanton, Delaware. The raw water supply source for this plant is the White Clay Creek, a tidally influenced and occasionally brackish fresh water tributary to the Christina River, which ultimately flows to the Delaware River. Under drought conditions, freshwater creek flows diminish and brackish water from the Delaware River can migrate up the White Clay Creek resulting in elevated raw water chloride levels at the UWDE plant intakes.

In 1998, UWDE designed and constructed the Tidal Capture Structure (TCS) for capturing freshwater tidal flows with acceptable chloride content to supplement natural stream flow, thereby increasing available source water for treatment. During periods of low flow and elevated chlorides, this source water has been further augmented with fresh water releases from the upstream Hoopes Reservoir to additionally increase this important source of water.

This paper will describe the TCS, review operational history and explain how this unique source water management component has helped stretch our source water for a better return.

Biography:

Mr. Greene is currently the Project Manager for Duffield Associates, Inc. Mr. Greene has over 11 years of experience in water resources. His background includes water supply, storm water management, storm sewer design, floodplain analysis, wetlands creation, wetlands as a best management practice analysis, erosion and sediment control planning, municipal engineering, permitting, land development, and permitting plans for wireless telecommunications sites. His responsibilities have included underground storm sewer design, wetlands analysis, site development and planning. He has also worked as a graduate assistant teacher in hydrology and fluid mechanics courses at Pennsylvania State University.

Session 5: Track 2

Urban Case Studies I

Facilitator: Ginger North

Water Resources Enhancements at the Blue Ball Properties

Bruce Jones

Abstract:

The improvements implemented at Blue Ball Properties presented the opportunity for local government agencies and legislators, civic leaders, and area residents to combine forces to transform several hundred acres of land into a multi-purpose transportation, recreation and water resources enhancement project that benefits those who live and pass through the Brandywine Hundred area of New Castle County, Delaware. Led jointly by the Delaware Department of Transportation (DelDOT), the Delaware Department of Natural Resources and Environmental Control (DNREC) and the Delaware Economic Development Office (DEDO), the project team has incorporated the areas existing water resources and newly created water resources into many of the project's components. The major components of this project include: 1) the creation of new recreational park areas that provide children's facilities, multi-use play fields and passive recreational opportunities; 2) greenway bike and walking trails; 3) an expansion of an existing golf course; and, 4) significant transportation improvements. Each of these components either benefits from water resources or has created an opportunity for water resources enhancements in the form of recreational improvements or natural resources and water quality improvements.

The Perkins Run Flood Abatement Study completed in 1998 identified the Matson Run stream corridor, which passes through the Blue ball site, as a focal point for water quality and flood mitigation improvements in the Perkins Run watershed. The Blue Ball Properties project provided the platform to implement several of the improvements recommended in this study. The road improvements and park projects incorporate Green Technology Best Management Practices (GTBMPs) to treat stormwater runoff prior to discharge to Matson Run. New on- and off-line permanent pool stormwater ponds adjacent to Matson Run enhance water quality by removing sediments and other pollutants from flood waters, and provide aesthetic and recreational opportunities. The golf course project features an on-line dam that provides significant flood control and water quality improvements. In addition, improvements were made to the City of Wilmington's Porter Reservoir clear well that will provide greater reliability of water supply for the City's customers. The proposed greenway bike and walking trails benefit aesthetically and functionally as they pass adjacent to portions of Matson Run and its associated wetlands. Finally, the community at large benefits from the significant road project which greatly improves traffic flow in the vicinity of Interstate 95, Route 202 and Foulk Road.

Biography:
Mr. Jones has over 20 years of experience in water resources and civil engineering in the public and private sector. A Delaware native, he began his engineering career in the Washington, DC metropolitan area with an international engineering consulting firm performing water and wastewater treatment design. In 1996, he moved back to Delaware and joined the public sector for several years as a manager in New Castle County's Engineering Section and then as the Program Administrator for DNREC's Division of Soil and Water Conservation, Drainage Section. Mr. Jones founded Green Stone Engineering in 2004 and is now Managing Principal of that firm. He is also one of the only Delaware-based engineers qualified to perform stream stability analyses and stream restoration using geomorphic principles.

Watershed Improvement/Restoration in an Urban Setting

Peter Mandeville
James Eisenhardt

Abstract:
This presentation will explore a case study (Tweeds Park) for achieving multiple policy and program improvement objectives for a contaminated/blighted site in the White Clay Creek Wild and Scenic Watershed. Brownfields development, flood mitigation/control (regional), habitat restoration and cultural resources preservation goals were achieved in this unique public/private partnership.

Duffield Associates, Inc. was retained to assist the Delaware Department of Transportation in regional stormwater improvements at this location for protecting downstream properties/development, while simultaneously planning, designing, and constructing a recreation park that includes the addition of multi-purpose athletic fields and the relocation and restoration of the historic two-story Tweed's Tavern dating from 1796. Duffield Associates is providing "Green Technologies" for control of the runoff from the park and upland drainage basin, such as reforestation, wetlands creation, bio-retention and bio-swales. Almost completed, this design build park project will consist of an historic village, a regional stormwater management facility, 3 multi-purpose athletic fields, a Tot-lot, parking and access improvements for adjoining properties.

Concurrently, Duffield Associates was retained by the Hockessin Athletic Club (HAC) to redevelop an adjoining land locked parcel. Access through the DelDOT site was required. Brownfield related cleanup and money was used for both projects. The HAC, scheduled for completion in winter 2006, includes the removal of previous industrial users and conversion of the site to a state of art athletic facility complementing the Tweeds Park. The redevelopment of this contaminated site includes riparian reforestation, use of BMP water quality techniques and open space reforestation.

This is an example of a positive private-public partnership that was able to achieve multiple restoration and improvement objectives not otherwise or typically possible.

Creative funding, planning, permitting, design and construction approaches were all used to achieve project objectives.

Biography:
Mr. Mandeville is a Water Resource Engineer at Duffield Associates, Inc. His background includes design of on-site community septic systems, storm water runoff storage and complex hydrologic assessment of surface and ground water flows. He also worked as a graduate assistant teacher in fluid mechanics and hydrology courses at the University of Pittsburgh.

CAFO Designs/Environmental Stewardship at Delaware Park: Obtaining Multiple "Green and Blue" Goals on a Wild and Scenic Watercourse

Albert Demerich
James Eisenhardt

Abstract:
Delaware Park, a multi-dimensional establishment featuring horse-racing, casino slots, and an 18-hole golf course, is nestled between the White Clay Creek (Wild and Scenic) and Mill Creek in Stanton, Delaware, just upstream of the tidal influence of the White Clay Creek/Christina River. Established in the 1930's in the floodplain, the establishment is prone to flooding. This presentation will review multiple environmental stewardships (unique uses of BMP practices for water quality, floodplain reforestation, wetlands restoration, stream restoration and native upland meadow management) Delaware Park has undertaken and how these improvements have created "green" opportunities …not only function but "green" amenities increasing value to the establishment.

As the first such establishment in the state directed to adopt a Concentrated Animal Feeding Operation (CAFO) under the guidelines of the Environmental Protection Agency (EPA), Duffield Associates designed a system which focuses on improving water quality in the watershed system. The primary goal of the project was to address the concentration of non-point source pollution as a means to enhance watershed quality. The design became two-fold: one aspect focused on directing stormwater runoff away from barn and stable areas; and, a second facet was to treat runoff resulting directly from daily equine operations and removing this from the stormwater system. BMPs typically considered for urban uses were adapted to this "traditional" agricultural operation. This tied in well with other urban stormwater quality controls contemplated on site. Design also considered "aesthetics" for these functional amenities needed to be compatible with a resort image.

BMPs used included bio filtration basins, "rain gardens" and bio swales. Another feature was the installation of carport roofing over manure bins, limiting the potential for nutrient run off. The manure is collected on a routine basis and hauled off-site for recycling.

Other components of the stewardship included stream restoration along Mill Creek and creation of wetlands in the floodplain, stream restoration along the White Clay Creek, riparian forest restoration, upland meadow and upland forest restoration and stormwater quality BMPs. Many of these improvements were included in the golf course design, creating a sense of "nature and isolation" in the midst of this urbanized setting – fostering an added appeal to attract people to the resorts.

Various partnerships were established to meet multiple policy and program objectives in the watershed at this location, an example of a positive public-private approach to meeting common objectives.

Biography:
Mr. Demerich is a Senior Consultant for Duffield Associates, Inc. He has over 25 years of experience in Landscape Architecture and the various disciplines associated with the profession. This includes site designs, project management and permitting for residential, corporate and industrial projects. Site investigations for future development, development of concept designs, through client and regulatory approvals and construction implementation have all been a part of his experience. Currently he is investigating the application of non-structural BMP's for the aesthetic treatment of stormwater on site work.

Teaneck Creek-Reclaiming Forgotten Urban Lands for a Wetland Eco-Park

Jeremiah Bergstrom

Abstract:
Bergen County Department of Parks in partnership with the Teaneck Creek Conservancy (TCC), a local non-profit organization, is working to realize a passive recreation-focused eco-park in the heart of Northern New Jersey on a formerly undeveloped 46-acre property located in the Township of Teaneck. The project, through grassroots support and determination, has recently completed construction of a formal trail system and outdoor classroom on the property, as well as raised necessary funds to investigate the environmental health of the site and develop a long-term habitat restoration plan for managing and improving the extensive wetlands complex on the property.

Beginning in 2002, a diverse team of professionals, including artists, designers, and community activists, have been developing concepts and building support for this project. TCC, a private non-profit organization, was awarded a lease in perpetuity from Bergen County to develop and maintain the site as a passive recreation and environmental education facility of the Bergen County Park System. After securing the right to make improvements on the property, TCC began earnestly raising necessary funds and lobbying support for the project from local constituencies. A team of professionals was hired to take community-based plan and broad-ranging ideas for the site and wade through regulatory requirements for wetlands, streams, and tidally influenced waterways and develop engineering designs and restoration plans to reclaim this former dumping

ground and impacted wetland and stream complex for public use and enjoyment as a passive park and outdoor environmental and cultural center.

To date, the project partners have successfully constructed over one mile of trails and boardwalks, including an outdoor classroom; replanted native wetland vegetation in approximately 1 acre of degraded wetlands; conducted a program of special events that includes community stewardship of natural resources and outdoor environmental and Eco-Art education programs for grade and high schools and college students, and the general public; implemented a 2-year monitoring and evaluation of the wetlands system through Rutgers University, and developed initial habitat restoration and management plans for the wetlands complex. In total, over 1.5 million dollars have been raised to support these ongoing efforts.

This presentation will provide an overview of the community-based project development process used to break ground on this innovative water resource focused eco-park.

The presentation will discuss necessary steps in implementing community-based projects to successfully create a recreational and environmental education facility in an urban setting.

Biography:
Mr. Bergstrom is a licensed Landscape Architect with a background in environmental restoration, stormwater best management practice design, native plant materials, GIS, watershed planning and data management. Over the past 10 years, Mr. Bergstrom has been responsible for the design, technical specifications, permitting, cost estimating, public bidding, and construction administration of multiple landscape design and environmental restoration projects. The majority of these projects were implemented in partnership with nonprofit, municipal and county entities. He also has extensive experience in inventory and analysis of natural, recreational, historic and scenic resources in regional and watershed planning. His specific experience includes landscape design and environmental restoration, native plants and soil-bioengineering, storm water management and best management practice (BMP) design, geographic information systems (GIS) / data management, and regional and watershed planning.

Session 6: Track 1

Tools for Watershed Planning

Facilitator: Kate Andersen

Rockaway River Priority Stream Segment Study Evaluating and Implementing TMDLs in an Urban Watershed

Jeremiah Bergstrom

Abstract:

The Rockaway River Watershed Cabinet (RRWC), in partnership with TRC Omni Environmental Corporation (TRC Omni), was contracted through the New Jersey Department of Environmental Protection (NJDEP) to complete the Rockaway River Priority Stream Segment Study. This project focused on identifying nonpoint source pollutant sources to address TMDL requirements for fecal coliform in the Rockaway River located in Morris County, New Jersey. This segment of the Rockaway River has been identified as a critical reach in the watershed. At this point, the river transitions from a relatively undeveloped forested drainage area into a developed urbanized corridor paralleling heavily-traveled Route 80 and Route 46. Much of the floodplain area in the reach remains undeveloped but historic encroachment and filling as well as stormwater discharges from surrounding land uses limit its effectiveness for filtering runoff and flood control. As the river flows deeper into the developed corridor, it becomes channelized and straightened with little opportunity to reach its floodplain and direct stormwater discharges and unfiltered overland flow contribute to water quantity and quality concerns. The partners were charged by NJDEP with evaluating nonpoint pollution sources, storm water runoff issues, and potential sources of fecal coliform. Additionally, partners were to identify and specify future projects to achieve the required water quality improvements in the Rockaway River.

In order to confirm initial concerns with storm water, nonpoint pollution sources, and fecal coliform, partners prepared and implemented a water quality sampling program that included seven months of water quality sampling consisting of six ambient sampling events, three low flow events, two baseline storm events, and a final intensive storm event and high flow event. In total, approximately 200 samples were collected and analyzed for fecal coliform and other key water quality parameters including TSS, TDS, phosphorus, fecal streptococci, temperature, and pH. The data from these sampling events was analyzed and showed distinctive trends.

This intensive analysis clearly identified high flow storm water events where runoff from areas immediately adjacent to the River, and flowing directly into the River, appears to be the primary sources of the fecal coliform impairment in this segment of the Rockaway.

This presentation will provide an overview of the process used to assess an urban stream and develop management strategies and implementation efforts to meet TMDL requirements. The discussion will focus on the potential environmental and economic impacts associated with implementing recommendations set forth as a result of the

detailed scientific data which has isolated specific areas where concentrations of non-point source pollutants are greatest in this reach of the Rockaway River.

Biography:
Mr. Bergstrom is a licensed Landscape Architect with a background in environmental restoration, stormwater best management practice design, native plant materials, GIS, watershed planning and data management. Over the past 10 years, Mr. Bergstrom has been responsible for the design, technical specifications, permitting, cost estimating, public bidding, and construction administration of multiple landscape design and environmental restoration projects. The majority of these projects were implemented in partnership with nonprofit, municipal and county entities. He also has extensive experience in inventory and analysis of natural, recreational, historic and scenic resources in regional and watershed planning. His specific experience includes landscape design and environmental restoration, native plants and soil-bioengineering, storm water management and best management practice (BMP) design, geographic information systems (GIS) / data management, and regional and watershed planning.

Asset Management Inventory and Inspection

Bryan Pariseault

Abstract:
New technologies are emerging every day that enable government agencies and private companies to manage and manipulate large amounts of data. Often, emphasis is placed on the uses of this data with Geographic Information Systems (GIS) applications. The actual acquisition of field data and the balance of efficiency and effectiveness are often overlooked. This paper will address data collection and equipment as well as explain initial steps needed and potential pitfalls.

Proper planning from the onset is crucial. A thorough understanding of the magnitude, constraints, safety issues, time frame, existing documentation, and data to be collected is required. Fieldwork typically includes two activities. First, assets must be located and surveyed, often using Global Positioning System (GPS) equipment. Second, field inspections must occur. Inspection data is recorded using a portable computer and pictures are taken using a digital camera. The use of a portable computer with pre-programmed pick-list selections to collect data results in excellent standardization and quality assurance. Data collected in the field is then transferred to the primary database. Once data is downloaded from the field, a GIS application is used to generate a map of the utility system allowing for checks of completeness and validation of connectivity.

To avoid pitfalls, it is critical to obtain buy-in from all affected parties regarding data needs and format. In addition, adequate safety training must be provided, and employees must be well versed in inspection procedures and project terminology.

The collection of large amounts of data in an efficient manner has many benefits. Drainage inventories are crucial in tracking down sources of illicit discharges, and are a

required part of NPDES Phase II compliance. Condition assessments can help prioritize maintenance activities. Finally, data can form the basis of an infrastructure inventory to aid in system operations and assist with GASB 34 reporting.

Biography:
Bryan has been with the Wilmington office of URS for 6 years. In that time he has been involved with a number of inventory and mapping projects to locate, classify and assess the condition of a variety of municipal assets. Projects have included the mapping of storm drainage systems, sanitary systems, trees, Best Management Practices (BMPs) and lighting fixtures. In additional to his asset management work, Bryan works on stormwater management projects and is currently working on several retrofits to stormwater management ponds here in New Castle County.

DELMARV Again: Hydrology of Flatland Watersheds

Greg Paxson

Abstract:
Hydrologic modeling of watersheds in flat regions can be difficult and results can be highly variable. The two parameters used in development of a unit hydrograph are the peak rate factor (or peaking coefficient) and the watershed response time. The SCS standard dimensionless unit hydrograph uses a peak rate factor (PRF) of 484. Twenty-five years ago, SCS developed the Delmarva unit hydrograph, with a PRF of 284, for use in the Delmarva Peninsula. A method for comparing the Snyder Peaking Coefficient (C_P) to the SCS PRF is presented in this paper and indicates that a C_P of 0.4 equates approximately to the PRF of 284.

As important and difficult to estimate for flatland areas as the PRF is the watershed response time, represented by either the time to peak (T_P) or lag time (T_L). There have been several studies in addition to the SCS Delmarva study related to the hydrology of flatland watersheds that evaluate the PRF as well as the time to peak. This paper includes a review of previous studies of flat, coastal plain regions, including the Delmarva Peninsula and New Jersey. The PRF and time to peak values for watersheds evaluated in these studies are presented. Equations for computing time to peak from these studies are also presented, including a new equation using data from several studies. Results of the application of these methods to subject watersheds are compared. Historical rainfall/runoff events are presented and used to develop calibrated Snyder Unit Hydrograph parameters for watersheds in coastal New Jersey and the Delmarva Peninsula.

Biography:
Mr. Paxson is a Senior Associate with Schnabel Engineering in their West Chester, Pennsylvania office. Greg received his undergraduate degree in Civil Engineering from the University of Delaware and his master's degree from Villanova University. He has over 13 years experience in dam engineering and has performed hydrologic and hydraulic

analyses for numerous dam projects, primarily in the northeast and Mid-Atlantic region of the United States. This experience includes several projects in the coastal plain of Delaware and New Jersey.

Session 6: Track 2

Urban Case Studies II

Facilitator: Thomas McKenna

Redevelopment of the Port Reading Coal Terminal; Balancing Brownfield and Greenfield Initiatives

Mark Gallagher

Abstract:

The redevelopment of the Port Reading Site in Woodbridge, New Jersey encompassed a balanced approach that not only focused on the redevelopment of a currently abandoned and contaminated port facility but also resulted in the restoration of a 14 plus acre estuarine wetland system on the Arthur Kill. The 292 acre Port Reading Site is situated in the Port of New York/New Jersey and is a designated Portfield site. The Portfield Initiative is a joint project of The Port Authority of New York and New Jersey and the New Jersey Economic Development Authority (EDA). However, unlike most redevelopment projects in this part of New Jersey this project included the restoration of approximately 14 acres of estuarine wetland.

The estuarine wetlands that once occupied the site were filled in the early part of the 20th century to facilitate the expansion of railroads operations associated with the coal terminal. Filling continued into the 1950's. Most of the wetlands were filled to an elevation that precluded tidal flooding. The redevelopment of the Port Reading Site required extensive remediation. The approved remediation plan form the NJDEP required that most of the site be capped. The cap relied heavily on the beneficial reuse of dredged material generated as part of the Port Authority's harbor deepening project. The need for fill material to cap the site resulted in the development of a plan to remove historic fill from low lying uplands and partially filled non-tidal wetlands. This effort provided the opportunity to restore the intertidal wetlands that once occupied the site.

The proposed intertidal wetland system envisioned for the site entailed the restoration of approximately 14.28 acres of common reed dominated freshwater wetland and upland from areas of historic fill. The proposed wetland system is designed to provide all of the elements of a typical estuarine community from open water to maritime grassland/shrubland and upland forest. The project will result in the re-establishment of natural habitat along 1800 linear feet of the site's 2400 linear feet of shoreline. Although a portion of the wetlands created/restored on the site were mandated to satisfy permit conditions, 11.13 acres are being restored for use as a mitigation bank. Due to the

difficulty in finding suitable wetland mitigation site in this part of New Jersey mitigation credits are anticipated to cost approximately $465-500, 000/credit.

Biography:
Mr. Gallagher is the Vice President of Princeton Hydro, a water resources oriented firm. He is in charge of all wetland and terrestrial ecology oriented projects. His primary interests are related to habitat enhancement and restoration. Currently, he is involved in a variety of restoration/mitigation projects including two wetland banks, the restoration of 20+ acres of degraded wetland on the Raritan River, a 12 acre freshwater wetland in Secaucus, NJ, a stream restoration project in Raritan Township, NJ, a forest enhancement project in Elizabeth, NJ and the restoration of a series of lakes at the Doris Duke Estate in central New Jersey.

The Fiscal and Economic Impact of Wilmington Riverfront Redevelopment

Dr. Simon Condliffe

Abstract:
The Wilmington Riverfront has changed dramatically since 1996. Abandoned buildings and brownfield areas have been replaced by new commercial and residential projects. The major projects include Christina Landing, One River Place (AAA), the Barclay's building, the Chase Center, the Shipyard Shops, the Riverfront Market, the Delaware Center for Contemporary Arts, the Delaware Theater Company, and the ING buildings.
Over this period the riverfront has received over $850 million of investment from public and private sources. The Riverfront has received $234 million in public funds between FY1996 and FY2007. Public funding sources include City, State, and Federal agencies. Private investment of $617 million has poured into the Riverfront. Simultaneously, the Riverfront has generated revenue streams for city, county, and state governments, as well as being an economic engine for job growth.

Over the period 1996-2007 the balance of public and private investment has shifted from predominantly public to predominantly private. In FY1996, 100 percent of investment was from public sources. In FY2007, 91 percent of investment is from private sources. Over the period FY1996 to FY2007, 73 percent of investment is from private sources, with public sources funding the remaining 27 percent.

This report quantifies the fiscal revenue received by Delaware's public agencies to derive a return on investment estimate. Further, the economic impact of the Riverfront is estimated using an econometric model of the State of Delaware. This model traces the linkages between the economic activities at the Riverfront and the broader state economy.

Biography:
Dr. Condliffe is an economist at the University of Delaware's Center for Applied Demography and Survey Research. His principal areas of research are regional economic analyses, economic impact studies, and health care economics, and he has been primary

investigator in numerous sponsored projects in these areas. Dr. Condliffe received his doctorate from the University of Delaware's Department of Economics.

The Chesapeake & Delaware Canal Trail

Larry Trout

Abstract:
The Chesapeake and Delaware (C&D) Canal is one of only two commercially vital sea-level canals in the United States. The vision of the canal began in the mid-1600s when Augustine Herman, a Dutch envoy and mapmaker, observed that two great bodies of water, the Delaware River and Chesapeake Bay, were separated only by a narrow strip of land. Original construction of the canal began in 1804 but the project was stopped after two years due to lack of funds. Construction resumed again in April 1824 and was open for use in 1829. Over the years, a number of modifications of the canal as well as bridge replacements have been constructed.

Today, the canal is 14 miles long, 450 feet wide and 35 feet deep and connects the Delaware River at Reedy Point, Delaware with the upper Chesapeake Bay in Maryland. C&D Canal is owned and operated by the U.S. Army Corps of Engineers, Philadelphia District. In 2006, nearly 8000 vessels passed through the canal including 40 percent of all ship traffic in and out of the Port of Baltimore. Millions of tons of cargo are transported through the canal annually. This water resource, in conjunction with the Chesapeake Bay and the Delaware River, is a major commercial navigation waterway that is extremely important to economic livelihood of the region including Baltimore, Wilmington and Philadelphia.

In addition to providing a route for water vessels to reduce their trip between Philadelphia and Baltimore by nearly 300 miles, the 9,000 acres of land occupied by the canal also provides for recreational activities including fishing, dog training, horseback riding, hunting and hiking. Johnson, Mirmiran & Thompson is currently designing the first phase to improve the recreational uses of the land so as to accommodate the current uses as well as additional uses such as biking, walking and jogging by providing a multi-purpose trail along the north side of the canal connecting Chesapeake City, Maryland and Delaware City, Delaware as well as a small portion on the south side in Chesapeake City. Also included are a number of trailheads to include parking, picnic areas and restroom facilities. The goal of the recreational enhancements is to provide more access to the existing natural area so that it can be more broadly appreciated and enjoyed and help meet demands for outdoor activities in this rapidly growing region. The hope is that the project will also provide economic benefits by helping to attract tourism. The cost of the improvements will be relatively inexpensive since little to no right-of-way acquisition will be needed. Additionally, project costs will be minimized by utilizing the compacted gravel of existing maintenance roads as a subbase for a large portion of the proposed trail.

Biography:

Larry G. Trout, Jr. is a Senior Associate with Johnson, Mirmiran & Thompson in their Newark, Delaware office. He currently heads the Water Resources group in that office. Larry has worked for over 13 years for both state government and as a private consultant as a civil engineer with his focus on water resources. He has extensive experience both designing and reviewing drainage, stormwater management and erosion and sediment control design for a variety of types of projects in both the public and private sector. He is also experienced in stream restoration and watershed and flood studies. Mr. Trout has completed Levels I, II, III, and IV of Dr. Rosgen's applied river morphology courses. He has both Master of Science and Bachelor of Science degrees from Bucknell University.

Friday, September 21, 2007

Session 7: Field Trips

Tour 1: ***Bringing Back Brandywine Shad***
Leaders: Robert Lonsdorf and Zach Stevenson, Brandywine Conservancy

Spanning 325 square miles in Pennsylvania and Delaware, the Brandywine watershed is one of the largest tributaries of the Delaware Estuary. Because of the Brandywine's dramatic drop in elevation, numerous mills flourished along its banks during the 18th, 19th, and 20th centuries. The mills required dams, which inadvertently reduced passage for spawning fish. The dams are owned by a variety of owners including the City of Wilmington, the State of Delaware, and several individual owners. In 2003 the Brandywine Conservancy was awarded a grant to determine the feasibility of restoring fish passage to the Brandywine.

This field tour includes a visit to a sampling of the 11 dams located along the Brandywine River, stretching from the City of Wilmington up to Brandywine Creek State Park. A representative from the Brandywine Conservancy will discuss the history of the river, the dams, the project and its importance, and how the Conservancy is proposing to provide for fish passage at the dams.

For more information visit: *http://www.brandywineconservancy.org/shad.html*

Tour 2: ***BMP Tour***
Leader: James Eisenhardt, Duffield Associates

A field trip to several of the projects that are being presented at the conference will be conducted. This tour will provide the opportunity to see "in the ground" project implementation in context as an extension to several of the presentations from the concurrent sessions. All of the sites are located within a short driving distance from the conference/University of Delaware and the majority of them have recently been completed (within the last year or two). Sites include a variety of water resources related topics including: stream restoration, wetland/urban stormwater systems, flood control/mitigation, water supply, and water quality BMPs.

Possible site tours may include:
– Pike Creek Stream Restoration (presented at the 2006 Mid-Atlantic conference by the Delaware Department of Natural Resources and Environmental Control)
– United Water's Tidal Capture Structure on the tidal White Clay Creek
– Delaware Park's Environmental Master Plan Implementation
– DelDOT/New Castle County's Glenville Buyout/Flood Control/Wetlands Mitigation
– DelDOT Tweeds Park Brownfield Redevelopment/Regional Stormwater-Wetland and Park
– DNREC Christ the Teacher Urban Wetlands/Stormwater Ponds Retrofit
– New Castle County/DelDOT Red Clay Creek Detention Facilities

Tour 3: ***Part 1 - Restoring and Sustaining an Urban Farm – Case Study of Land Use Planning for the University of Delaware's Farmland***
Part 2 - Stewards of the Future–New Strategies for Promoting Responsible Farm Management

Leader: Jenny McDermott and Alyssa Collins, University of Delaware

Part 1: Restoring and Sustaining an Urban Farm: Case Study of Land Use Planning for the University of Delaware's Farmland

The College of Agriculture and Natural Resources of the University of Delaware manages a 350 acre "urban farm" that is located in the city limits of Newark, Delaware. While the farm has many facets, it is essentially a small dairy farm (~100 cows) with pastures and crop lands used mainly to grow corn silage and hay. There are also a number of important natural areas and waters on the farm, including a 35 acre "Ecology Woods" and tributaries of the White Clay Creek Wild and Scenic River. The farm is located directly behind the college and is regularly used in teaching and research projects by UD faculty and students. In 2003 the College of Agriculture and Natural Resources initiated a comprehensive land use planning effort designed to address some pressing agricultural and natural resource issues but, beyond that, to convert the farm into a working, educational agro-ecosystem of value to the University, the Newark community, and others in the state and region. This part of the tour summarizes the planning efforts and highlights how UD is taking innovative steps to resolve manure and nutrient management problems on the farm and to enhance the streams, wetlands, and other natural areas that are so critical to our college's agro-ecology programs. We will also relate the efforts completed or underway on our farm to land use changes throughout our watershed to show how a well designed "urban farm" can be sustained and bring a wide range of values to the broader community.

Part 2: Stewards of the Future: New Strategies for Promoting Responsible Farm Management

St. Andrew's School is a residential boarding school in southern New Castle County, Delaware, and is partly within the Middletown town limits, where population grew by 61 percent from 1990-1999, versus 18 percent for Delaware. St. Andrew's also represents one of the largest contiguous parcels of land remaining in Delaware (2,200 acres) and currently farms about 1,500 acres, primarily in row crop rotations. Beginning in 2005, St. Andrew's School and the University of Delaware initiated cooperative efforts to re-design the farm and its forests, riparian zones and ponds in a manner that would ensure its sustainability as an agro-ecosystem for the next century. At the same time St.
Andrew's has set the example of sustainability and created an innovative, educational farm program and environment for the School's students. This part of the tour will provide an overview of the comprehensive land use planning undertaken at St. Andrew's to date. The tour will also highlight the agricultural, natural resource, and water quality projects underway and relate these land use changes to the broader issue of agricultural sustainability in the 21st Century.

The presentation will also explore the 'transferability' of this research to working landscapes under development pressure and how these findings can enhance farm survivability in the suburban community.

Tour 4: ***Urban Wildlife Refuge***
Leader: Thomas Moran, DNREC

The Russell W. Peterson Urban Wildlife refuge is one of the few urban wildlife areas in the country. The urban wildlife refuge is located about 15 miles northeast of Newark, in Wilmington, Delaware on the riverfront of the Christina River. The refuge is named after Russell W. Peterson, former Governor of Delaware, who gained international recognition as an environmentalist, scientist, activist, and public servant.

The 202-acre tidal freshwater marsh is a remnant portion of several thousand acres of wetlands that were once among the nation's most valuable fish and wildlife habitats. After three centuries of neglect and abuse, the Riverfront Development Corporation (RDC) is leading efforts to restore the diversity of vegetation in the marsh to provide an enhanced habitat for migratory waterfowl and other wildlife. The RDC worked with the Department of Natural Resources and Environmental Control and owners of the marsh properties to gain rights to establish the Russell W. Peterson Urban Wildlife Refuge on the Old Wilmington Marsh site (also known as Dravo Marsh, located just south of the Shipyard Shops at Riverfront Wilmington). Property owners include New Castle County, Conectiv, and Norfolk Southern Railroad. This project would not be possible without the extensive cooperation between the numerous public and private partners.

An extensive marsh restoration process began in 1998, and has already enabled beneficial vegetation to flourish in the marsh and provide habitat for wetland wildlife. Rehabilitation efforts include stabilizing the shorelines, re-excavating water channels to their historic patterns, restoring tidal exchange, *Phragmites* removal and other invasive species management, and installing wildlife nesting structures. Future plans for the refuge include a visitors' center, educational programs, and elevated observation walkways. This trip will include a tour of the refuge site with a focus on the restoration activities and the future plans for the Russell Peterson Urban Wildlife Refuge.