2012 Delaware Wetlands Conference

Protecting Our Communities & Coasts for the Future

February 29, 2012

Dover, Delaware

Welcome Message

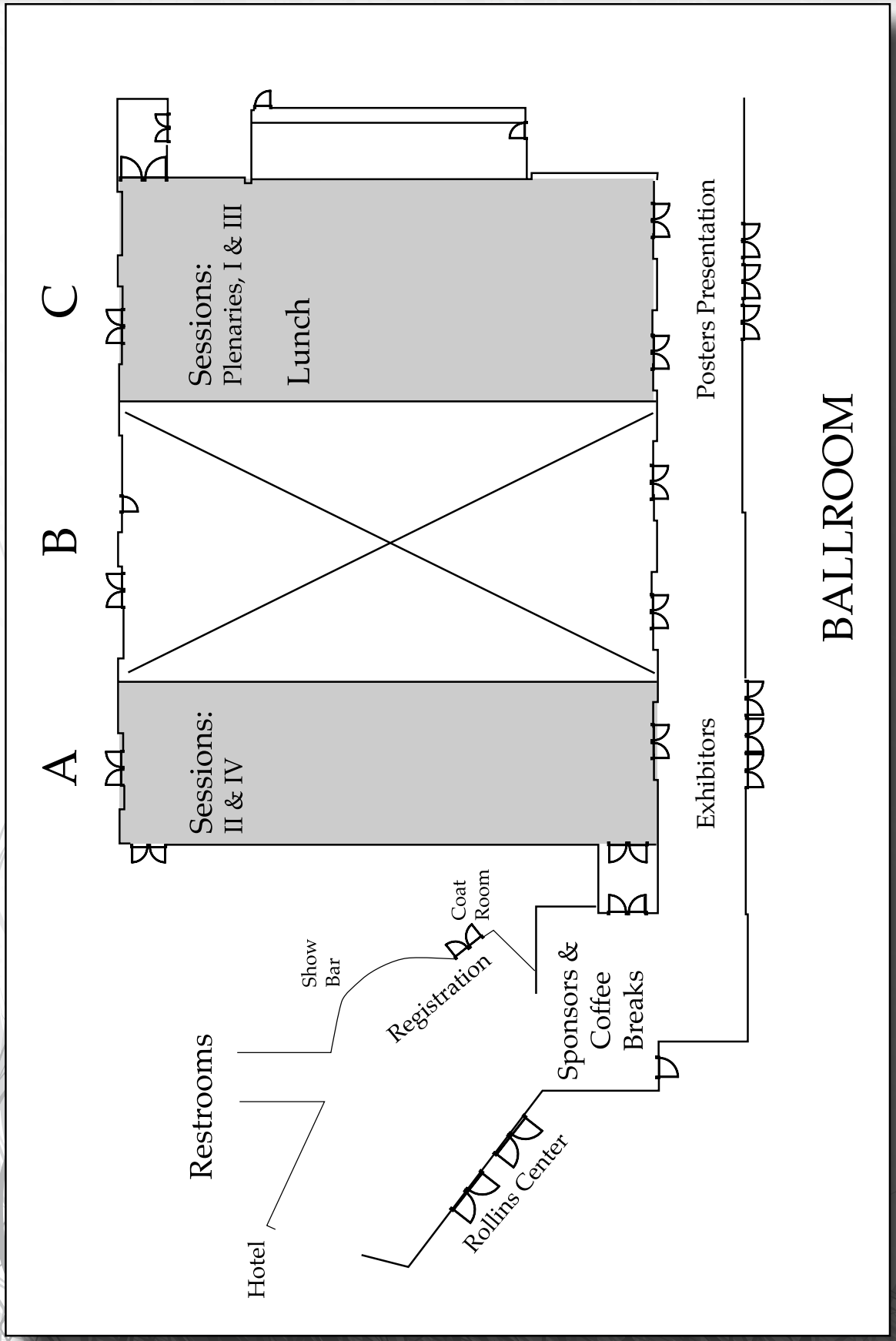
Welcome to the fourth biennial Delaware Wetlands Conference. This year we are highlighting the theme Protecting Our Communities and Coasts for the Future. Many of you are returning attendees and we appreciate your continued interest and support. We are also happy to receive new attendees that have discovered this opportunity to share a common interest in Delaware's wetland resources. The Delaware Wetlands Conference offers scientists, resource managers, and decision makers alike the opportunity to convene for one day to showcase recent advances in the wetland discipline. Great collaboration takes place every day across Delaware to enhance the science and management of wetlands and to foster the integration of this information into decisions affecting wetlands and the services they provide to the citizens of the First State.

Despite our recent progress, there is still new ground to be covered to ensure that our wetland resources continue to provide their unrivaled natural services. Our priorities are centered on improving water quality, sustaining wetland habitat, ensuring flood and storm protection, maintaining recreationally and commercially valuable fish and wildlife, and mitigating climate change through carbon storage. Inherent in these priorities is communication of current and accurate information among professionals, the transfer of relevant information to decision makers, and the education of Delaware's citizens through effective outreach. We hope today's conference embraces these priorities and cultivates momentum toward achieving them together.

We are excited to team up again to host the 2012 conference and offer the opportunity to share information and improve the communication and collaboration between wetland professionals in Delaware. Our agenda today offers presentations on wetland restoration, managing our coasts, new mapping applications, and the latest in wetland monitoring and assessment. We have invited several professionals to highlight innovative work related to measuring and valuing ecosystem services, reaching audiences through effective messaging, and turning science into better policy. We also hope you opt to network with new and familiar colleagues, engage in our panel discussion focusing on impoundment management, and mingle among our contributed posters, event sponsors, and exhibitors. Thank you for your support in attending and contributing to the wealth of material offered today.

Thank you,
Wetland Monitoring and Assessment Team and the Coastal Training Program

Conference Map



Biography

Jeanne Christie
Executive Director of the Association of State Wetland Managers, Inc. (ASWM).

Jeanne Christie is the Executive Director of the Association of State Wetland Managers, Inc. (ASWM). She has been with ASWM since 1999 and Executive Director since 2001. She has worked extensively to assist states in developing wetland programs and to better integrate state, federal and local wetland programs. From 1995 to 1999 she was a Resource Conservationist with the USDA Natural Resources Conservation Service, Wetlands and Watersheds Division where she was national program leader for the Wildlife Habitat Incentives Program. She worked for the U.S. Environmental Protection Agency, Wetlands Division (1988-1995) moving from the staff level to Section Chief and Acting Branch Chief. At EPA she worked as a liaison between the Wetlands Division and federal and state programs. As an environmental planner at the Wisconsin Department of Natural Resources (1985-1988) responsibilities included the Green Bay Remedial Action Plan and the 208 Watershed Plan for Southeastern Wisconsin. She has a B.A. in Political Science and a B.S. in Environmental Science, both from the University of Maine at Presque Isle. Jeanne is a 2007 winner of the National Wetlands Award for Education and Outreach. She lives in an 1860 farmhouse in Windham, ME with her husband Larry and their 'rescued' animal companions Tux, Gabby and Massey. In her free time she runs the local snowmobile trails, gardens furiously and teaches photography.

Gerald Kauffman
Project Director of the University of Delaware Water Resource Agency

Gerald (Jerry) Kauffman has served as the Project Director of the University of Delaware Water Resource Agency in Newark since 1997. Jerry holds secondary faculty appointments from the University of Delaware School of Public Policy and Administration and Department of Civil and Environmental Engineering. Since 1999, Jerry has taught graduate courses in watershed science, management and policy and undergraduate courses in water resources engineering, hydraulics, and hydrology. In 2009, he was awarded Conservationist of the Year by the Delaware Nature Society. Jerry holds degrees from Rutgers University, the University of Delaware and is completing a Ph.D. in Marine Policy including a dissertation on coastal watershed management. Before locating in Delaware, Jerry worked in Chicago and New Jersey. Jerry has authored numerous articles, reports and chapters, and contributes to columns in The News Journal.

Chip Paterson, Principal and Partner with IEc

Chip Paterson is a Principal and Partner with IEc, an economic and environmental consulting firm in Cambridge, Massachusetts. He directed the analysis of wetland ecosystem service values for DNREC in collaboration with Dr. Polasky. His work focuses on the valuation of natural resource services and environmental quality in the context of natural resource damage assessment, regulatory analysis and environmental litigation. Chip holds a B.A. in Economics from Colby College, and earned an M.S. in Resource Economics and Policy from the University of Maine, Orono. Chip's professional writings can be found in journals such as Land Economics, the Journal of Environmental Economics and Management, Ecological Economics, and Health Economics. In his free time, Chip completed the 2011 Vermont 100 mile endurance run.

Dr. Stephen Polasky Fesler-Lampert Chair in Ecological/Environmental Economics at the University of Minnesota

Dr. Stephen Polasky serves on the Governing Board of the Natural Capital Project. He holds the Fesler-Lampert Chair in Ecological/Environmental Economics at the University of Minnesota. His research interests include ecosystem services, natural capital, biodiversity conservation, sustainability, integrated ecological and economic analysis, renewable energy, environmental regulation, and common property resources. He served as Senior Staff Economist for environment and resources for the President's Council of Economic Advisers 1998-1999 and currently serves on the Science Advisory Board of the US Environmental Protection Agency, the Board of Directors for the Beijer Institute of Ecological Economics, and the Board of Directors and the Science Council of The Nature Conservancy. He was elected into the National Academy of Sciences in 2010. He was elected as a Fellow of the Association of Environmental and Resource Economists in 2011, the American Academy of Arts and Sciences in 2009, and the American Association for the Advancement of Science in 2007.

2012 Conference Agenda

8:00 AM	Registration (lobby)	
8:30 AM	**Welcome** - DNREC Secretary Collin O'Mara	
8:45 AM	**Delaware Wetlands: Tracking and Assessing Landscape Change** Mark Biddle, DNREC	
9:10 AM	**Climate Change and Coastal Wetlands** Danielle Kreeger, Partnership for the Delaware Estuary	
9:30 AM	**Wetland Loss, Wetland and Natural Hazards, and Policy** Jeanne Christie, Executive Director Association of State Wetland Managers	
10:15 AM	Coffee Break - Coffee sponsored by Ecosystem Investment Partners	
	Session I: Restoration	**Session II: Coastal Management**
10:35 AM	**Implementing the Nanticoke River Watershed Restoration Plan: Status Update** Brian Jennings, USFWS	**Regulating Wetlands and Waterways** Scott Figurski, DNREC
10:55 AM	**Salt Marsh Creation/Restoration for the Indian River Bridge Project** Ken Dunne, DelDOT	**IMPOUNDMENT MANAGEMENT PRESENTATIONS AND PANEL Wetland Management along a Changing Coast: A Manager's Dilemma** Michael Stroeh, USFWS
11:15 AM	**The Delaware Estuary Living Shoreline Initiative (DELSI): Field Reconnaissance & Living Shoreline Conceptual Planning** Laura Whalen, PDE	**The Importance of Managed Wetlands to Wildlife** Kevin Kalasz, DNREC
11:35 AM	**Coastal Wetland Restoration Defining Your Project to Maximize Ecological Benefits, Be Sustainable, and Financially Feasible.** Douglas Janiec, Cardno Entrix	**Evaluating the Evolution of Natural Tidal and Managed Wetlands in Delaware** Bartholomew Wilson, DNREC
11:55 PM	**Prioritizing Areas for Wetland Restoration to Improve Water Quality** Kathy Boomer, The Nature Conservancy	**PANEL - Wetland and Coastal Impoundment Management, Time For Change** Moderator Robert Scarborough, DNREC
12:15 PM	Exhibitor and poster session	
12:30 PM	Lunch and poster session - Lunch sponsored by URS	

2012 Conference Agenda

1:30 PM	**Wetlands Are Green (and Good as Gold!)** Jerry Kauffman, Project Director of the University of Delaware Water Resource Agency	
2:00 PM	**Advances in Ecosystem Service Valuation and Implications for Wetland Management** Chip Patterson, Industrial Economics Inc. and Steve Polasky, Natural Capital Project	
2:30 PM	**Oh, the Horror...Overcoming Swamp Thing's Approach to Messaging Ecosystem Services** Jennifer Holmes, DNREC	
2:50 PM	Coffee Break	
	Session III: Mapping Applications	**Session IV: Monitoring and Assessment**
3:10 PM	**A Web-based Mapping System for the Delivery of Hydrogeologic Data for Delaware** John Callahan, Delaware Geologic Survey	**Mid-Atlantic Coastal Wetland Assessment: Monitoring wetlands through rapid and intensive methods** Angela Padeletti, Partnership for the Delaware Estuary
3:30 PM	**Applications of Multi-Altitude Aerial Platform as Wetland Observing System** Jo, Young-Heon, University of Delaware	**Initiation of Intensive Long-term Wetland Monitoring in the Delaware Estuary** Tracey Elsey-Quirk, Partnership for the Delaware Estuary
3:50 PM	**The Delaware Coastal Flood Monitoring System** Kevin R. Brinson, University of Delaware	**Adaptive Management Techniques for Wetland Restoration Maintenance and Monitoring** Katie Eberhart, URS Corporation
4:10 PM	**Mapping horizontal sea-level rise using vegetation communities in the Coastal Zone of Delaware** Robert Coxe, DNREC	**Comparing Wetland Function Estimates from Landscape Level Analysis to Intense Field Assessments** Alison Rogerson, DNREC
4:40 PM	Informal Happy Hour at the Fire and Ice Lounge	

Presentation Abstracts

Highlighted Presentations:

DELAWARE WETLANDS: TRACKING AND ASSESSING LANDSCAPE CHANGE

Mark Biddle, Delaware DNREC Division of Watershed Stewardship

The landscape of Delaware is in constant flux. Whether change is man-made or natural, wetlands in particular are affected directly and indirectly by surrounding land use. The Delaware Department of Natural Resources and Environmental Control recently completed a new statewide wetland mapping effort which included a status assessment for wetlands. This was an update from a similar effort for the period 1981/2-1992. These updated wetland maps used the NWI-Plus methodology from the USFWS National Wetlands Inventory which adds classification by abiotic properties and is a more conservative mapping technique. This combined effort ensured that federal (NWI) and state (DE) wetland maps are the same, eliminating confusion by users of wetland data. The associated 15-year (1992-2007) assessment provided data on wetland loss, gain, and change between two mapping exercises. Nearly 3,900 acres of vegetated wetlands were converted to another land use, while 768 acres of vegetated wetland were gained or restored during this period. Ninety-two percent of the losses were to non-tidal wetlands with the majority of losses to headwater forests. Results also revealed that Delaware experienced an increase in the rate of wetland loss per year compared to the previous study. Delaware gained 2,285 acres of open water ponds, which important for stormwater retention but are no substitute for the multitude of functions provided by natural wetlands. In addition to assessing wetland acreage and type, this project included a landscape level functional assessment for 11 services provided by wetlands. This presentation will focus primarily on changes to wetland acreage, and causes of these changes on the landscape.

CLIMATE CHANGE AND COASTAL WETLANDS: WINNERS, LOSERS AND ADAPTATION IN THE DELAWARE ESTUARY

Danielle Kreeger, Priscilla Cole, Angela Padeletti, Laura Whalen, Sari Rothrock and Jennifer Adkins
Partnership for the Delaware Estuary

By 2100, temperatures will rise 1.9-3.7 degrees, precipitation by 7-9%, the growing season by 15-30 days, and sea levels by 0.5-1.5 meters. Wetland ecologists and managers were shown local climate predictions and polled to build consensus on top vulnerabilities for coastal wetlands. Increased temperature, sea level, salinity, storms, and altered seasonal precipitation are expected to interact with ongoing landscape change, perturbing many ecological relationships and affecting coastal wetlands in many ways. Nationally rare freshwater tidal marshes are threatened most by salinity rise and continued development. In contrast, brackish and salt marshes are threatened mainly by increased rates of sea level rise interacting with management practices and local stressors; e.g., sediment deficits, nutrient loadings, local subsidence. Although some species may eventually benefit, we predict substantial net declines in acreage, condition, and ecosystem services unless proactive adaptation measures are adopted to stem losses. SLAMM v6 predicts that 26% of our >150,000 hectares will be lost by 2100 and more recent estimates exceed 50-75%, with concomitant declines in critical services such as flood protection, fisheries and wildlife support, and water quality. Due to climate momentum over the next 30+ years, coastal wetland management will need to adapt to these changing conditions. Adaptation tactics include strategic retreat, living shorelines, setbacks, and sediment supply tactics to maximize both landward migration potential and vertical accretion potential. Greatest bang for the buck will be achieved by smart local decision-making using GIS, science, and results from continuous monitoring and assessment of coastal wetland status and trends.

WETLAND LOSS, WETLANDS AND NATURAL HAZARDS, AND POLICY

Jeanne Christie, Associate of State Wetland Managers

Conserving and restoring wetland resources should be a high priority for every state. Wetlands provide ecological services that contribute to the overall health of a state's citizenry, its natural resources, and its overall economy. Historically, the majority of states have relied on the Clean Water Act and other federal programs to protect wetland resources. Recent national status and trends reports have indicated that wetland losses have slowed to the point where there were actually modest gains occurring around the nation. However, this is not the whole story and the future is likely to be very different from the recent past. Wetlands are imperiled and loss and destruction of these resources is likely in the immediate future unless individual states take action. Sea level rise, stronger, more erosive storms, decreased protection for isolated wetlands under the Clean Water Act, possible changes to the Farm Bill and smaller federal and state budgets are likely to present challenges. I will discuss national trends, federal policies, and state-specific opportunities for protecting and conserving wetland resources through both regulatory and voluntary programs.

Presentation Abstracts

WETLANDS ARE GREEN (AND GOOD AS GOLD!)

Jerry Kauffman, University of Delaware Water Resources Agency

It has long been known that wetlands have disproportionately high ecological value for their footprint. However, it is becoming increasingly clear that these hydrophilic systems have significant economic value as well. Wetlands have been described as the kidneys of the Delaware Estuary as they provide near irreplaceable ecosystems services to society such as water filtration, flood control, and fish nursery habitat. Freshwater and saltwater wetlands cover just 15% of the Delaware Estuary watershed in Delaware, New Jersey, and Pennsylvania yet they provide over 50% of the estimated $12 billion ecosystem goods and services value of this interstate basin. Wetlands are fish factories as the nurseries for the commercial $2 million striped bass and $10 million blue crab fisheries in the bay. The U.S. Fish and Wildlife Service reports indicate that fishing, hunting, and bird watching is an $800 million enterprise in the tri-state watershed, much of it on wetlands. NOAA estimates that coastal wetlands along the Delaware Bay are responsible for over 1,500 jobs. Wetlands are green in many different ways but in the Delaware Estuary watershed they are good as gold!

ADVANCES IN ECOSYSTEM SERVICE VALUATION AND IMPLICATIONS FOR WETLAND MANAGEMENT

Chip Paterson, Industrial Economics, Inc. and Steve Polasky, Natural Capital Project

In recent years, decision-makers have placed increasing focus on valuing ecosystem services in order to capture as complete an accounting as possible of the costs and benefits of land and resource management programs and policies, such as wetland conservation and restoration.

This presentation will discuss the need for and evolution of ecosystem service valuation tools and methods, with a particular focus on the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) model. InVEST was developed by ecologists and economists at The Natural Capital Project, a collaboration of the Woods Institute for the Environment at Stanford University, The Nature Conservancy, the World Wildlife Fund, and the Institute on the Environment at the University of Minnesota. Results from a recent analysis of wetland ecosystem services in Delaware will be highlighted, including implications for management strategies and areas of future research.

OH, THE HORROR...OVERCOMING SWAMP THING'S APPROACH TO MESSAGING ECOSYSTEM SERVICES

Jennifer Holmes, Education Coordinator, Delaware National Estuarine Research Reserve

Swamp Thing is a fictional horror story character who used scare tactics to protect his swampy home. Although effective, it may have produced more harm than good especially in perpetuating negative views of wetlands. Even today, there are people who have negative opinions of wetlands for various reasons. According to the "2005 Inventory and Needs Assessment for Green Infrastructure Education Programs in Delaware" residents stated that they were concerned about water quality but less concerned about the preventive loss and degradation of non-tidal wetland. Why is there such a disconnect? Perhaps, it is not our overall message of "protecting wetlands" but the way we deliver that message. In this session, we will re-define outreach methods to appeal to the target audiences' values to strive to achieve the goal of protecting Delaware's wetlands. This is an opportunity to join the discussion of how to best reach multiple and diverse audiences with information on wetland ecosystem services. Explore the use of multiple communication tools understanding that the means to reaching the goal is to integrate audience needs and motivations into various aspects of information dissemination.

Presentation Abstracts

Session Presentations:

PRIORITIZING AREAS FOR WETLAND RESTORATION TO IMPROVE WATER QUALITY

Kathy Boomer and Amy Jacobs, The Nature Conservancy

Limited funds and uncertainty in how to reduce human impacts on our water resources present major challenges to developing effective watershed management plans. Most decision-support tools (i.e., models) do not provide information at a spatial scale relevant to that of land management decisions. To meet this critical need, The Nature Conservancy is developing a framework to identify land-based sources of nutrients and sediment and to prioritize locations for best management practice implementation including wetland restoration and enhancement practices. The approach consists of 1) refining land use data to reflect current management; 2) identifying hydrologic pathways between a source and a targeted waterbody; and 3) designing appropriate best management practices to capture sediment and nutrients, given the magnitude of the source, the landscape setting, and the resources available for implementation. The recent widespread availability of fine-scale topography data (1 to 2 m horizontal resolution; 15 cm vertical accuracy) provides the basis for characterizing source-sink connections and fine-scale targeting (the right practices at the right places in priority watersheds). As an outcome, the framework provides a basis for developing land-owner incentive programs, as well as designing scientific monitoring programs that can be used to assess bmp performance, thus providing capability to improve the framework overtime. **Session I Restoration**

THE DELAWARE COASTAL FLOOD MONITORING SYSTEM

Kevin R. Brinson1, John Callahan2, Daniel J. Leathers1, Linden S. Wolf1, David R. Legates1
1University of Delaware, 2Delaware Geological Society

In the last two decades storms such as Hurricanes Katrina and Ike along the Gulf of Mexico and Floyd and Isabelle along the Atlantic Coast of the United States have resulted in significant loss of life, injuries and property damages reaching well over 100 billion dollars. Much of the damage from these and other tropical and extra-tropical weather systems is associated with severe coastal flooding. The Delaware coastline is extremely vulnerable to such events, examples being the great March 1962 storm and the recent Mother's Day Storm of 2008. The added concern of sea-level rise and its effect on the frequency and intensity of flooding events, have further emphasized the need for a modern, dependable coastal flood monitoring system for Delaware. Such a system has been developed for several coastal communities of Kent County, Delaware and is being expanded to other areas along the coast. The overriding objective of the system is to allow State constituencies to be informed as to tidal conditions and possible coastal flooding situations in advance of their occurrence. Essentially, the system incorporates data from NOAA forecast models and utilizes the Delaware Environmental Observing System (DEOS) to notify relevant personnel of a potential flooding situation up to 48 hours in advance. Predicted water levels along the coast and a lidar-based digital elevation model (DEM) are used to develop flood inundation maps and selected road elevation profiles within each community. This information is displayed collectively with real-time water level observations in a web-based mapping application. **Session III Mapping Applications**

A WEB-BASED MAPPING SYSTEM FOR THE DELIVERY OF HYDROGEOLOGIC DATA FOR DELAWARE

John Callahan, Delaware Geologic Survey

Data, reports, and map products from the Delaware Geological Survey (DGS) are increasingly being used by State agencies (DNREC, DelDOT, DDA) and local governments to support land-use planning and resource management decisions. Several existing and proposed regulations and ordinances cite these DGS resources and encourage and require their use for preparation of development plans and permit applications. Provision of DGS resources through a common, openly accessible data delivery mechanism would standardize the reporting and access to these resources and enhance efficiency for governmental agencies, the development community, consultants, and the public.

This project is designed to deliver, by web-based mapping technology, the most commonly available geologic and hydrogeologic information for the State of Delaware, appropriate for use in hydrologic studies required by regulation and ordinance, and for use by state agencies to support resource management decisions. Much of the information has direct linkage and usage within wetland evaluations. Depth to water table grids, in typical wet, normal and dry years, can be used to estimate groundwater flow and direction. Groundwater recharge potential can be used as a proxy for permeability/hydraulic conductivity of the near surface layer. Other data available through the portal include surficial geologic maps, depths/thicknesses of aquifers, and groundwater levels, geophysical logs, and descriptive logs at numerous locations throughout the state. In addition to the portal application, the DGS website offers graphs and tabular display of depth to water records from hundreds of current and past wells. **Session III Mapping Applications**

Presentation Abstracts

MAPPING HORIZONTAL SEA-LEVEL RISE USING VEGETATION COMMUNITIES IN THE COASTAL ZONE OF DELAWARE

Robert Coxe, DNREC Division of Fish and Wildlife

Vegetation communities are the plant expressions of habitats on the ground. Each of the species within a given area prefers specific habitat conditions and as a result can reflect changes hydrology and/or salinity. By mapping change over time, trends and rates of change can be determined. Vegetation communities in the Delaware Coastal zone were interpreted and mapped using aerial imagery from 1937, 1954, 1997, 2002, and 2007. Communities from each map produced were then compared as to acreage, location, and change from 1937 to 2002, 1954 to 2002, or 1997 to 2002 and to 2007 depending on historical image quality. Field observations were made to ground truth the more recent imagery and changes. Using the above comparisons it has been found that North Atlantic High Salt Marsh is declining at a rapid rate, with average losses of 6.0 acres (2.4 ha) /year at Assawoman Wildlife Area, 2 acres (0.8 ha)/year at Milford Neck Wildlife Area, little more than 1 acre (0.4 ha)/year at Ted Harvey Wildlife Area, and 2.5 acres (1.0 ha)/year at Cape Henelopen State Park. Little Creek Wildlife Area is the lone exception gaining on average about 4 acres (1.6 ha)/year likely due to Phragmites removal efforts. Average land loss due to water inundation varied with Assawoman Wildlife Area losing 2.8 acres (1.1 ha)/year, Milford Neck Wildlife Area losing 1.2 acres (0.5 ha) /year, Ted Harvey Wildlife Area losing 1.0 acres (0.4 ha)/year, and Little Creek Wildlife Area losing 3.4 acres (1.4 ha)/year. **Session III Mapping Applications**

SALT MARSH CREATION/RESTORATION FOR THE INDIAN RIVER BRIDGE PROJECT

Ken Dunne, Delaware Department of Transportation and Justin T. Reel, RK&K Consulting Engineers

The Indian River Bridge required the creation/restoration of salt marsh as compensation for wetland loss. The north site is now more than five years old. During the process, the design focused on replicating the elevations and hydrology of an existing neighboring marsh. This reference marsh was extensively surveyed as to elevation with those elevations tied to the structure and architecture of the reference marsh. These elevations were then tied to NGVD. A tide gauge was then placed and tied to NGVD. The data was analyzed to determine inundation times per 24-hours in 0.05 foot intervals. The data indicated that the marsh plain of the reference marsh was very flat with an inundation time that was decidedly short (4-6 hrs/day) in comparison to the physiological tolerance of Spartina alterniflora. This suggests the reference marsh is strongly accreting sediment. Further south, there is a second mitigation site. This site is much further from the inlet and the tidal inundation patterns are distinctly irregular with massive seasonal changes depending on the direction of the prevailing winds. Yearly differences in the inundation patterns at the southern site are pronounced. Spartina alterniflora growth at the southern site is limited to elevations much lower when compared to the northern site. **Session I Restoration**

ADAPTIVE MANAGEMENT TECHNIQUES FOR WETLAND RESTORATION MAINTENANCE AND MONITORING

Katie Eberhart, URS Corporation

Maintenance and monitoring activities have been conducted at two restored wetlands in Newport, Delaware for nearly 15 years. Within five years following remediation, both wetlands achieved restoration success metrics for backfill stability, vegetation coverage, and invasive plant species coverage. The monitoring has demonstrated that approximately nine acres of restored tidal and non-tidal wetlands support diverse plant communities and levels of ecological function and societal value well beyond preremediation conditions.

Ongoing maintenance and monitoring activities are now focused on an adaptive invasive species management program to ensure the long-term success of the restoration. Implemented in the early 2000s, the program aims at controlling the extent of common reed (Phragmites australis) and purple loosestrife (Lythrum salicaria) in the restored wetlands. Continuation of an adaptive management approach allows for making management decisions specific to each of these species on an as-needed basis. While Phragmites is managed using herbicide treatments, a voluntary biological control program using Galerucella sp. beetles was implemented for purple loosestrife. Based on long-term monitoring data, this program has achieved significant progress towards establishing a self-sustaining beetle population that will lead to biological control of purple loosestrife.

Session IV Monitoring and Assessment

Presentation Abstracts

INITIATION OF INTENSIVE LONG-TERM WETLAND MONITORING IN THE DELAWARE ESTUARY

Tracy Elsey-Quirk 1, David Velinsky1, Danielle Kreeger2, Martha Maxwell-Doyle3, and Angela Padaletti2
1Academy of Natural Sciences, 2Partnership for Delaware Estuary, 3Barnegat Bay National Estuary Program

Climate change, sea-level rise, and coastal development are only a few of the factors affecting tidal wetlands. How wetlands will change in area, composition, and function over time in response to the interactive influences of these factors is relatively unknown. A scarcity of long-term wetland monitoring data limits our ability to assess changes over time and predict future adaptation or loss of area and function. To assess physical, chemical, and biological changes over time, we have established six wetland monitoring stations in the Delaware Estuary. Beginning in 2010, changes in surface elevation, elevation relative to sea level, soil and water chemistry, surface chl a, plant biomass, plant communities are being monitored at each of the fixed stations. The network of monitoring sites includes tidal freshwater, brackish, and salt water wetlands. While initial data reveal apparent site differences, long-term data are expected to result in a better understanding of the interacting effects of factors such as elevation, sedimentation, and nutrients on wetland change over time.
Session IV Monitoring and Assessment

REGULATING WETLANDS AND WATERWAYS

Scott Figurski, DNREC Division of Water

This presentation will include a brief overview of the Wetlands and Subaqueous Lands Section. I will start by covering our two areas of jurisdiction which are subaqueous lands, tidal wetlands and non-tidal wetlands of 400 or more contiguous acres. I will give some examples of subaqueous lands and show what a State-regulated wetland map looks like as well as a 2007 aerial photo with the lines of the same map overlaid on it. I will cover activities which require a permit and those that are exempt which will lead me into talking about violations and what happens when someone performs work without a permit and I will elaborate on the circumstances surrounding the Blackbird Creek –Parsons violation.
Session II Coastal Management

COASTAL WETLAND RESTORATION – DEFINING YOUR PROJECT TO MAXIMIZE ECOLOGICAL BENEFITS, BE SUSTAINABLE, AND FINANCIALLY FEASIBLE.

Douglas Janiec, Cardno Entrix, New Castle, DE

Today's green coastal projects, such as estuary restoration, living shorelines, dune/beach systems, or shoreline stabilization, need to consider new technologies and natural processes that simply were not on the radar screen as little as five to 10 years ago. These new technologies and natural processes present both challenges and opportunities for the coastal planner, designer, and regulator. Coupled with the fact that funding for coastal projects has become harder to come by and it is under greater scrutiny, there is a necessity that funds be applied to projects that maximize the ecological benefits to the greatest extent possible, and in a manner that is defensible, economical, and has general public support. The purpose of this talk is to outline a thought process and associated considerations that provides a logical and efficient pathway towards defining a green coastal project in terms of maxim benefits and goals. Topics such as SLR, high vs. low energy systems, partnering, new technology, sustainability goals, funding, and agency support will be discussed. The goal of the presentation is to stimulate participants to think beyond the immediate issue(s) that is generating the project; to identify solutions that not only meet the immediate needs but also go beyond by benefiting other ecological functions/system needs as well. **Session I Restoration**

Presentation Abstracts

IMPLEMENTING THE NANTICOKE RIVER WATERSHED RESTORATION PLAN: STATUS UPDATE USFWS

Brian Jennings, USFWS Wetland Reserve Program

In 2009 the Nanticoke Restoration Work Group comprised of state, federal, and local government representatives as well as non-government organizations developed the Nanticoke River Watershed Restoration Plan (Restoration Plan). The Delaware Department of Natural Resources (DNREC) Watershed Stewardship Section took the lead to implement the restoration plan by conducting outreach to private landowners, ground-truthing the GIS model, and providing funds to implement restoration projects. Two mailings to private landowners with follow up phone calls have been conducted, one by the Delaware Division of Fish and Wildlife and the other by Ducks Unlimited. The Natural Resources Conservation Service (NRCS) took the lead on most of the projects generated from the mailings and phone calls. The Plan also identified restoration projects on public lands including. Public lands have many opportunities, but funds are limited because managers have other goals and objectives beside wetland and riparian restoration projects. Currently most of the restorations funds have been spent on projects in Redden State Forest, because unlike other public areas the majority of Redden State Forest is in the head waters of the Nanticoke River where most of the wetland degradation has occurred. Projects have focused on flood plain reconnection, and forested wetland restoration. Currently there are many proposed projects in Redden State Forest and a few in State Wildlife Areas. We are working on a stream channel restoration in the Nanticoke tax ditch to improve aquatic habitat, reduce maintenance, and increase storage capacity. **Session I Restoration**

THE IMPORTANCE OF MANAGED WETLANDS TO WILDLIFE

Kevin Kalasz, DNREC Division of Fish and Wildlife

Coastal impoundments provide important breeding, migration, and wintering habitat for a variety of birds. They serve as nurseries for fish and help to control mosquitoes. In addition, they provide important consumptive and non-consumptive recreational opportunities. Balancing all of these objectives in a single impoundment is impossible. However, by managing a number of impoundments in concert as a complex provides greater flexibility in meeting several, often competing objectives. In addition, because they are managed wetlands where water levels can be manipulated and are also relatively protected from storms, impoundments can serve as habitat refuge in the face of climate change. Wetland loss, whether the wetlands are natural or managed, will have dramatic consequences on wildlife populations. Therefore, impoundment management needs to be conducted in the short term to maximize the services they perform annually but also in the long term to ensure they will be available for, and provide utility to sea level rise adaptation. An impoundment management plan that addresses the interconnectedness of impoundments and their surrounding habitats in an adaptive way and within the context of sea level rise will help to ensure wetland habitat is available over the long term. **Session II Coastal Management**

MID-ATLANTIC COASTAL WETLAND ASSESSMENT: MONITORING WETLANDS THROUGH RAPID AND INTENSIVE METHODS

Angela Padeletti1, Danielle Kreeger1, Andrew Howard2, Alison Rogerson2, Tracy Elsey-Quirk3, and Martha Maxwell-Doyle4
1Partnership for the Delaware Estuary, 2Delaware DNREC, 3Academy of Natural Sciences, 4Barnegat Bay National Estuary Program

The Mid-Atlantic Coastal Wetlands Assessment (MACWA) was developed in the Delaware Estuary to track the health and status of the extensive tidal wetlands that provide critical ecosystem services. Efforts to regulate and preserve coastal wetlands in the Mid-Atlantic are currently hampered by a lack of high resolution assessment, mapping, and monitoring. Since 2010, the Partnership has been working closely with state agencies such as DNREC, and partners such as Academy of Natural Sciences, the Center for Inland Bays and Barnegat Bay Partnership to implement MACWA. The program combines landscape census data, rapid assessment data, scientific studies and intensive monitoring at fixed locations to produce an integrated picture of spatial and temporal changes in wetland acreage, condition, and function. For example, rapid assessment methods are being used to assess wetland condition across representative sub-watersheds in the region. The approach relies on the Mid-Atlantic Tidal Rapid Assessment Method, first established by the state of Delaware. Results from the Christina wetlands assessment in 2011, both tidal and non-tidal will be discussed. Another MACWA effort consists of monitoring at fixed stations established within coastal wetlands (see talk by Quirk). MACWA is expected to improve our understanding of the status and trends of coastal wetlands and the effects on water quality, coastal flood protection, and other ecosystem services. Coastal resource managers will thereby have better information to plan for increased rates of sea level rise, enact better management practices, implement more strategically located restoration projects, and assist in regulatory decision-making for the region. **Session IV Monitoring and Assessment**

Presentation Abstracts

COMPARING WETLAND FUNCTION ESTIMATES FROM LANDSCAPE LEVEL ANALYSIS TO INTENSE FIELD ASSESSMENTS

Alison Rogerson, Mark Biddle, Andy Howard, Rebecca Rothweiler, DNREC Division of Watershed Stewardship

We compared onsite wetland function scores to landscape functional estimates to gauge how well abiotic wetland classifications (LLWW) can predict wetland functions.

We compiled Level 3 field-based function scores for four wetland functions (Hydrology, Biogeochemistry, Plant Community and Habitat) from flat and riverine wetlands in Delaware. Field-based function scores were derived from wetland assessment variables that consider ecological quality and adjacent land use impacts. Delaware has been using field assessment methods for 10+ years to measure wetland condition and function. On the ground data from field visits are valuable but are labor, time and therefore cost intensive.

Level 1 Landscape analysis can also be used to estimate wetland function based on wetland type. Landscape functional analysis involves GIS evaluation and can cover a much larger area with no upfront field work. The USFWS's National Wetland Inventory recently completed the 2007 Delaware State Wetland Mapping Project which included a landscape functional estimate for 11 wetland functions. The NWI Plus process adds abiotic properties for Landscape position, Landform, water flow path and water body type (LLWW) to a wetland layer. It focuses on the potential of wetlands to perform functions based on classifications and function correlation developed for the northeast (Tiner 2003). Landscape level function estimates can be a valuable tool for evaluating future wetland impacts or areas for protection, especially when validated with onsite field data.

Session IV Monitoring and Assessment

WETLAND MANAGEMENT ALONG A CHANGING COAST: A MANAGER'S DILEMMA

Michael Stroeh, USFWS Coastal Delaware Refuge Complex

The challenges associated with coastal wetland management in a changing climate are most evident at Prime Hook National Wildlife Refuge. Recent breaches along the shoreline have had a dramatic impact on the refuge's impoundments, which had been managed as freshwater wetlands for decades. Although impoundment management successfully achieved refuge waterfowl habitat objectives, years of wetland alterations prior to refuge establishment, and subsequent impoundment management, left the refuge's coastal wetlands vulnerable to negative impacts from the rapid reintroduction of salt water. Future management of the refuge's coastal wetlands is currently being determined through a Comprehensive Conservation Planning process, which includes consideration of three alternatives; re-establishing freshwater impoundments, proactively restoring salt marsh, or passively permitting the area to respond naturally. Extensive data collected in partnership with DNREC provides the basis for evaluating the alternatives and formulating potential restoration strategies. **Session II Coastal Management**

THE DELAWARE ESTUARY LIVING SHORELINE INITIATIVE (DELSI): FIELD RECONNAISSANCE AND LIVING SHORELINE CONCEPTUAL PLANNING

Laura Whalen1, Danielle Kreeger1, Sari Rothrock1, David Bushek2, Joshua Moody2
1Partnership for the Delaware Estuary, 2Haskin Shellfish Research Laboratory, Rutgers University

Sea level rise presents numerous challenges for preserving critical habitats and protecting communities along the Delaware Bayshore. Chief among this is the potential loss of tidal wetlands. Adaptation to sea level rise includes "horizontal" and "vertical" measures to facilitate the landward succession of natural habitats that elevate or protect vulnerable structures, communities, or habitats. Protection and elevation options are diverse and include "hard" tactics such as building seawalls, bulkheads, dikes, and tidal control systems, as well as filling lands. However, hard structures typically degrade wetlands and stream banks and the ecological goods and services they provide. "Soft" tactics such as living shorelines are an alternative that promotes natural habitats which can provide similar protection or elevation without degrading ecosystem goods and services.

The Partnership for the Delaware Estuary (PDE) is working with several partners to assess where and how living shorelines might be installed throughout the Delaware Estuary to address issues associated with sea level rise and erosion. Findings will be presented from PDE's field reconnaissance of selected areas within Delaware. Field reconnaissance consisted of using an RTK-GPS for elevation, vegetation and substrate types at each point, as well as an assessment of erosion, slope, flora and fauna, and energy. These data were used to create contour maps of the shoreline that are now being used to produce conceptual plans for living shoreline demonstration projects. By spring 2012, PDE will have identified at least 1-2 locations where demonstration projects might be implemented to build awareness and to test tactics. **Session I Restoration**

Presentation Abstracts

EVALUATING THE EVOLUTION OF NATURAL TIDAL AND MANAGED WETLANDS IN DELAWARE

Bartholomew Wilson, DNREC Division of Soil and Water

To plan for the future, an understanding of the evolution of Delaware's wetlands over the last 100 years is required. DNREC and USFWS are currently supporting research to quantify marsh accretion, marsh elevation, and organic/inorganic mass accumulation rates within coastal impoundments and in adjacent natural marsh. The information gathered in these projects will be paramount in developing proper management for the sustainability of these wetlands. The integration of radionuclide analyses, RTK and RTN surveying, SET analysis, accretion marker layers, and the determination of the preferred growth range for Spartina alterniflora is being used to determine the evolutionary trends in the managed and reference tidal wetlands. Integrating the elevation of the marsh platforms to a common datum, and the elevations relative to MHW and MLW at each site has yielded interesting correlations to below ground biomass production in short form Spartina alterniflora. Trends revealed in the current and historic organic and inorganic sedimentation accretion rates of these marshes will further the understanding of the processes and the potential sediment fluxes This information and the spatial variability in inorganic accretion can be used to estimate the long-term viability of wetland's and to prioritize restoration efforts. With this knowledge management strategies can be modified to ensure long-term survivability. **Session II Coastal Management**

APPLICATIONS OF MULTI-ALTITUDE AERIAL PLATFORM AS WETLAND OBSERVING SYSTEM

Young-Heon Jo1, Matthew Shatley1, Andrew Homsey1, Richard Field1, Kurt Philipp2
1University of Delaware, 2Wetland Research Services

Satellite remote sensing is a powerful and cost-efficient monitoring tool for environmental changes that College of Earth, Ocean and Environment (CEOE), UD is capable to provide from eight different satellites. However, satellite observations have limitations by their resolutions and different weather conditions. Some environmental processes in the wetlands require high spatial (less than meters) and temporal (less than a few hours) resolutions that satellite remote sensing cannot provide at the same time. Alternative monitoring system has been developed using a Helikite (Helium balloon + Kite). This system has two advantages over other remote sensing observation systems. The imagery can be obtained either/both at fixed location And/or along a towed path by a car or a boat, so that one can monitor the sites as long as needed at a fixed place and can survey large areas by making mosaics of the imagery. The imagery of this new monitoring platform, which is comparable to that of high resolution satellite and aircraft photography, can be obtained on demand at much lower cost and with much shorter planning lead time.

We will present four different field experiments with Helikite Aerial Platform (HAP): Indian River inlet, a tidal flat at S. Korea, a bay near Chesapeake Biological Lab (CBL), and UD Agriculture farm. The optical measurements reveal the bottom bathymetry, submerged vegetation, school of fish, surface waves, plumes, etc. Since HAP system can satisfy key requirements to monitor environmental changes in Anytime, Anywhere and Any resolutions (AAA), its applications to monitor wetlands will be also discussed. **Session III Mapping Applications**

Presentation Abstracts

PANEL: WETLAND AND COASTAL IMPOUNDMENT MANAGEMENT, TIME FOR CHANGE

Moderator: Bob Scarborough, DNERR Research Coordinator, DNREC Delaware Coastal Programs
Panel Members: Michael Stroeh, USFWS Coastal Delaware Refuge Complex Manager
Susan Guiteras, USFWS Supervisory Wildlife Biologist
Bart Wilson, DNREC Delaware Coastal Program
Kevin Kalasz, DNREC Natural Heritage Program
Greg Moore, DNREC Wildlife Section Administrator

Sea level rise, climate change, erosion and time have brought publicly owned wetlands managed for wildlife habitat to a critical tipping point. Of particular concern are coastal impoundments, which fill a critical void in the distribution of wetland habitats along the Delaware Bay. These ponded, tidal freshwater and brackish wetlands were created to provide habitat for waterfowl and shorebirds; however, management practices did not consider sea level rise and other natural processes. The United States Fish and Wildlife Service, and the Delaware Division of Fish and Wildlife are currently examining the consequences of these changes and planning for the future. Effectively dealing with this potential loss of coastal impoundments and wetlands may require drastic changes in management policies.

This session will examine the land and wildlife management issues of these publicly owned lands in Delaware; the plans to provide suitable habitat for waterfowl, migratory birds and other wildlife by Federal and State agencies, and ongoing research to provide the needed information to these land managers. After the presentation, there will be a panel discussion with the speakers and other representatives from the USFWS and DNREC to answer questions from the audience.

Poster Abstracts

EXAMINING WASTEWATER DISCHARGE IN THE LEWES-REHOBOTH TIDAL CANAL: A CASE STUDY ON HEAVY METAL CONTAMINANTS

Amy Cannon and Dr. Gulnihal Ozbay, Department of Agriculture and Natural Resources, Delaware State University

Delaware's Inland Bays have experienced the impacts of chronic eutrophication and sediment erosion resulting from several decades of development and nutrient input from the surrounding watershed. The cumulative effect of these processes along with over fishing and disease outbreaks has degraded water quality and reduced the diversity and abundance of submerged aquatic vegetation (SAV), fishes, and invertebrates, especially shellfish. To that end, a point source was chosen next to the Delaware Inland Bays to observe and record the state of the waterway's well-being. Samples are collected using EPA Method 1669 protocols. Physical and chemical water quality parameters measured using YSI instruments and protocols in the field and in the lab. Heavy metals measured are cadmium, mercury and arsenic (III) using a PDV 6000 plus. Considering the adverse health effects of metals on humans in drinking water, monitoring heavy metals in this setting offers insight to potential threats as well as solutions. One location is directly at the mouth of treatment plant discharge, one location is where discharge meets brackish water in the tidal canal. Two locations, one each approximately 65 meters on either side of the discharge point. One final control location is approximately 650 meters away from the discharge location. Results are being continuously collected; therefore conclusive data is not yet available until the study is complete. Data is being examined to see if a direct relationship exists between levels of heavy metals and proximity to the point source. So far the results from the preliminary data show no effects of the wastewater discharge in cadmium, mercury and arsenic concentrations.

IMPLEMENTATION OF COMPREHENSIVE STORMWATER MANAGEMENT PLANNING (CSWMP) & GREEN TECHNOLOGY BEST MANAGEMENT PRACTICES (GTBMPS) FOR NEW CASTLE COUNTY (NCC) MUNICIPAL SEPARATE STORMWATER SEWER SYSTEM (S) (MS4)

Todd Fritchman, Envirotech Environmental Consulting Inc.

In March of 2007, The State of Delaware's New Castle County Department of Special Services (NCCDSS) requested service relative to the county's Stormwater Pollution Prevention Plan (SWPP). Comprehensive SWM and GTBMPs design criteria required to maintain and enhance the structural, functional, and ecological integrity of SWM systems (SWMSs) were provided. The first phase of the process included in-field assessments of SWMSs. The second phase included an interpretation of the Management Units (MUs) and implementation procedures. The third phase was to conduct a needs assessment on four (4) design-built retrofit SWMSs. CSWMP manuals were created for each of the four (4) SWMSs. The fourth phase included "in-the-field" training exercises detailing maintenance and management GTBMP procedures. The fifth phase was to create a cost(s) analysis for a continued maintenance and management program for sixty-two remaining NCC SWMSs. The final stage was to design a "Service Provider Request for Proposals Qualifications Statement". The CSWMP and GTBMPs resulted in structurally, functionally, and environmentally sound SWMSs. NCCDSS now possesses an understanding of the regulatory policy, educational criteria, service provider qualifications, and capital required for the continued maintenance of SWMSs. The acquired qualitative and quantitative information may be applied to all components of the county-owned MS4s.

Poster Abstracts

IMPLEMENTATION OF LOW IMPACT DEVELOPMENT (LID) SYSTEMS: THE USE OF FILTREXX® FILTERCELL™TECHNOLOGY FOR NUTRIENT MANAGEMENT

Todd A. Fritchman, Envirotech Environmental Consulting, Inc.,

The Filtrexx FilterCell™ filtration system is a temporary or permanent water or stormwater filtration system used to remove sediment and/or soluble pollutants. This portable Land Improvement System (LIS) uses organic FilterMedia™ and native vegetation to remove pollutants from water and stormwater before it is discharged into collection ponds, wetlands, infiltration basins, fields, or receiving waters. This innovative filtration system utilizes a mesh-like "sock" and an all-organic fill material in conjunction with native vegetation and proprietary flocculants to filter point and non-point runoff sources. Flocculants are prescribed on a site-specific basis to remove target pollutants from contaminated water and stormwater flows. Filtrexx® FilterCell™ technology used in conjunction with proprietary flocculants, have demonstrated the following pollutant removal levels:

Target Pollutant	Percent (%) Removal
Petroleum Products	99%
Bacteria	99%
Phosphorous	92%
Nitrogen	25-33%
Heavy Metals	47-73%

The FilterCell™ technology can be utilized in temporary applications during land disturbing/construction activities or for permanent applications where native vegetation can be established to create a permanent organic vegetative filter designed into the existing landscape. Typical applications include sediment and soluble pollutant control of stormwater and agricultural runoff. In addition, vegetated FilterCells™ reduce runoff velocity and pollutant levels flowing into surface waters, therefore decreasing soil erosion and increasing pollutant removal through trapping, sediment deposition, and biological plant uptake.

INVESTIGATING RELATIONSHIP BETWEEN ENVIRONMENTAL PARAMETERS AND TOTAL BACTERIA AND VIBRIONACEA POPULATION IN THE LEWES-REHOBOTH CANAL, DELAWARE

Kenneth Hannum and Dr. Gulnihal Ozbay, Department of Agriculture and Natural Resources, Delaware State University

Delaware's coastal lagoons, known locally as "Inland Bays," have been experiencing the impacts of sustained nutrient input and sediment erosion resulting from several decades of development within the watershed. The cumulative impact of these anthropogenic effluents has degraded water quality and reduced the diversity and abundance of various species of fishes, invertebrates, and submerged aquatic vegetation. As Delaware's coastal landscape continues to develop in a low-density and sprawling manner, the health of valuable natural resources, many of which sustain local economies, is increasingly at risk. Managing the demands for protecting critical habitat areas and managing water resources are a complex and continuously changing challenge in Delaware. Our primary objective is to assess the aquatic health of the Inland Bays through bacterial and water quality testing at a point source in this study. We have been investigating relationship between environmental parameters with total bacteria and Vibrio population in water and eastern oysters (Crassostrea virginica) in the Lewes-Rehoboth Canal, Delaware. Oysters were placed in enclosed trays and submerged in the canal at four study sites. Physical and chemical water quality parameters were measured at all sites, three of which are proximate to a municipal waste water treatment plant discharge, and one control site away from the discharge. Vibrio was detected in canal water and in oysters via the COPP assay, which identifies bacterial colonies that exhibit strong peptidase activity such as Vibrio. Vibrio counts in the canal water were highest during August and September, while total bacteria counts were high virtually throughout the study period.

Poster Abstracts

DELAWARE'S WETLAND FIREFLIES IN THE GENUS PHOTURIS (COLEOPTERA: LAMPYRIDAE)

Christopher M. Heckscher, Department of Agriculture and Natural Resources, Delaware State University

Although fireflies have captured the imagination of children and adults alike for centuries, surprisingly little is known about the habitat associations of most species. Eleven species of fireflies in the genus Photuris have been reported from Delaware. Recent research in Delaware has revealed that eight of these species are dependent on wetlands (both tidal and non-tidal) and some are associated with specific wetland ecosystem types. Seven of the eight wetland species are considered uncommon or rare including five that are considered state imperiled: Photuris bethaniensis, P. cinctipennis, P. BBB, P. SPH and P. salina. Some species can be identified by their distinctive flash patterns and their presence or absence at certain wetland sites could be considered by managers and conservationists as a partial indicator of the ecological integrity of local wetlands.

HYDROMORPHOLOGY OF EASTERN SHORE MARYLAND COASTAL GRID DITCHED MARSHES

Dot Lundberg, University of Maryland

Ditch plugging is a low-impact method of restoring marshes but its effects on hydrological regime and ecosystem services has not been widely determined. Main goals of the project are to determine the sustainability of ditched sites versus unditched sites, and assess hydrological and ecological responses to ditch-plugging. Six marshes within Somerset and Worcester County will be used consisting of pre-post plugging, control, and reference sites. All sites will be monitored for four years (two years prior and two years after restoration at restored sites). Hydrological, meteorological, and ecological properties such as ditch intensity, water quality, water table fluctuations, salinity, vegetation, wind, precipitation, evapotranspiration, and mosquito composition will be assessed.

DELAWARE OYSTERS: POTENTIAL TO PURIFY, PROVIDE AND PROTECT

Brian Reckenbeil and Dr. Gulnihal Ozbay, Delaware State University

Oyster reefs are often cherished for the many ecosystem services they provide. Of these, the most notable are the oysters' ability to purify and filter water, provide habitat for a variety of organisms, and protect and stabilize shorelines from erosive forces. However, in recent times, oyster populations have dramatically declined, and naturally growing oysters are rarely found in the Delaware Inland Bays (DIB). To promote the proliferation of oysters, Crassostrea virginica, in the DIB, The Delaware Oyster Gardening program was started in 2003 by the Center for the Inland Bays. Volunteer citizens, also known as oyster gardeners, raise oysters for 2 years in floating aquaculture gear called "Taylor floats" until the oysters are large enough to be planted in the bay. Beginning in June 2010, 5 of these sites were selected to monitor the growth and survival of oysters to identify ideal gardening locations. Each float started with approximately 120-125 living oysters from cohort 2009. Oyster survival looked promising from June to October of 2010, ranging from 100% survival to 74% across the five months. A large die-off was apparent from July to September 2011, just after these oysters reached two years of age. It appears that oysters survive well within the waters of the DIB in floating aquaculture gear, particularly in Lighthouse Cove, Fenwick Island. Natural recruitment of oysters was observed on oysters in floats as well as on nearby riprap, which may be a promising sign that oysters in the gardening program are reproducing within the DIB.

Poster Abstracts

DELAWARE ESTUARY LIVING SHORELINES INITIATIVE: WHY YOU SHOULD CARE (AND HOW TO GET INVOLVED)

Sari Rothrock, Partnership for the Delaware Estuary

Delaware's coast faces extreme erosion due to sea level rise and storm surge. Beaches and coastal communities are at risk. Tidal wetlands are disappearing at an alarming rate. Living shorelines (LS), a method of shoreline stabilization, helps vulnerable wetlands to survive while simultaneously enhancing a site's ecological function. Typically, LS are constructed with natural materials, including live plants and animals. In some places, LS can prevent erosion as well as bulkheads, but at comparable or lower costs. The Delaware Estuary LS Initiative seeks to develop a better understanding of the costs and benefits of LS, identify and overcome barriers to implementation, match tactics with local issues, and install projects to stem losses of coastal wetlands.

The PDE is working with several partners to launch this initiative. First, staff is conducting GIS analyses of the Delaware Estuary coast to identify eroding locations that would benefit from LS. Second, workshops are being held to introduce LS concepts to regulatory agencies, as well as nonprofits and corporations that work on restoration projects. Third, workshops are being held for coastal communities to familiarize leaders and officials with LS options, and for workshop organizers to learn about local erosion issues that might benefit from LS projects. Thanks to funding and support from DNREC, the PDE has initiated work in the state of Delaware. Work in New Jersey and Pennsylvania will soon follow. Drawing on lessons from LS installations in New Jersey, PDE will strive to secure funding to implement comparable projects in Delaware.

MARSH CHANGE ANALYSIS IN DELAWARE'S INLAND BAYS, 1937 TO 2007

Kelly Somers, Andrew Homsey, Richard Field, Jo, Young-Heon, Kurt Philipp, Vic Klemas, and Chris Bason

The University of Delaware's College of Earth, Ocean and Environment, in conjunction with the Delaware Center for the Inland Bays, embarked on a project to quantify present and historical marsh changes in the Delaware Coastal Bays. The study area includes Rehoboth Bay, Indian River Bay and Little Assawoman Bay. The three year project focuses on estuarine marshes and contiguous non-tidal wetlands within a three hundred meter buffer around the study area. The project was designed to examine four time series in the Coastal Bays: 1937, 1968, 1992 and 2007 to determine marsh changes. The first phase of the project looked at 1992 and 2007 State Wetland Mapping Data and NWI to categorize marsh type and determine changes between these two years. Also, physical characterization of marsh areas with fragmented pooling and locations of hardened wetland/upland boundary were delineated and quantified for both years. Changes in the nature of the marsh platform and of the degree of shoreline hardening can thus be determined. We have embarked on the next phase of the project, using aerial photography from the earlier two epochs (1937 and 1968) to determine marsh characteristic changes (vegetation, marsh integrity and type, shoreline transgressions, wetland loss/gain, etc.) across a broad time frame. An important step is the vectorizing of 1972 State Wetland Maps (produced by Frank Daiber, see Daiber, et al. and Klemas, et al.) to guide wetland classification. Phase two will also map and quantify hardened surfaces and fragmented pooling in the earlier time series (1937 and 1968).

Poster Presentations

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Implementation of Low Impact Development (LID) Systems: The Use of Filtrexx® FilterCell™Technology for Nutrient Management
Todd Fritchman, Envirotech

Delaware's Wetland Fireflies in the Genus Photuris (Coleoptera: Lampyridae)
Christopher Heckscher, Delaware State University

Hydromorphology of Eastern Shore Maryland Coastal Grid Ditched Marshes
Dot Lundberg, University of Maryland

Marsh Change Analysis in Delaware's Inland Bays, 1937 to 2007
Kelly Somers and Andrew Homsey, University of Delaware

Implementation of Comprehensive Stormwater Management Planning (CSWMP) & Green Technology Best Management Practices (GTBMPs) for New Castle County (NCC) Municipal Separate Stormwater Sewer System (s) (MS4).
Todd Fritchman, Envirotech

Investigating Relationship Between Environmental Parameters and Total Bacteria and Vibrionacea Population in the Lewes-Rehoboth Canal, Delaware
Kenneth Hannum, Delaware State University

Examining Wastewater Discharge in the Lewes-Rehoboth Tidal Canal: A case study on heavy metal contaminants
Amy Cannon, Delaware State University

Delaware Oysters: Potential to Purify, Provide and Protect
Brian Reckenbeil, Delaware State University

Delaware Estuary Living Shorelines Initiative: Why You Should Care (and how to get involved)
Sari Rothrock, Partnership for the Delaware Estuary

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Chesapeake Bay Nutria Project (USDA) **www.fws.gov/chesapeakenutriaproject/FAQs.html**

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