NEW JERSEY FLOWS

New Jersey Water Resources Research Institute

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Features

The 2nd Passaic River Symposium was organized by the **Hudson- Delaware Chapter of SETAC & The Passaic River Institute at Montclair University**

SECOND PASSAIC RIVER SYMPOSIUM DRAWS 300 TO DISCUSS "PROGRESS AND CHALLENGES"

Kirk Barrett & Lisa Baron, symposium co-chairs

The environmental challenges facing the Passaic River basin and the progress that has been made in meeting them was the focus of the Second Passaic River Symposium. The Symposium, organized by Montclair State University's Passaic River Institute and the Hudson Delaware Chapter of the Society of Environmental Toxicology and Chemistry, attracted more than 300 people to the MSU campus on October 13, 2006. Abstracts and presentations are archived at http://pages.csam.montclair.edu/pri/symposium2006/.

An unprecedented panel of leaders of environmental agencies lead off the Second Passaic River Symposium. *From left to right*, Kirk Barrett, Director of Montclair State's Passaic River Institute & co-chair of the Symposium; Alan Steinberg, Region 2 Administrator of the U.S. Environmental Protection Agency; Lisa P.Jackson, Commissioner of the NJ Dept of Environmental Protection; Colonel Aniello Tortura, NY District Commander for the U.S. Army Corps of Engineers; Lisa Baron, NJ Dept of Transportation and HDC-SETAC co-chair of the Symposium; and Mark Stout, Asst. Commissioner, NJ Dept of Transportation

As co-chairs of the Symposium, we felt it was time to reconvene those interested and active in the basin to gauge what progress has been made in addressing problems in the basin since the first Passaic River Symposium in 2004, what new efforts have been launched, and what new challenges we face.

The symposium drew leading federal and state environmental officials, scientific experts and environmental advocates to discuss the river's current health and the status of cleanup efforts. It featured an unprecedented panel of agency leaders who gave their perspective of environmental strategies and efforts: Alan Steinberg, Region 2 Administrator of the U.S. Environmental Protection Agency; Lisa P. Jackson, Commissioner of the New Jersey Department of Environmental Protection; Colonel Aniello Tortora, New York District Commander for the U.S. Army Corps of Engineers; and Mark Stout, Assistant Commis-

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The Director's Chair Joan G. Ehrenfeld, Ph.D

This issue features reports from the recent Passaic River Symposium held at Montclair State University in October, 2006. The Passaic Basin holds more challenges - and opportunities – than virtually any other river in the US. These articles portray the scope of those challenges and opportunities, and illustrate the wide range of research needed to respond to both. We are pleased to be able to bring the Passaic River to a wide audience.

sioner representing the New Jersey Department of Transportation. US Congressman William Pascrell, Jr. also gave a compelling keynote address.

During the morning panel session, NJDEP Commissioner Jackson asserted strongly that the continued presence of the toxic chemical dioxin in sediments of the lower river is the overriding concern, and it should be removed as soon as possible. Alan Steinberg announced that one of his primary goals as Regional Administrator is to implement an early action during his tenure, but the solution must consider all contaminants of concern, all potentially responsible parties, and must be supported by the science. Later, Congressman Pascrell offered his opinion that litigation is not the solution and would further prolong any positive action within the River. Although the leadership provided different approaches and perspectives, their goals are similar and it remains clear that the agencies need to work together in order to further remediation and restoration in the Lower Passaic River's near and long-term.

During much of the day, the Symposium featured two concurrent tracks: the Lower Passaic River (below the Dundee Dam to the confluence with Newark Bay) and the upper Passaic watershed (above the Dam). The Lower Passaic River Restoration Project (LPRRP), a cooperative effort between six federal and state agencies (see www.ourpassaic.org), was highlighted in the Lower Passaic session. Presentations in this track discussed "Assessment of Contaminant Sources, Inventory and Transport", "Remediation Strategies" and "Comprehensive Restoration Planning". Highlights of this session were presentations from the LPRRP on the environmental dredging pilot completed in December 2005, ongoing decontamination studies, and the evaluation of early action alternatives (including dredging or capping contaminated sediments).

The second track examined projects and issues in the upper River and tributary watersheds. Presentations focused on issues such as water quality protection (particularly phosphorus and eutrophication), flooding, groundwater supply, stormwater management and nonpoint source pollution identification and control in the watershed above the Dundee Dam.

A session focused on issues in the larger NJ/NY Harbor and how the estuary is influenced by the Passaic River from contaminant transport and fish advisories followed. Twenty-four posters across a spectrum of topics were also presented through the day and into the evening reception.

The large turnout and the breadth of topics underscore the continued interest in and importance of the Passaic River basin, as well as the need for periodic, inter-organizational meetings where we can review the progress and the persistent challenges. One can expect a 3rd Passaic River Symposium in 2008 which will hopefully focus on the progress made over the next two years rather than the challenges.

Kirk Barrett (kirk.barrett@montclair.edu, 973-655-7117) is the director of the Passaic River Institute at Montclair State University. Lisa Baron (lisa.baron@dot.state.nj.us, 609-503-4779) is the Project Manager at the Office of Maritime Resources/NJDOT.

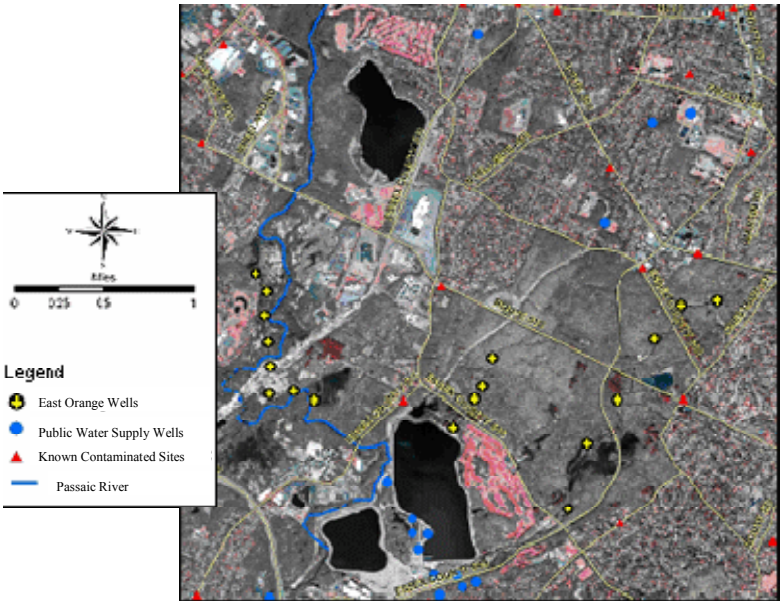
The East Orange Water Reserve – 100 Years of Wellhead Protection

Vincent W. Uhl

Since the early part of the 20th century, the City of East Orange, New Jersey has derived its water supply from a Water Reserve located approximately 7.5 miles west of the City along the Passaic River. Currently, four major wellfields within the water reserve produce approximately 10 million gallons per day (MGD). These four wellfields, the Braidburn, Dickinson, Canoe Brook and Slough Brook, have a total of 18 production wells in service. Twelve wells derive groundwater from a sequence of unconsolidated glacial outwash deposits referred to as the Buried Valley Aquifer System and six wells are completed in fractured bedrock comprised of sandstone, shale and basalt.

The Water Reserve comprises 2,300 acres of woodlands, wetlands, and the flood plains of Canoe Brook, Slough Brook and the Passaic River surrounded by populated suburban areas. It is essentially undeveloped, although a golf course, roads and rights-of-ways for utility lines lie within its confines. For nearly 100 years, the Water Reserve has served to:

- Protect the quality of the underlying aquifer systems by providing a buffer between the wellfields and the surrounding land uses (industrial, commercial and residential) that can impact groundwater quality.
- Maintain natural recharge capacity to the underlying aquifer systems and provide areas that can be used for artificial recharge.
- Provide access to existing wells for operation and maintenance and to new sites for replacement production wells



Well Field, East Orange, New Jersey

The first available water quality data for a well field within the Water Reserve were collected in 1905. Long-term chloride, total dissolved solids and hardness water quality data were evaluated to assess the impact of land use changes within the

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watersheds of the four well fields on groundwater quality. The 1950's and 1960s represented a period of rapid development in the area surrounding the water reserve. The chloride concentration in the water supply has increased six-fold since 1961. Total dissolved solids (TDS) concentration in the water supply has shown a steady rise over the past four decades and an increase in concentration of around 80 percent. Hardness of the water supply has also increased.

Twenty years of volatile organic compound (VOC) data were evaluated to access concentration trends and potential sources of very low VOC levels in certain wells in the Water Reserve. In the delivered water, only trace concentrations of trichloroethylene (TCE) and tetrachloroethylene (PCE) have been detected with any regularity. An analysis of VOC concentration since 1987 shows a decreasing trend for both PCE and TCE. Unlike many surrounding communities, and due to the beneficial effects of the Water Reserve, the City of East Orange has not had to treat its water for VOCs.

Vincent W. Uhl (Ph 609-397-9161; Fax 609-397-9165; vuhl@vuawater.com) of Uhl, Baron, Rana & Associates, Inc. (243 North Union Street; Lambertville, NJ 08530) was one of the many presenters at the symposium.

ANALYSIS OF ENVIRONMENTAL & ECONOMIC BENEFITS OF NATURAL FLOOD STORAGE AREAS IN THE PASSAIC RIVER

Sarah C. Watts, Josephine R. Axt, Ph.D., & Mark H. Burlas

As part of the United States Army Corps of Engineers (USACE), New York District's, Passaic River Flood Damage Reduction Project (Project), NEA conducted an analysis of the environmental and economic benefits of natural flood storage areas along the Passaic River in New Jersey. The purpose of the study was to identify and discuss the feasibility of using environmental and economic benefits to justify preserving natural flood storage areas along the Passaic River. The New Jersey Department of Environmental Protection is the non-Federal sponsor of the Passaic River Preservation of Natural Flood Storage Areas project and also is the regulatory agency responsible for wetlands in New Jersey.

The Project area has a history of flooding that dates back to the 1800s, and continued development in the watershed has increased the frequency and severity of flooding. Damage estimates from the 1990s estimated that annual damages attributed to flooding cost approximately $95 million. There is heavy development pressure in the Passaic River watershed, and if no action is taken to preserve natural flood storage areas, the USACE projects that approximately 346 acres would be lost to development by 2050. Water quality, water supply, and open space and recreation benefits would be lost with the conversion of wetlands to impervious or disturbed land uses.

Palustrine forested (PFO) wetland in the Canoe Brook Area, with red maple (Acer rubrum), red oak (Quercus rubra), green ash (Fraxinus pennsylvanica), and patches of shrubs such as buttonbush (Cephalanthus occidentalis) and multiflora rose (Rosa multiflora).
[Photographer: S. Watts; October 1, 2003]

For this study, the USACE assessed marketable and non-marketable goods and services that are directly and indirectly associated with preservation of natural flood storage areas in the Passaic River watershed. Preservation of the natural flood storage areas in the Passaic River watershed would result in the protection of substantial environmental benefits at a relatively low cost. The average annual environmental benefits ranged from $3.7 million to $83 million (2004 dollars). The average annual cost was estimated at $784,105, with average annual costs based solely on the real estate costs of purchasing wetlands for preservation. The benefit-to-cost ratio therefore ranged between approximately 5:1 and 105:1. Data collected on the benefits of preserving the natural flood storage areas in the Passaic River Central Basin indicate that the benefits of preservation substantially outweigh the costs.

Study estimates for the number of lost acres of natural flood storage were based on actual land use conditions in 1990. Development in the region has continued since these initial calculations were made, with a resulting in increase in impervious surfaces in the region, so it is likely that flood hydrographs underestimate current flooding potential. Future development of the natural flood storage areas in the Passaic River watershed could produce long-term, irreversible changes to the watershed, and to the many goods and services currently provided by these wetlands.

Contact information:
Sarah C. Watts: Northern Ecological Associates, Inc., (NEA), 451 Presumpscot Street, Portland, ME 04103, Ph: (207) 879-9496, Fax: (207) 879-9481, Email: swatts@neamaine.com, Website: www.nea-enviro.com
Josephine R. Axt, Ph.D: NEA, 2 Avalon Place, Santa Fe, NM 87508, Ph: (505) 466-1890, Fax: (505) 466-1890, Email: jaxt.nea@comcast.net, Website: www.nea-enviro-com
Mark H. Burlas: US Army Corps of Engineers, New York District, 26 Federal Plaza, New York, NY, 10278, Ph: (917) 790-8704. Fax: (212) 264-6040, Email: mark.h.burlas@usace.army.mil, Website: www.nan.usace.army.mil

AN ENVIRONMENTAL HISTORY OF THE HARRISON REACH OF THE LOWER PASSAIC RIVER, 1666-2006.

Stephen G. Marshall, Esq. & Tammy A. Marshall, N.J. Meadowlands Commission

The two-mile stretch of the lower Passaic River between Point No Point and the Jackson Street Bridge is widely considered to be the most polluted section of one of the most polluted rivers in the United States. Although the lower Passaic River had been settled by colonists during the 1660s, most scholarly attention and scientific research has focused on the dumping of dioxin byproducts from the manufacture of DDT and Agent Orange during 1940-1970 and on subsequent clean-up efforts. Recent investigations have detailed the presence of extensive amounts of dioxin, polynuclear aromatic hydrocarbons (PAHs), and other organic and inorganic pollutants: http://www.ourpassaic.org/projectsites/premis_public/index.cfm?fuseaction=contaminants.

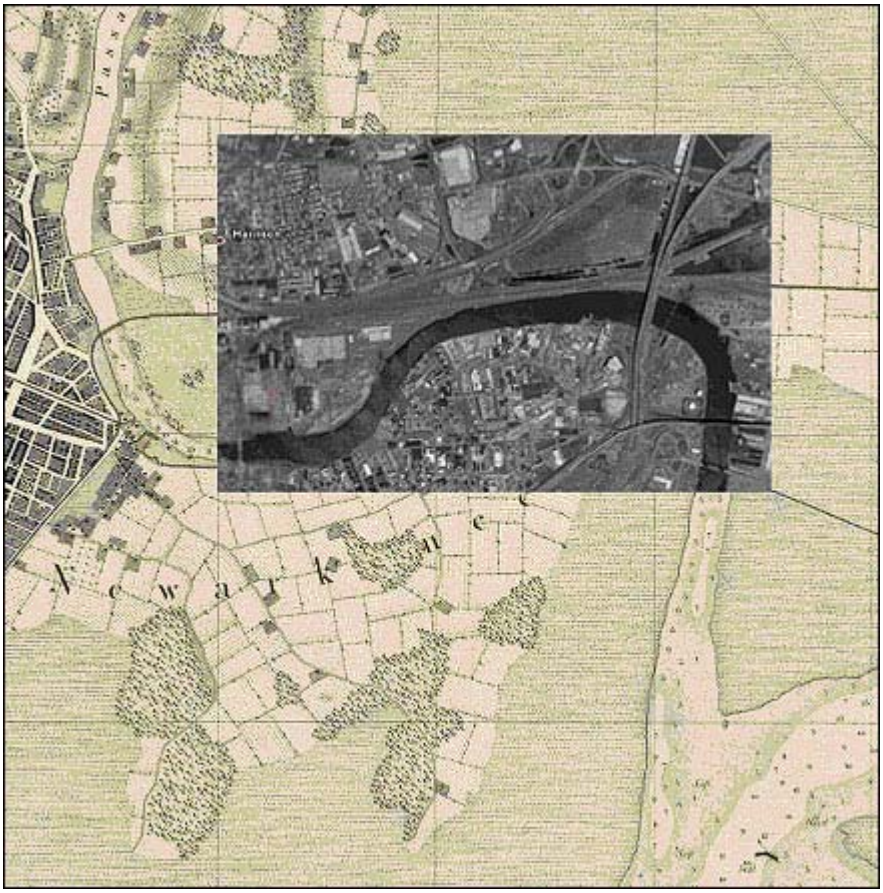

Illustration. 1844 Coastal Survey of Upper Newark Bay and Lower Passaic River, with overlay satellite image of contemporary Harrison Reach.

Understanding of the current condition of the lower Passaic River is enhanced by study of the large amount of historical materials dealing with the river's 340 years of recorded history, particularly nautical charts of New York Harbor published by the U.S. Coastal Survey. This series of uniform maps, produced over 1 1/2 centuries at 10-15 year intervals, provide valuable information about the morphological history of the lower Passaic River. They delineate the changing boundaries between upland, wetlands, and navigable tidal waters, as well as riverbank infrastructure. They are available online via the NOAA Office of Coast Survey's Historical Map & Chart Collection: http://nauticalcharts.noaa.gov/csdl/ctp/abstract.htm.

These may be supplemented with maps published by the N.J. Geological Survey, the City of Newark and other sources, as well as the wide range of historical documents and images stored at the Newark Public Library, the N.J. Historical Society, and the N.J. Meadowlands Commission.

Almost all of the Harrison Reach had been bordered by wide tidal wetlands which remained largely undeveloped for nearly two centuries after Newark's initial settlement. Development first took the form of construction of railroad tracks along the northern riverbank, and the Morris Canal on the south side of the river (though what is now Newark's Ironbound district), during the 1830s. Intensive siting of transportation facilities, including PATH and the New Jersey Turnpike, has characterized the northern riverbank to the present day.

For the initial two centuries after European settlement, most pollution of the Harrison Reach came from upriver sources, particularly human sewerage from the growing population of the Newark and industrial pollution from leather tanneries, factories and breweries. Substantial development of, and direct pollution into, the Harrison Reach began in the 1850s with the construction of animal bone-based fertilizer and chemical factories by English immigrants Alfred and Edwin Lister on the southern riverbank.

The U.S. Army Corps of Engineers began dredging the lower Passaic River in the 1870s, which encouraged further industrial development and pollution along the Reach and upriver. Subsequent construction of dams and reservoirs along the Pequannock River and other tributaries of the Upper Passaic diverted large amounts of fresh water and altered the salinity gradient of the Lower Passaic. Extensive portions of wetlands bordering the southern riverbank were filled in by the New Jersey Manufacturers Railroad during the early 1900s, for the specific purpose of creating new industrial sites. These were occupied by metal refineries and by factories which produced paint, varnish and other chemicals, as well as large amounts of waste containing organic pollutants and heavy metals which were dumped into the river.

During the late 1930s, MIT-trained chemical engineer Leon Kolker selected 80 Lister Avenue as the site of Kolker Chemical Works, which subsequently became one of the nation's largest producers of DDT and, under the name Diamond Alkali Corporation, of Agent Orange. The 1980 enactment of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, eventually led to: 1) detailed studies of the extent of pollution at the Harrison Reach; 2) preliminary attempts at remediation and restoration; and, 3) debates over liability for clean up costs.

This project was assisted by a grant from the NJ Historical Commission, a division of Cultural Affairs in the Department of State.

THE IMPACT OF THE MUNICIPAL STORMWATER REGULATIONS ON THE QUALITY OF THE PASSAIC RIVER

Tosin A. Sekoni & Bruce S. Friedman

Barely three (3) years into its adoption and implementation, the New Jersey Pollutant Discharge Elimination System (NJPDES), Municipal Stormwater Regulation Program (MSRP) is the most recent regulatory tool that will have a significant impact on minimizing the amount of pollutants from nonpoint sources entering the Passaic River. This regulatory program emerged as a result of the United States Environmental Protection Agency's Phase II stormwater rules published in 1999. The New Jersey Department of Environmental Protection (Department) developed this program and new rules to facilitate the implementation of the same. The program addresses pollutants flowing into the waters of the state from "municipal separate storm sewer systems" (MS4s) owned or operated by local, State, interstate or Federal government agencies. The Department's NJPDES stormwater rules were signed on January 5, 2004.

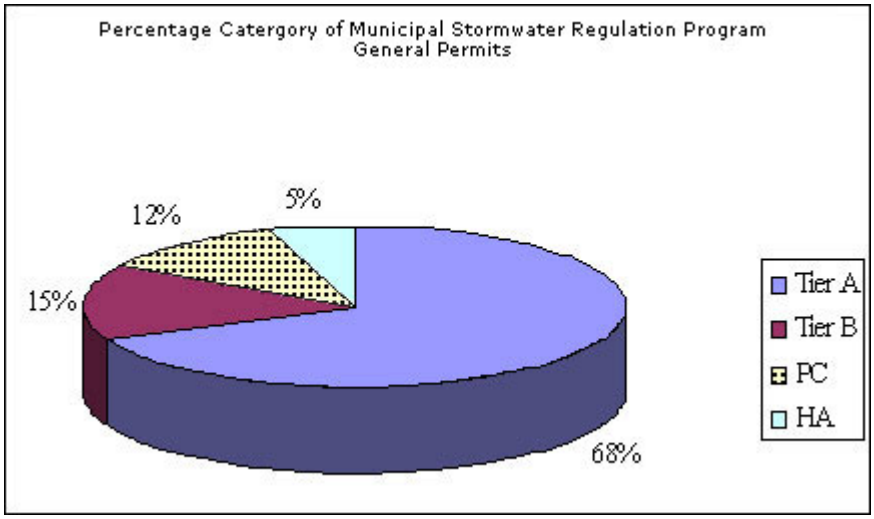

Chart I

The MSRP regulates five hundred and sixty (560) municipalities who are assigned into Tier A or Tier B categories, seventy-seven (77) public complexes and thirty-three (33) highway agencies. Above is a chart showing the percentage number of permittee in each category (see Chart I). NJPDES general permits were issued to each regulated entity. The permits established Statewide Basic Requirements (SBRs) designed to regulate the actions, practices and operations of the regulated municipalities as well as the residents, businesses, students, users and employees of the regulated entity. The SBRs address stormwater quality issues related to new development and redevelopment, and existing development through the implementation of certain Best Management Practices (BMPs). Permitees are required to develop a stormwater program, which includes the preparation of a written Stormwater Pollution Prevention Plan that describes the implementation of the mandated SBRs: Public Notice, Post-Construction Stormwater Management in New Development and Redevelopment, Local Public Education, Improper Disposal of Waste, Illicit Connection Elimination and MS4 Outfall Pipe Mapping, Solids and Floatable Controls, Maintenance Yard Operations and Employee Training.

Given the ecological structure, history and vulnerability of the Passaic River, current trends show a level of impairment by nutrients among other pollutants. As part of the municipal program, the regulated communities within the close proximity of the Passaic River are required to implement the SBRs incoporating several BMPs that will reduce and/or eliminate the amount of pollutants emanating from the MS4s to the Passaic River. Many of the SBRs to be implemented by municipalities directly address these impairments. In addition, the municipal permits contain a mechanism to require municipalities to implement Total Maximum Daily Loads (TMDLs) as they are developed to address specific impairments identified in the Passaic River.

Based on its geography, the Passaic River meanders through three (3) watershed management areas, five (5) counties and one hundred and eighteen (118) regulated municipalities. From the rivers headwaters at Osborn Lake, straddling Somerset and Morris Counties, until it reaches the Borough of Little Falls in Passaic Count, the Passaic River flows through areas best described as rural and undeveloped to suburban with modest development. These areas contain less impervious surface and less development and therefore it could be reasoned that BMPs mandated by the Department's Municipal Stormwater Regulation Program are not likely to significantly decrease pollutant loading or result in marked water quality improvements. However, from the Borough of Little Falls to its confluence with the Hackensack River in Newark Bay, the Passaic River flows through municipalities that are urbanized and highly developed with industrial land uses, such as Kearny, Newark, Harrison, and Paterson. In

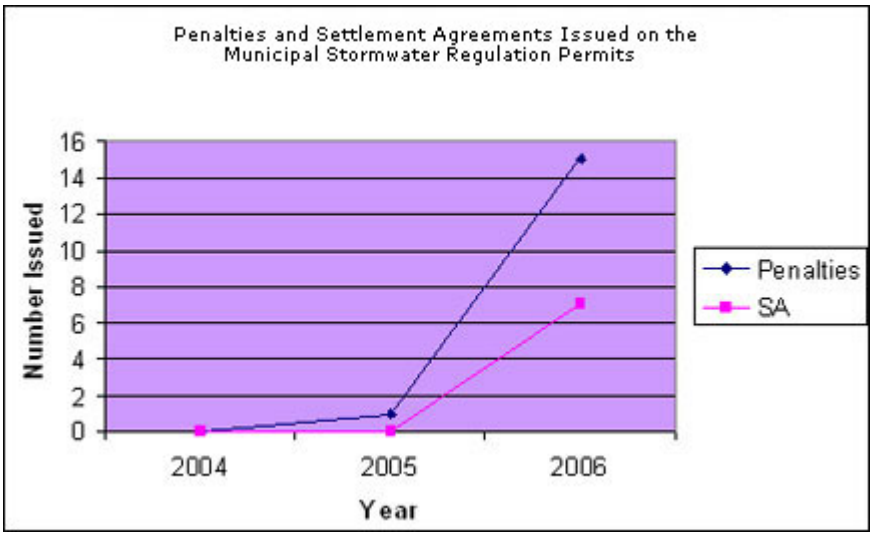

Chart II

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addition, in these areas the Passaic River is also paralleled or intersected by major highways or roadways such as McCarter Highway, McLean Blvd., interchanges for the Garden State Parkway, New Jersey Turnpike, and route 1 and 9 all carrying significant vehicle and truck traffic. As regulated municipalities cumulatively implement required SBRs and BMPs specifically for solids and floatable controls, significant water quality improvements are likely to be attained. Permit compliance is a significant obstacle to the realization of these water quality improvements. Municipalities must implement permit requirements for improvement to be realized and for the program to be successful. The Department has acknowledged from the onset of the program that getting municipalities to implement a comprehensive stormwater program would be challenging. Urbanized municipalities are faced with many competing problems including social issues such as crime and poverty. Stormwater issues may not be a municipality's first priority or primary focus. The Department's tracking of permit implementation is primarily through the submittal of Annual Reports and Certifications. A second measure of program implementation can be gauged through enforcement actions. Chart II (see page 5) indicates the number of penalties issued per year since the programs inception. The general trend as indicated by Annual Report and Certification submittals and enforcement actions taken, shows that compliance is increasing. The Department is committed to actively enforcing the implementation of permit conditions.

While it may be challenging to determine how much impact the program has made since its inception, the effectiveness of this program will be better determined as the program becomes fully implemented over the next couple of years. The program, if properly implemented by the regulated communities adjacent to the Passaic River, will greatly alleviate the nonpoint source pollutant loading overwhelming the Passaic River, thereby improving the quality of the same.

Contact information:
Tosin A. Sekoni (tosin.sekoni@dep.state.nj.us) & Bruce S. Friedman (bruce.friedman@dep.state.nj.us) of the NJ Department of Environmental Protection, Division of Water Quality, Bureau of Nonpoint Pollution Control, PO Box 029, Trenton, NJ 08625, (609) 633-7021, (609) 984-2147, www.njstormwater.org

THE PREAKNESS BROOK 319(h) RESTORATION AND PROTECTION PROJECT

Richard R. Pardi

Preakness Brook is the major stream within the Township of Wayne, Passaic County, New Jersey. Its watershed is almost entirely within the boundaries of the Township. In its upper reaches, near its headwater on Preakness Mountain Preakness Brook is considered a trout-maintenance (C1) stream, one of the highest classifications that can be given to a stream in New Jersey. Segments of Preakness Brook further downstream had been previously identified as impaired by the United States Geological Survey (1998) and the NJ Department of Environmental Protection (1993 & 1998). The impairments include elevated fecal coliform bacteria and habitat decline as indicated by increases in pollution-tolerant macroinvertebrate species. The source of pollution is thought to be widely distributed (non-point source). As such, attempts to mitigate and restore the stream to as close to a natural state as possible come under the purview of the Clean Water Act, section 319h.

William Paterson University is the grantee of a NJDEP funded non-point source pollution project to restore and protect Preakness Brook. The Township of Wayne, along with the Lower Passaic and Saddle River Watershed Alliance are major partners in the project. William Paterson's primary role will be to collect and assess water quality data along the length of the stream. These studies began during the spring of 2006 and will continue into 2007.

Preliminary analysis of the fecal coliform data indicated that the bacterial impairment is very widespread and persistent along the streams generally increasing downstream from the Brook's headwaters to its confluence with the Passaic River. Efforts to identify any potential point sources have, to date, resulted in negative results. To help measure water quality, macroinvertebrates were sampled at eight locations along Preakness Brook. A biotic index, based on taxonomic order, was derived from the data. The results indicate that water quality generally decreased from the upper reach to the lower reaches. The trend correlated with land use, whereas the lower reaches of Preakness Brook were affected by greater industrialization. When other engineering data are available, we will assess the land use effects on macroinvertebrate diversity and distribution.

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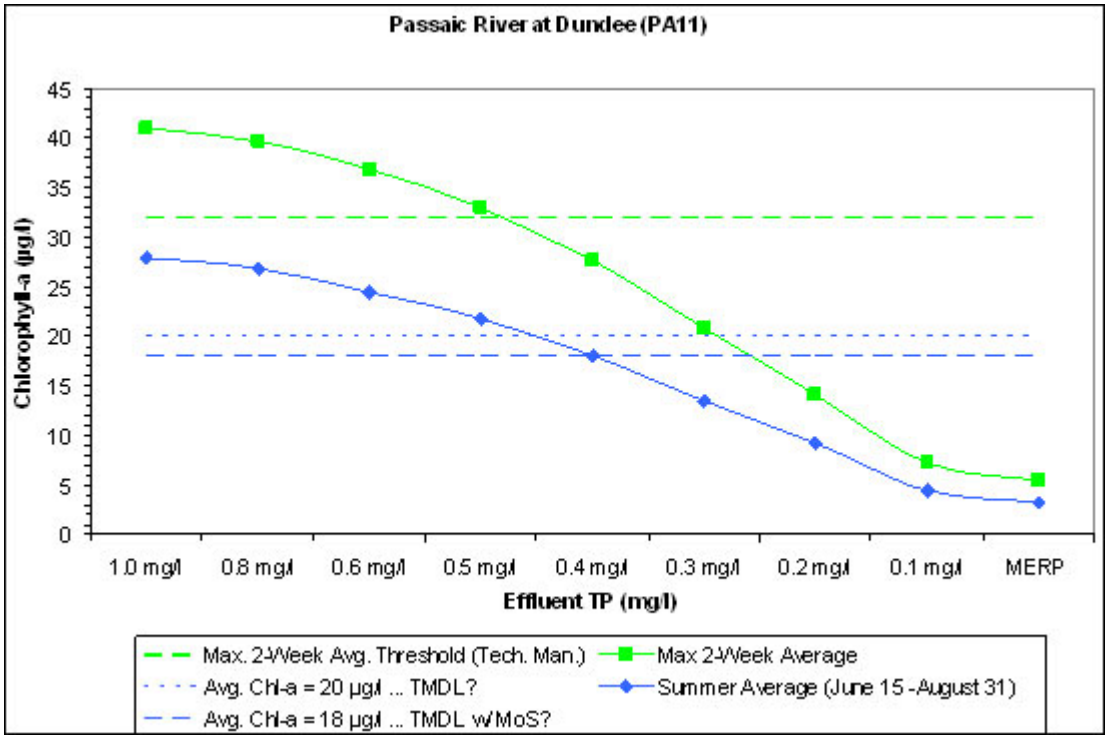
Besides monitoring fecal coliform concentrations in stream water at several localities and quantifying habitat impairment through macroinvertebrate surveys, William Paterson University faculty and students will measure stream discharge (flow), nutrient levels and other common water quality variables at several sites along the length of the Brook. In addition, we will be applying state-of-the-art biotechnology methodology to establish the source of measured coliform bacteria.

Author information:
Dept. of Environmental Science, Wayne, NJ
William Paterson University, Grantee

PHOSPHORUS TMDL DEVELOPMENT FOR THE NON-TIDAL RIVER BASIN

Thomas Amidon & James Cosgrove

The overall approach of the Passaic Total Maximum Daily Load (TMDL) study was to develop a comprehensive watershed model to relate nutrient sources to productivity impacts, namely diurnal dissolved oxygen swings and phytoplankton blooms, and to back-calculate allocations to point and non-point sources accordingly.



Impact of STP Effluent Phosphorus Concentration on Phytoplankton in Passaic River

TRC Omni Environmental Corporation (TRC Omni) performed extensive monitoring during 2003 and 2004 to identify existing and potential water quality impairments due to nutrients, to characterize nutrient sources, and to provide data to calibrate a water quality model of the non-tidal Passaic River basin. TRC Omni developed a comprehensive GIS-based watershed model to simulate conditions over a four-year period from 1999 to 2003 that encompass a wide range of weather and flow conditions. The result is a system-wide water quality model calibrated and validated for nutrients, dissolved oxygen, and chlorophyll-a (phytoplankton blooms).

NJDEP intends to select water quality targets to protect against phytoplankton blooms (expressed as chlorophyll-a) at two critical locations in the non-tidal Passaic River basin: the Wanaque Reservoir and the Passaic River upstream of Dundee Dam. Load and wasteload allocations for phosphorus sources throughout the basin will be developed to satisfy the water quality targets at these two critical locations.

TRC Omni is currently working with NJDEP and Najarian and Associates to integrate the Passaic River Basin TMDL study with the Wanaque Reservoir TMDL to determine the final load reductions needed for selected endpoints. NJDEP intends to use the results of the study to propose the selected water quality targets as site-specific criteria along with the TMDL itself. NJDEP will then implement the TMDL through permit modifications and non-point source reduction measures. It is anticipated that a point source trading scheme will be developed to optimize the reductions necessary to achieve the water quality targets. The result of these targeted phosphorus source reductions will be a noticeably cleaner Passaic River!

In the next NJ Flows...

Have an idea for our next issue? Interested in writing an article? Please let us know!
Email your suggestions to njwrri@aesop.rutgers.edu

Conference Calls

Meadowlands Symposium II: Call for Abstracts

Deadline: January 17, 2006

For more info, visit: http://meri.njmeadowlands.gov/conf_2007

AWRA 3rd National Water Resources Policy Dialogue

January 22-23, 2007 in Arlington, Virginia

For more info, visit: http://www.awra.org/meetings/DC2007/index.html

The 2007 Delaware Estuary Science Conference & Environmental Summit

January 22-24, 2007 in Cape May, NJ

For more info, visit:

http://www.delawareestuary.org/scienceandresearch/Science_Conf/Scnc_Conf_Main.asp#Info

4th International Conference on Remediation of Contaminated Sediments

January 22-25, 2007 in Savannah, Georgia

For more info, visit:

http://www.battelle.org/environment/er/conferences/sedimentscon/default.stm

USDA-CSREES 2007 National Water Conference

January 28-February 1, 2007 in Savannah, Georgia

For more info, visit: http://www.soil.ncsu.edu/swetc/waterconf/2007/home07.htm

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New Jersey Flows

New Jersey Water Resources Research Institute

Dr. Joan G. Ehrenfeld, Director
(732) 932-1081
ehrenfel@rci.rutgers.edu

Katie Stewart, Editor
(732) 932-9632
njwrri@aesop.rutgers.edu

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